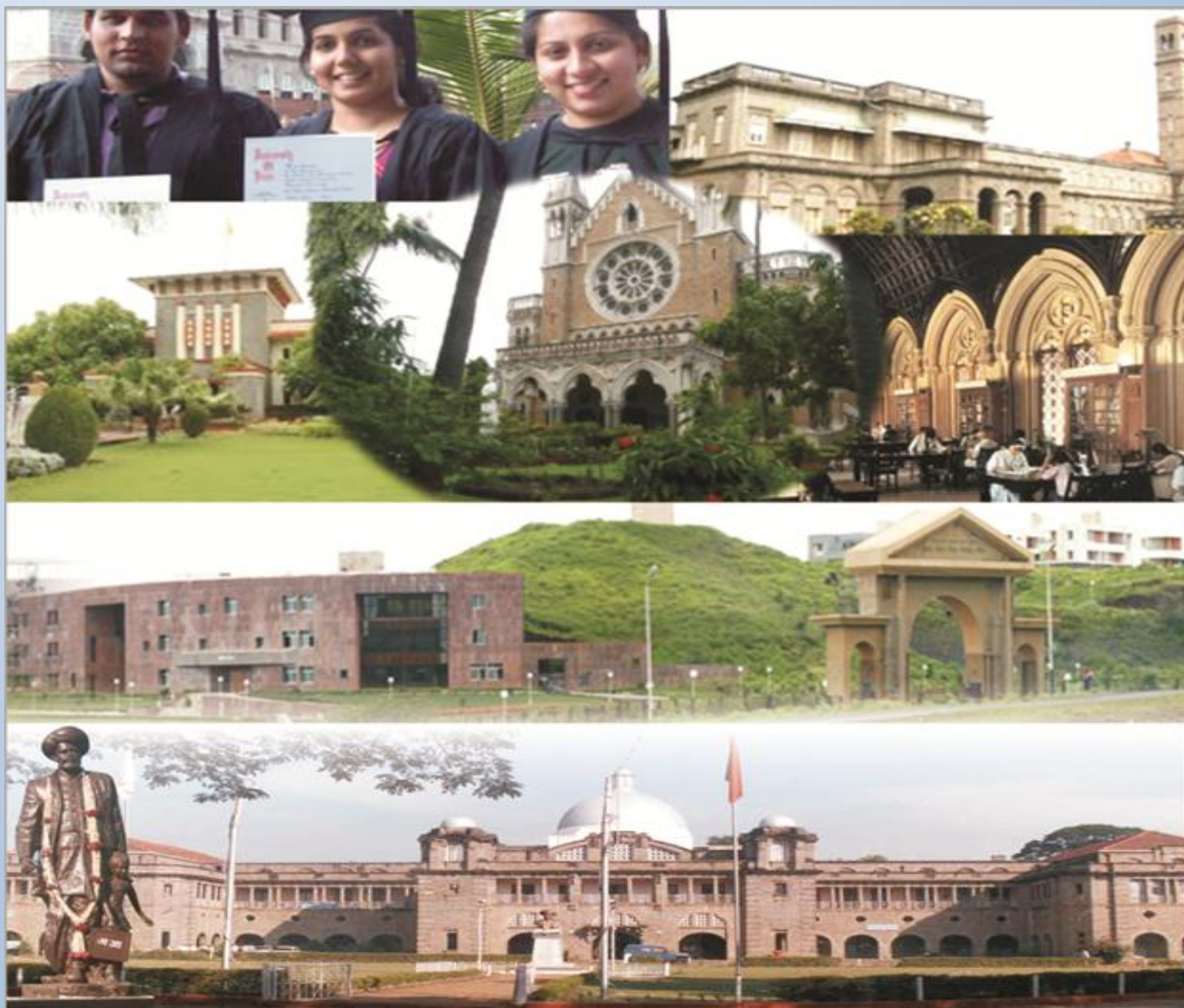




Report on Reforms in Examinations System in Universities of Maharashtra through use of Technology



Submitted to
Government of Maharashtra

Foreword

It gives us great pleasure to present this Report on Reforms in Examinations System in Universities of Maharashtra through ICT to the Govt. of Maharashtra. This report is a culmination of over one month of significant research, effort and hard work from a team of dedicated, sincere individuals who are passionate about creating better opportunities for the youth of our country.

The Report details the present scenario of Universities Examinations and Key issues and challenges faced in them. The Report explores the usage of Information Technology to make the examination process secure, robust, student –friendly and infallible. Emphasis is also laid on making the examinations process accessible and supportive to Persons with Disabilities.



This report is not limited to just prevention of leakage of examination papers but includes the comprehensive discussion and recommendations regarding examination process of university from end to end. As a separate note, we have also added a section on Comprehensive University Management System for all functionalities of Universities.

On behalf of Committee for Reforms in Examinations System in Universities in Maharashtra, we are thankful to one and all who have contributed their valuable time and inputs for successful preparation of this report.

Dr. Subhash Deo
(Secretary of the Committee)

Rajesh Aggarwal
(Chairman of the Committee)



Acknowledgements

The development of this report on “Reforms in Examinations Systems in Universities of Maharashtra through use of Technology” has been a result of close cooperation among several institutions and individuals. The committee acknowledges and appreciates the support and encouragement provided by such individuals and institutions.

The committee is highly appreciative of the leadership, encouragement and extensive support provided by Government of Maharashtra. We are especially thankful to Shri Jayant Kumar Banthia, Chief Secretary, Government of Maharashtra, Shri Sanjay Kumar, Principal Secretary, Higher and Technical Education Department and Shri Vikas Rastogi, Secretary to Hon. Governor.

We would also like to convey our heartfelt thanks to Vice Chancellors of various Universities of Maharashtra for lending their support and cooperation in successfully executing the study of examination systems in universities in Maharashtra. We are especially thankful to the teams in Mumbai University, Pune University, Nagpur University, Aurangabad University and Mahatma Phule Krishi Vidyapeeth, Rahuri for hosting the committee meetings and extending generous hospitality. It has been a real pleasure to work with these very fine individuals.

In addition, we take this opportunity to thank various industry representatives who came from across India and shared their views and precious time and enriched the committee meetings.

Finally, we thank one and all who have made this report possible. We also thank those who contributed suggestions through Facebook www.facebook.com/ExamsCommittee.Maharashtra and emails on examscommittee@maharashtra.gov.in. We thank them for their commitment and contribution to the development and realization of this Report.

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Chapter 1: Introduction

Background to the Study

Examinations play an important role in imparting education and knowledge to students. Examination is an instrument to evaluate the knowledge, understanding and learning of students. For Teachers, it provides feedback to evolve their way of teaching.

In the last couple of decades, higher education has witnessed tremendous growth in terms of number of accredited colleges, number of students enrolled, number of courses offered, reach of institutes etc. As a result of this growth, the examination system at universities has become quite complex and complicated. One of the major problems faced by a university is to conduct infallible examinations and provide tamper proof certificates. Leakages of question papers defeat the main purpose of examination, i.e. assessing the depth of knowledge and extent of skill acquired by the student.

In Maharashtra, serious concerns have been expressed on various allegations regarding leakage of university examination papers and negative image being portrayed by the media about the capabilities of Universities to hold and organize examinations in a fair manner. In this regard, Hon Chief Secretary opined that immediate action needs to be taken to set up a reliable system so that aforementioned incidences do not occur and Universities can hold the examinations smoothly.

In this regard vide GR No. Misc.–2012/Pra.Ka. 200/12/Vishi-3 dated 20th July 2012 (copy of the GR attached as Annexure A), a committee of the representatives of all universities under the chairmanship of Secretary, IT had been constituted. The committee has been mandated to provide recommendations to leverage IT and implementation of end-to-end system for secure delivery of examination papers.

Members of the Committee

The committee comprises of representatives from Examination cells/divisions of all universities in Maharashtra, under the chairmanship of Secretary, Information Technology, Government of Maharashtra. The members of the committee are

1. Shri Rajesh Aggarwal, Secretary (IT) - Chairman

2. Dr. Vijay Pandripande, Vice Chancellor, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
3. Dr. P.N. Mandhare, Controller of Examinations, SNDT University, Mumbai
4. Dr. D. J. Salunkhe, Controller of Examinations, Solapur University
5. Dr. A.M. Paturkar, Associate Dean, Bombay Veterinary College, Parel, Mumbai
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7. Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra University of Health Sciences, Nashik
8. Dr. Sampada Joshi, Controller of Examinations, Pune University
9. Dr. R.K. Kamat, Associate Professor, Department of Electronics, Shivaji University, Kolhapur
10. Dr. R.P. Kate, Incharge Controller of Examinations, Dr. Babasaheb Ambedkar Technological University, Lonere
11. Dr. S.P. Kane, Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University
12. Dr. Nitin Koli, Head, Computer Center, Sant Gadge Baba University, Amravati
13. Dr. R.S. Patil, Dean and Director of Instruction, Mahatma Phule Krishi University, Rahuri
14. Dr. R.W. Ingle, Deputy Registrar, Dr. Panjabrao deshmukh Agriculture University, Akola
15. Dr. N.S. Kokode, Director, BCUD, Gondwana University, Gadchiroli
16. Dr. Dilip Ukey, Pro Vice Chancellor, Swami Ramanand Teerth Marathwada University, Nanded
17. Dr. Swati Mujumdar, Principal Director, Symbiosis Open Education Society, Pune

18. Dr. Subhash Deo, Director (Examinations), Mumbai University - Member Secretary

Special Invitees (In Various Meetings)

1. Dr. Rajan Welukar, Vice Chancellor, Mumbai University
2. Dr. V.S. Sapkal, Vice Chancellor, RTM Nagpur University
3. Shri Vikas Rastogi, Secretary to Hon' Governor of Maharashtra
4. Dr. Rupa Shah, Ex-Vice Chancellor, SNDT Women's University, Mumbai
5. Dr. Ashok Chavan, Controller of Examinations, BAMU University, Aurangabad
6. Dr. Sanjay Pawar, Technical Committee, SNDT Women's University, Mumbai
7. Dr. S.D. Gorantiwar, Head of the Department, Agricultural Engineering College, MPKV Rahuri
8. Dr. R.P. Andhale, Technical Officer, Dean, MPKV, Rahuri
9. Shri D.M. Netke, Deputy Registrar, Confidential, Dr. BAMU, Aurangabad
10. Mrs. Sulbha Powar, Head, Computer Section, SNDT Women's University
11. Shri Vinod. P. Patil, Dy Registrar, Mumbai University

Knowledge Partner

Mrs. Aarti Harbhajanka, Accenture Services Private Limited

Shri Lokesh Bohra, Accenture Services Private Limited

GR Constituting the Committee

- राज्यातील सर्व विद्यापीठांकडून घेण्यात येत असलेल्या परिक्षांच्या पेपरफुटीवर सर्वकष अभ्यास करुन विविध उपाययोजना करण्यासाठी एक उच्चस्तर समिती घठीत करण्याबाबत.

महाराष्ट्र शासन

उच्च व तंत्रशिक्षण विभाग

शासन निर्णय क्रमांक-संकीर्ण-२०१२/प्र.क्र.२००/१२/विशि-३

मंत्रालय, मुंबई - ४०० ०३२.

दिनांक - २० जुलै, २०१२

प्रस्तावना :

मा.मुख्य सचिव यांना मा.कुलपति तथा राज्यपाल महोदयांकडून दि. ६ जून, २०१२ च्या पत्रान्वये प्राप्त झालेल्या निदेशानुसार राज्यातील सर्व विद्यापीठांकडून घेण्यात येत असलेल्या विविध परिक्षांच्या पेपरफुटीबाबत चिंता व्यक्त केली आहे. त्याबाबत, मा.कुलपतिनी दिलेल्या निदेशानुसार राज्य शासनाकडून आवश्यक ती उपाययोजना करुन सर्व विद्यापीठांच्या परिक्षा बिनदिवकत व सुरळीतपणे पार पाडण्याच्या दृष्टीने आधुनिक तंत्रज्ञानाच्या (ICT) वापर करुन सदर परिक्षा यंत्रणा निधोक (Fool Proof System) करण्यासाठी काय कार्यवाही करता येईल याबाबत सर्व विद्यापीठांचे कुलगुरु व त्यांचे प्रतिनिधी यांच्या समवेत मा.मुख्य सचिव यांनी दि.११ जून, २०१२ रोजी एक बैठक आयोजित केली होती. सदर बैठकीत झालेल्या सर्वकष चर्चेनुसार सचिव (IT) यांच्या अध्यक्षतेखाली एक उच्चस्तरीय समिती घठीत करण्याचा निर्णय घेण्यात आला.

शासन निर्णय :

२. सदर बैठकीत घेण्यात आलेल्या निर्णयानुसार उक्त समिती घठीत करण्याची बाब शासनाच्या विचाराधीन होती. त्यानुसार सचिव (IT) यांच्या अध्यक्षतेखाली सर्व विद्यापीठांच्या कुलगुरुंचे प्रतिनिधी यांची एक उच्चस्तरीय समिती घठीत करण्यात येत आहे.

- | | | |
|--------------------------------------------------------------------------------------|---|---------|
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३. सदर समितीने विद्यापीठांच्या सर्व परिक्षा आयोजित करण्याच्या दृष्टीने सर्वकष व व्यापक विशेष अंमलबजावणी पध्दती (SoPs) विकसित करणे व पेपरफुटीसारखे प्रकार घडू नये म्हणून एक समान परिक्षा पध्दतीची तजवीज करणे तसेच विद्यापीठांच्या सर्व परिक्षा आय.टी. वर आधारित

सेवांच्या माध्यमातून ऑनलाईन पध्दतीचा अवलंब करणे याबाबत अभ्यास करेल. त्या माध्यमातून या सर्व विद्यापीठांच्या परिक्षा यंत्रणा निधोक (Fool Proof System) करण्यासाठी सदर समिती विचार करून योग्य त्या उपाययोजना सुचवेल. सदर समितीवरील सन्माननीय सदस्यांना प्रवास व इतर भत्यावरील खर्च अनुज्ञेय राहणार नाही. तो खर्च संबंधित विद्यापीठांनी / संस्थांनी करणे अपेक्षित आहे.

४. यासंदर्भात डॉ.सुभाष देव, सदस्य सचिव तथा संचालक, परिक्षा विभाग, मुंबई विद्यापीठ, मुंबई यांना विनंती की, सदर समितीच्या बैठकीच्या आयोजनाबाबत मा.सचिव (माहिती व तंत्रज्ञान) यांचे समवेत समन्वय साधून त्यांच्या आदेशानुसार पुढील योग्य ती कार्यवाही करण्याची विनंती आहे. त्यांचा संपर्क दूरध्वनी क्रमांक ०२२ २२०२६५३४ असा आहे.

५. सदर समितीमध्ये वरील सर्व बाबींचा विचार करून आपला सविस्तर अहवाल एक महिन्याच्या आत शासनास सादर करील.

महाराष्ट्राचे राज्यपाल यांच्या आदेशानुसार व नांवाने


(रा. गो. जाधव)

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(Fax - 020 66211182)
२०)सर्व कार्यासन अधिकारी, उच्च व तंत्रशिक्षण विभाग
२१)निवड नस्ती, विशि-३

Scope of the Study

The mandate of the committee as per the GR is to provide recommendations on Usage of Information Technology for prevention of leakage of Examination Papers in Universities. However, the committee felt that the report should not be limited to just technological interventions but should also provide recommendations on academic interventions, resource allocation, cost benefit analysis etc. for complete success of this initiative.

The committee has also provided recommendations on usage of Information Technology for end-to-end examination system in Universities. A separate note for comprehensive Universities Management system has also been attached as annexure.

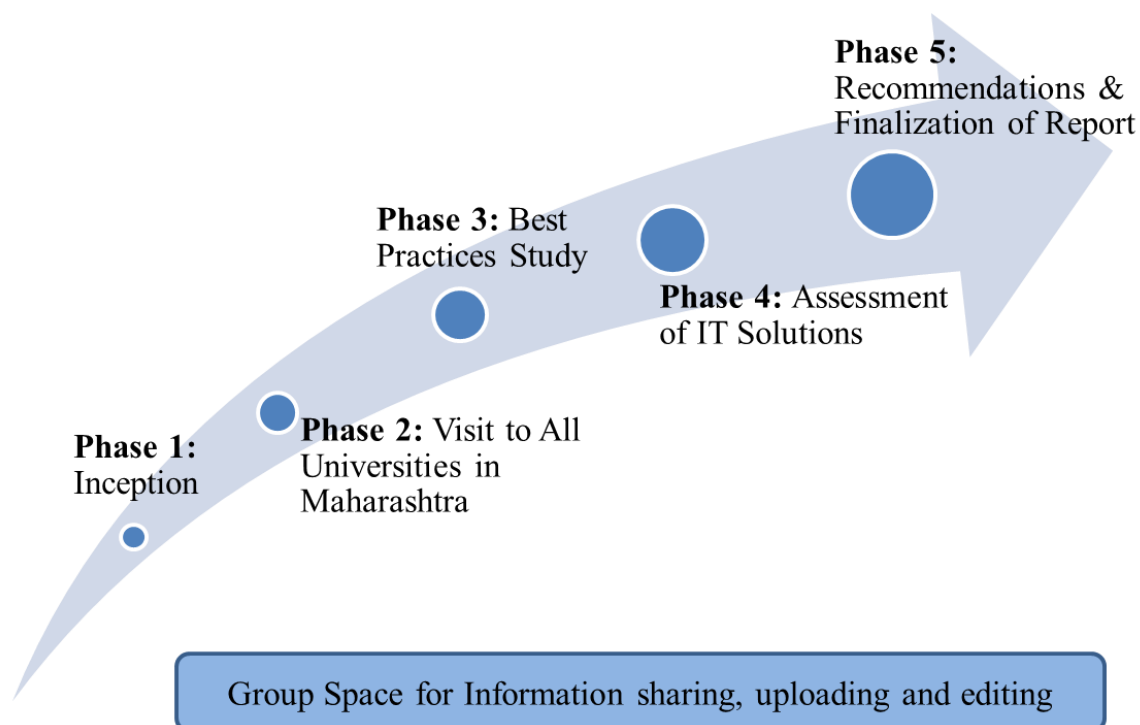
With the above mentioned objective, the committee conducted the following activities:

- Understanding of University Examination – Present Scenario
- Key Issues and Challenges faced in the examinations system in Universities
- Study of Case Studies/Best Practices across India on implementation of examinations management system
- Recommendations on Technology, Academic Reforms, Resource Allocation etc. for smooth execution of university examinations
- Cost Benefit Analysis of the proposed solution
- A comprehensive University Management System for automation of all processes of Universities

Methodology of the study

At the onset, the committee followed an approach that was systematic and collaborative in nature to achieve greater impact and results given the paucity of time. In this study, the approach consisted of distinct phases yet tightly integrated for achieving the targeted outcomes. The key phases of the study included:

Approach and Methodology



Phase 1: Inception

The committee, comprising of Heads/ senior officials of examination cells/Divisions of all universities of Maharashtra, first met on 8th August 2012 at Pune University. In this meeting, the committee members informed the committee on the examination processes in their respective universities and key issues and challenges faced. This understanding of uniqueness, variance and intricacies of examination process in different universities established a strong foundation for the report.

Phase 2: Visit to all universities in Maharashtra – Primary Research

The Primary aim of this phase was to collect complete, detailed descriptive information on current status of various components of examination process in all universities in Maharashtra. Therefore in this phase, various universities of Maharashtra were visited by different committee members for studying the following:

- Key Characteristics of examinations process of respective universities
- Nuances of examinations process of the university
- Current Resource Allocation and Future Staffing Requirements
- Details of IT initiatives implemented by University
- Best Practices/Learnings on implementation of IT

A uniform template for capturing the information was used by all the committee members during their visits.

Questionnaire on Examination Process in Universities

Date: _____

A committee has been constituted vide GR No: Misc – 2012 / Pra. Ka. 200 / 12 / Vish-3 dated 20th July 2012 (copy of the GR enclosed herewith) for providing recommendations on implementation of end-to-end system for secure delivery of examination papers through ICT in Universities in Maharashtra. The committee has created sub-groups for visiting all universities in Maharashtra & studying their examinations process. The sub groups are requested to capture information as per following template:

Name of the University	
Officers met in the University	
Name of Committee Members that visited the university	

1) Key Characteristics of University Examination Process

S.No	Parameter	Characteristic of
1.	Territorial Jurisdiction of University	
2.	Number of Affiliated Colleges	
3.	Number of Students studying under the university (including university campus & affiliated colleges in all years (I, II, III & IV)	
4.	Frequency of University Examinations (University Conducts Examinations every semester / only final semester/ only final 2 semesters etc)	
5.	Weightage of University Examinations: Internal Examinations.	
6.	Examinations Fees	
7.	Existence of Dedicated Examination Cell in the University (Yes / No)	
8.	Pattern of University Examinations (How many marks of MCQ, Short Answers, Long Answers etc)	
9.	Paper Setting is done at : University Campus / Institutes etc	
10.	Location of Printing of Questions Papers (In Campus / Outside Printing Press etc)	
11.	Dispatch of Questions Papers is through university permanent staff / temporary staff/ any other agency appointed by the university	
12.	At the examination centre, the exam papers are in custody of (Principal of	

Snapshot of Questionnaire on Examination Process in Universities

the institute / Treasury Office / Postal Department etc)	
13.	Sealed packets are opened in presence of:
14.	Any other characteristic of university which is unique to the university.

2) Enumeration of Key Process Steps & Issues Faced in University Examination Process

S.No	Key Process Step	Key Issues / Challenges faced
Pre Examination Phase		
1		
2		
3		
4		
5		
During Examination Phase		
1		
2		
3		
4		
5		
Post Examination Phase		
1		
2		
3		
4		

Remarks if any: _____

3) Enumeration of Current Staffing & Future Requirement of Examination Cells at University (applicable).

S.No	Designation	No. of Permanent Staff		No. of Temporary Staff	Fut. Requir
		Sanctioned	Filled		
1.	Controller of Examinations / Director				
2.	Deputy Registrar				
3.	Clerks				
4.	Peons				

4) Details of IT Initiative implemented by University in Examinations Process

[[Initiative: 1

Name of the Initiative	
Implemented in Year	
S/W Developed by	
Details of Initiative	
Benefits of Initiative	

[[Initiative: 2

Name of the Initiative	
Implemented in Year	
S/W Developed by	
Details of Initiative	
Benefits of Initiative	

5) Details of IT Initiative implemented by University, other than in Examination Cell

[[Initiative: 1

Name of the Initiative	
Implemented in Year	
S/W Developed by	
Details of Initiative	
Benefits of Initiative	

The visits to the universities were conducted as follows:

I. Visit by complete Committee

The meetings of the committee were held in four universities over the span of one month as follows:

University	Date
Pune	8 th August 2012
Aurangabad	22 nd August 2012
Nagpur	30 th August 2012
Mumbai	6 th and 7 th September 2012
Mumbai	14 th September 2012
Rahuri	30 th September 2012

During these meetings, the examinations process of the individual universities was studied in detail.

II. Visit by sub-committees

In order to visit the other universities, sub committees were formed which visited the rest of the universities between 23rd to 30th August 2012. The groups and the respective universities that were assigned are as follows:

S.No.	Group Members	Universities to be Visited
1.	<ul style="list-style-type: none">• Dr. P.N. Mandhare,• Dr. R.P. Kate,• Dr. Subhash Deo	<ul style="list-style-type: none">• SNDT Women's University, Mumbai• Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli• BATU Lonere, Raigad
2.	<ul style="list-style-type: none">• Dr. D.J. Salunkhe• Dr. R.K. Kamat	<ul style="list-style-type: none">• Shivaji University, Kolhapur• Solapur University, Solapur
3.	<ul style="list-style-type: none">• Dr. Sameer Narkhede• Dr. Shekhar Rajderkar	<ul style="list-style-type: none">• North Maharashtra University, Jalgaon
4.	<ul style="list-style-type: none">• Dr. R.S. Patil	<ul style="list-style-type: none">• Maharashtra University of Health Sciences, Nashik

5.	<ul style="list-style-type: none"> • Dr. N.S. Kokode • Dr. R.W. Ingle • Dr. Nitin Koli 	<ul style="list-style-type: none"> • Sant Gadge Baba Amravati University, Amravati • Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola • Gondwana University, Gadchiroli
6.	<ul style="list-style-type: none"> • Dr. Sampada Joshi • Dr. R.S. Patil 	<ul style="list-style-type: none"> • Mahatma Phule Krishi Vidyapeeth, Rahuri
7.	<ul style="list-style-type: none"> • Dr. Dilip Ukey • Dr. Ashok Chavan 	<ul style="list-style-type: none"> • Swami Ramanand Teerth Marathwada University, Nanded • Marathwada Agricultural University, Parbhani
8.	<ul style="list-style-type: none"> • Dr. S.P. Kane • Dr. A.M. Paturkar 	<ul style="list-style-type: none"> • Maharashtra Animal and Fishery Sciences University, Nagpur

All the members submitted the reports of their visits on 30th August 2012.

Phase 3: Best Practices Study

In this phase, the committee studied the successful implementation of examination management systems in universities across India. The objective was to identify the good practices implemented within India and incorporate the key learning from such experiences in the recommendations.

The Committee members during their visits to various universities studied the IT initiatives implemented by the Universities and the key learnings from it were enumerated.

Phase 4: Assessment of IT Solutions

In this phase, the committee invited presentations from various service providers on their IT solutions to develop a thorough understanding of the available solutions in Markets. During these presentations, the committee members shared their individual experiences in implementation of IT and assessed the IT solutions against universities requirements and constraints.

Phase 5: Recommendations and Finalization of Report

On basis of previous stages, the committee prepared section-wise areas of recommendations for improving the examination systems in Universities. These recommendations were discussed at workshop of the committee members on 6th and

7th September in Mumbai. In this workshop, feedback was sought from all the committee members and incorporated suitably to finalize the deliverables.

Phase 6: Group Space

Realizing the importance of sharing information throughout the project, the committee created a Google group space online to upload, share and edit data. All the documents related to the study were uploaded and shared through this space.

This phase is an overarching phase and activities under it were carried out throughout the project. The various committee members consulted and shared information throughout the duration of the project.

Limitations of the study

There are two limitations that need to be acknowledged regarding the present study.

- The First Limitation is that every University has different Rules, ordinances, characteristics, mandates, resources (financial and human), structure etc. Further, there are different kind of universities like Technological University, Health University, Agricultural Universities, MAFSU and Non-Agricultural universities that are governed by different Acts and have different structure of functioning, syllabus, examination patterns etc. Therefore, though the committee recommended the best solution, it also provided alternate solutions in case any university can't implement the recommended solution due to some constraints. Therefore the report contains various alternate options of each solution. The university on basis of their circumstances may choose among the options.
- Second Limitation is that Technology can't be the solution to all the malpractices in the examinations. Technology can aid in curbing many examinations related malpractices. However, it is only the inculcation of strong ethical and moral values in Human beings involved in examination processes, which can end all the problems related to malpractices in examinations.

Chapter 2: Examinations system in Universities in Maharashtra: Present Scenario

Type of Examinations conducted by Universities

In Maharashtra, Universities typically conduct following types of examinations

- Semester Examinations
- Annual Examinations
- Supplementary Examinations

Semester Examinations

Universities typically follow a semester system wherein an academic year is divided into two terms. The final assessment is on basis of:

- Internal Assessments conducted by the respective colleges and universities departments/schools through periodic tests, quizzes etc.
- External/University End Semester Examination typically conducted by the Universities.

Different Universities have different weightages and patterns of Internal and External Evaluations. Select Universities like Mumbai University have decentralized the evaluation process, wherein the universities only assess the semester examinations for the final year of the course. The semester examinations of previous years are conducted by the colleges on their own.

Therefore each university has a unique examination system process, which they have shaped on basis of University Ordinances, constraints, unique characteristics, resources available etc. In this section, we have tried to capture the typical process of Examinations in University which may be prevalent in majority of the universities.

Annual Examinations

Annual Examinations are typically conducted by university at the end of an academic term. The purpose of these examinations is to make a final review of the topics covered and assessment of each student's knowledge of the subject at end of the academic term.

Supplementary Examinations

Supplementary Examinations are conducted to provide second chance to students who didn't qualify in the main exams due to following reasons:

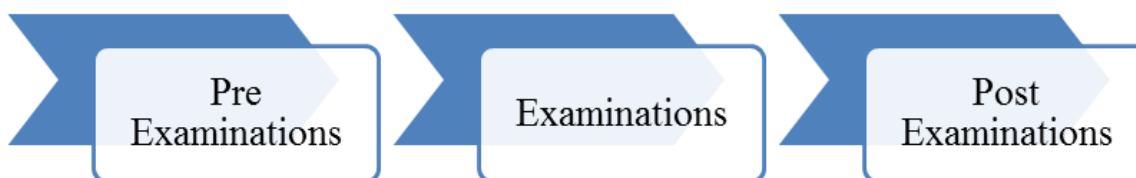
- Failure to secure minimum pass marks in Theory or Practical examination of a paper or failure to appear in any Theory or Practical examination on any grounds including medical may be eligible for Supplementary examination in that particular paper.
- Students debarred from appearing in examination due to shortage of attendance in Theory or Practical may also be eligible for Supplementary examination subject to the condition that they have to attend the classes in that particular paper whenever it is offered by the institute.

Overview of Examination Process

A typical examination process contains of three broad phases:

1. Pre-Examination Phase
2. Examinations
3. Post-Examination Phase

Major Phases of Examinations Process



Phase 1: Pre Examinations Phase

This phase typically consists of activities like notification of examinations centers, fee structure, examination schedules etc. to students, Issue of Examination Application Forms, Generation of hall tickets, Setting Questions Papers, Printing and distribution of Question Papers to respective examination centers. The key activities in this phase are elaborated below:

i. Issuance of Examination Application Forms

Schedule for issue of Examination application forms from the University to the constituent colleges and Schedule for submission of application forms to the University is notified. Accordingly, Examination forms duly filled, verified and affixed with latest stamp sized attested photographs of the candidate is arranged Examination wise, course wise and branch wise by the respective institutes and submitted to the University by due date.

ii. Hall Ticket Generation

On basis of examination forms collected, hall tickets are generated for the end semester examinations. Candidates are required to have possession of hall tickets in on all the days of theory examinations. In the event of non-possession or loss of Admission card, the duplicate hall ticket may be issued.

iii. Setting Question Papers

Experts in the subjects and recognized as paper setters/examiners by the University are selected as question paper setters/examiners. The question papers are set through any of the following two processes:

- The examination papers are set centrally at a secured building wherein the paper setters of concerned faculties meet as per the schedule.
- Model sets of question papers are called from affiliated colleges. Following this, moderation of the questions papers is conducted by paper setters to prepare the final set of examination papers.

Select universities prepare multiple sets of questions papers and the final question paper is chosen by senior authority at random to prevent leakage of examination papers by faculty.

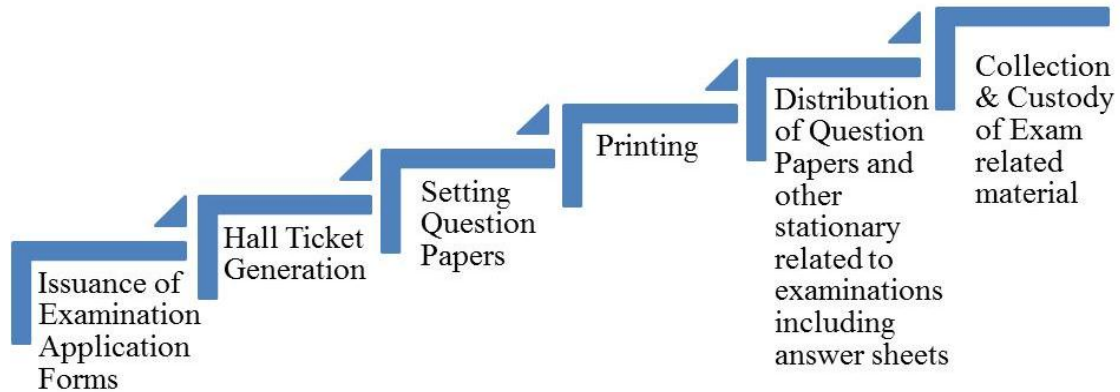
iv. Printing

Most of the universities have established in-house printing infrastructure where they print the selected Question Papers and other stationary items. Universities print these papers on confidential printers.

Center code-subject code wise student capacity is given to printer along with selected question papers where subject code is mentioned. The printer prints the question papers as per the quantity provided by the university and seals the packets.

They make the sealed boxes center code wise, which will be further distributed by as per time table to respective examination center.

Key Activities in Pre-Examinations Phase



v. **Distribution of Question Papers and other stationary related to examinations including answer sheets**

The Question papers, properly packaged by confidential printers are then dispatched to numerous examination centers across the territorial jurisdiction of the university. The Universities typically employ large number of contract staff for distribution of question papers.

Similarly, other examination related stationary including answer sheets is distributed in a systematic phased manner.

vi. **Collection and Custody of Examination related Material**

Question papers and other examination related material are then collected by the respective authorities of the affiliated colleges and kept in safe custody till the day of examination.

Phase 2: Examination Phase

This phase typically involves the following activities:

i. **Opening of Question Paper Packets**

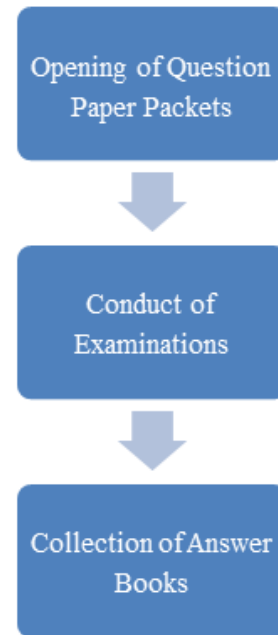
The Senior Authorities at the examination center personally check the covers containing the question papers for the intactness of the seal, correctness of the question paper code, and open the covers in the presence of Chief Conductor/Superintendent, Joint Chief Superintendent/Conductor and representatives of students or the examination committee. Discrepancies, if any, are immediately brought to the notice of the Controller of Examination. The Question papers are opened typically half an hour to one hour before the examinations as prescribed by the university. The Questions papers are then sent to examination halls.

ii. **Conduct of Examinations**

Invigilators issue question papers to the candidates at the appointed time. Unused question papers are returned to the University. The Candidates write the examinations on the Answer sheets provided by the Examination Centers.

iii. **Collection of Answer Books**

The invigilators collect the answer booklets from all the candidates at the end of the examination. The institutes then arrange the answer booklets course wise, subject wise, branch wise etc. and send to the respective CAP (Central Assessment Programme) Centers.

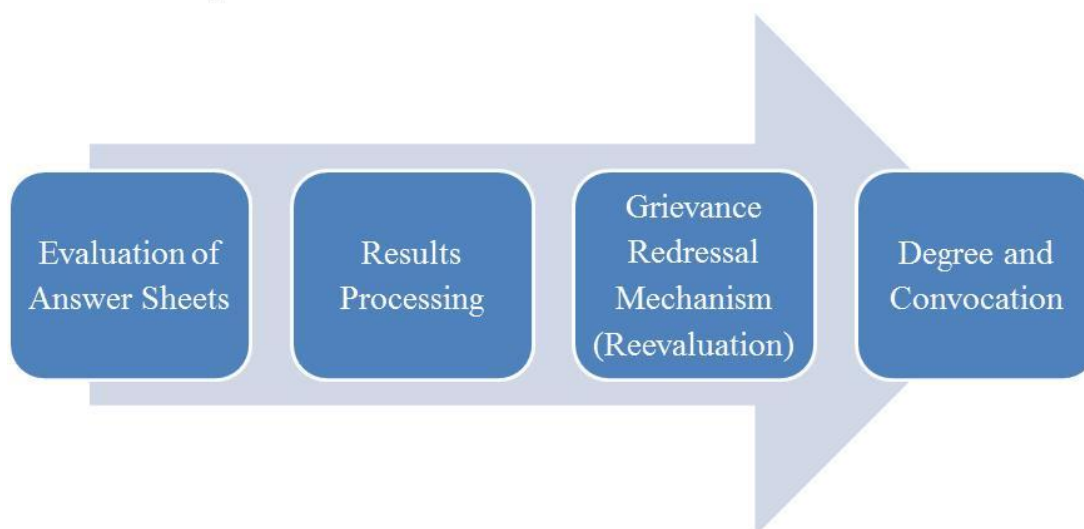


Key Activities in Examinations Phase

Phase 3: Post - Examination Phase

This phase typically involves the following activities:

Key Activities in Post-Examinations Phase



i. Evaluation of Answer Sheets

All the answer sheets collected at CAP are masked before assessment as per University Act. Universities employ different methods for this, including manual coding of answer sheets, barcoding etc. In the CAP centers, respective course teachers assess the Answer Booklets and moderate as per the prescribed norms.

ii. Results Processing

Accordingly, marks on the answer booklets are tabulated and fed in the results sheets. In the meantime, the affiliated colleges provide the internal marks and lab marks to the university. On basis of this, the final result is declared and mark sheets/ grade reports/ Passing certificates/Provisional Degree Certificates are issued.

iii. Grievance Redressal Mechanism (Re-evaluation)

Any student may apply for verification/photocopying/re-evaluation. Following this, the answer sheets are verified (re-totaling)/photocopied/re-evaluated as the case may be.

iv. **Degree and Convocation**

Finally, the degree is printed and issued to the students. Mostly the degrees are issued during convocation or thereafter. In a few cases (e.g. BAMU University, Aurangabad), Universities issue degrees before the convocation.

The demand for duplicate copy of degree may come at any time in the lifetime of student. Accordingly, the data of the student needs to be preserved for considerable future.

During all these phases, the data related to students needs to be preserved for a specific period of time and some of the data, like marks of the students and their registration, need to be preserved in order to ensure future verification or to settle disputes arising about veracity of the university degree at any time during the life time of the student.

Comparison of Examinations Process across Universities in Maharashtra

There are different kinds of universities governed by different Acts across Maharashtra like Non-Agricultural Universities, Technological University, Agricultural Universities, Health Universities and so on. Further, there are differences among Universities in terms of ordinances, territorial jurisdiction, resources, etc. As a result, Universities have differences in Examinations processes. The Following tables illustrates the key differences in examination processes in Universities (Universities are arranged in the order of establishment).

Part 1: Details of examination process in the universities

S.No	Name of the University	Year of Estb.	Territorial Jurisdiction of the University	No. of Affiliated Colleges	No. of Students studying under the Univ	Frequency of Univ Exams	Weightage of external to internal exams	Examination Fees
1	Mumbai University, Mumbai	1857	Mumbai, Sub-Urban, Navi-Mumbai, Thane, Raigad, Ratanagiri, Sindhudurg	664	6,50,000	Only Final 2 Semesters	External 60, Internal 40, some Examination external 100	₹ 600/-
2	SNDT Women's University, Mumbai	1916	All over India	417	65,000	Only Final 2 Semesters for Semester pattern, only final year for yearly pattern, nursing B.Sc, M.Sc all years	UG: Univ – 75% Internal 25% PG: Univ – 50% Internal 50%	Basic courses – 525 per sem P.G – 800 per sem Prof courses-1200 per sem
3	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	1923	Six districts: Nagpur, Wardha, Gondia, Bhandara, Chandrapur, Gadchiroli	807	4,03,480	Every semester, Every annual and supplementary exams	100%	(Min.: 242, Max.: 6221)

4	University of Pune, Pune	1948	Pune, Ahmednagar, Nashik	680 colleges + 227 institutes and 49 research centres	7,50,000	Annual as well as Semester	Annual: 80% - 20% Semester – 40% - 10% Online – 50%-50%	Variable in different faculties.
5	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	1958	Aurangabad, Jalna, Beed and Osmanabad	415	2,75,000	Annual as well as Semester	Semester : 30 : 20 Some Exams -60:40 and 80:20	Variable in different faculties.
6	Shivaji University, Kolhapur	1962	Three Districts: Kolhapur, Sangli and Satara	271	2,50,000	Every Semester	Mixed (80:20,70:30,60:40)	-
7	Mahatama Phule Krishi Vidyapeeth, Rahuri, Ahmednagar	1968	Ahmednagar, Nashik, Pune, Dhule, Jalgaon, Nandurbar, Sangli, Satara, Kolhapur, Solapur	43 + 5	13120	Every Semester	External Examination – 80% Internal Examination -20%	₹ 1600 per year
8	Dr. Panjabrao Deshmukh Krishi	1969	Vidharbha Region,	Under Graduate - 29. Post	Under Graduate -7305.	Every Semester.	External Examination – 80%	₹ 1600 per year

	Vidyapeeth, Akola		Maharashtra	Graduate - 3	Post Graduate -1132		Internal Examination -20%	
9	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri	1972	Thane, Raigad, Ratnagiri, Sindhudurg and Greater Mumbai	Aided = 05, Un- aided = 13	Graduate + PG = 3563 Diploma = 3244	Every Semester	End-semester = 80%, Mid-semester = 20%	₹ 1600 per year
10	Sant Gadge Baba Amravati University, Amravati	1983	Amravati, Akola, Buldhana, Yeotmal, Washim	413	3,64,000	Every Semester, Annual and Supplementary Exams	Differs across courses/syllabus	As prescribed by the ordinance from time to time
11	Dr. Babasaheb Ambedkar Technological University Lonere, Raigad	1989	Admission open to all Maharashtra State candidates	Nil	Degree+ Diploma = 2700+ 1573	Two mid-sem exams and one End-sem Examination conducted by the univ.	End-semester = 70%, Mid-semester = 30%	₹ 700 per semester
12	North Maharashtra University, Jalgaon	1990	Jalgaon, Dhule and Nandurbar	214	1,26,000	Every Semester	60+40,80+20,40+10, 75+25,70+30	Depends on Number of Subjects with Practical /Without Practical

13	Swami Ramanand Teerth Marathwada University, Nanded	1994	Latur, Nanded, Parbhani and Hingoli	373	1,15,000	All yearly pattern and all semester pattern Exams on University level.	80% : 20%	According to courses it is different (Minimum 350 for per semester)
14	Maharashtra University of Health Sciences, Nashik	1998	State of Maharashtra	311	65,000	Twice in a year – 1) Summer 2) Winter	Variable	Variable
15	Maharashtra Animal and Fishery Sciences University (MAFSU)	2000	State of Maharashtra	10	1775	Semester and Annual	University Exams: 50% Internal Exams:50%	Ranging from 400-1000 per year
16	Solapur University, Solapur	2004	Solapur District	123	93071	Every Semester	U.G/P.G: External 100% PG(Campus)/some prof courses: 70% : 30%	Ranges from 240 to 1295
17	Gondwana University, Gadchiroli (M.S.)	2011	Gadchiroli and Chandrapur District	215	75,000	Conducts examination of every semester	80% : 20%	BA/BSC/B.C om- 250/- approx Prof Courses 2000/- approx

Part II: Details of examination process in the universities

S.No	Name of the University	Existence of Dedicated Examination cell	Pattern of University Exams	Location of Paper Setting	Location of Printing	Distribution of Papers	Custody of papers
1	Mumbai University, Mumbai	Yes	Long Answers mainly	University Campus	University Press in Campus	University One Permanent Staff/One Temporary Staff	Principal of the Institute/College
2	SNDT Women's University, Mumbai	Yes	15% MCQ	University Campus	Outside Printing Press	Any other agency appointed by the university	Principal of the Institute/Superintendent of Exams
3	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	Yes	No Mcq pattern. SAQ, LAQ at UG level	Institute	Outside Nagpur (Confidential location)	University permanent staff	Principal of the Institute
4	University of Pune, Pune	Yes	Descriptive. MCQ only for online	University Campus	Confidential printer outside state	By University permanent staff by using univ vehicle	Principal/Senior Supervisor at institute/college
5	Dr. Babasaheb Ambedkar	Yes	As prescribed by board of studies	University Campus	Confidential printer outside state	By University permanent and contractual staff	Principal/Chief Superintendent of Institution/College

	Marathwada University, Aurangabad					by using univ and pvt vehicle	
6	Shivaji University, Kolhapur	Yes	Mixed pattern	University Campus	Confidential Press Outside	University Permanent Staff	Principal along with Senior supervisor appointed by university
7	Mahatama Phule Krishi Vidyapeeth, Rahuri, Ahmednagar	No	MCQ – Nil SAQ – 20% LAQ – 80%	Paper setting done at state level for four SAUs by the MAUEB, Pune	At MAUEB, Pune	Dy. Registrar (Academic) of Univ collects the question papers in person	College Principal and Senior Supervisor appointed by Univ
8	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola	No	MCQ – Nil SAQ – 20% LAQ – 80%	Paper setting done at state level for four SAUs by the MAUEB, Pune	At MAUEB, Pune	Dy. Registrar (Academic) of Univ collects the question papers in person	Principal along with Senior supervisor appointed by university
9	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Ratnagiri	No	MCQ – Nil SAQ – 20% LAQ – 80%	Paper setting done at state level for four SAUs by the MAUEB, Pune	At MAUEB, Pune	Dy. Registrar (Academic) of Univ collects the question papers in person	Principal

10	Sant Gadge Baba Amravati University, Amravati	Yes	As per the prescribed syllabus	University Campus	Outside Printing Press	University Permanent Staff	Principal (Officer in Charge) of the institute/ College
11	Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad	Yes	MCQ = 15%, 85% long and short answers	University campus by the concerned teacher only	In Campus	No Dispatch, Single Campus	In-charge printing and Sr. Supervisors
12	North Maharashtra University, Jalgaon	Yes	MCQ is applicable for General Knowledge Paper Only. For other Courses Decided by BOS.	University Campus	Outside Printing Press	Permanent Staff	Senior Supervisor appointed by the University
13	Swami Ramanand Teerth Marathwada University, Nanded	Yes	BA, BCOM, BBA & B. Sc first and second year 80% MCQ & 20% Internal and for remaining all discipline 80% descriptive and	In University Campus	Outside Printing Press	By University Permanent Staff and Contract Basis Staff of Univ by Univ Vehicle	Chief Superintendent of each College/Institute

			20% Internal.				
14	Maharashtra University of Health Sciences, Nashik	There is no such a specific cell. Whole Examination Section is dedicated to work	Pattern of allocation of marks for MCQ/LAQ/SAQ differs from faculty to faculty	University Campus	Outside Printing Press	Through permanent as well as temporary staff.	In-charge of Examination center (In-charge may be Principal or senior most teacher in college)
15	Maharashtra Animal and Fishery Sciences University (MAFSU)	Yes	Objective as well as subjective percentage varies with faculty	Papers are invited from the experts other than Parent University and Moderation is carried out at University Campus	In Campus	Permanent Staff of the constituent colleges	Principal of the Institute
16	Solapur University, Solapur	Yes	MCQ 20% SAQ 40% LAQ 40%	University Campus	Outside Printing Press	University Permanent Staff	Internal Senior Supervisor
17	Gondwana University, Gadchiroli (M.S.)	Yes	MCR --20% SAQ -40% LAQ -40%	In University Campus	Confidential Printer out of the State	By University permanent staff in a sealed Trunks and sealed packets	Principal/ Officer-in-charge appointed by the University

Part III: Details of examination process in the universities

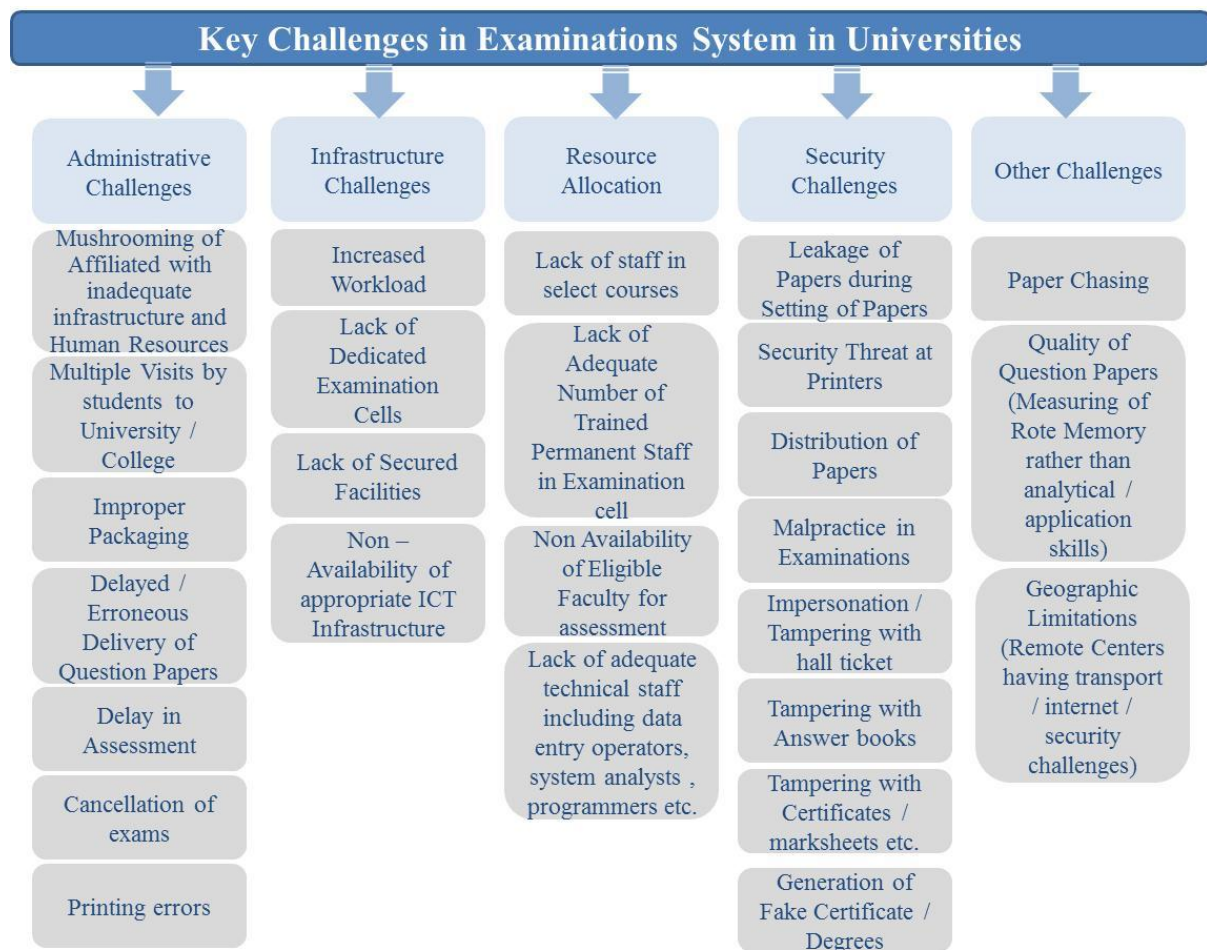
S.No	Name of the University	Sealed Packets opened in presence of	Any other remark
1	Mumbai University, Mumbai	Chief Conductor, Joint Chief Conductor, Sr. Supervisor and two student	-
2	SNDT Women's University, Mumbai	Superintendent of exams and 2 students appearing for the said courses	<ol style="list-style-type: none"> 1) Women's University 2) Conduct Exams in 8 states (Maharashtra, Gujarat/MP/UP/Goa/Bihar/Assam/Daman) 3) Remote rural and urban areas (Like DongarKathore/Nandurbar) 4) Conduct exams in 5 mediums (Marathi/English/Hindi/Gujrati/Urdu) 5) 4 Campuses
3	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	Chief Supervisor, Internal Supervisor, two students	
4	University of Pune, Pune	Principal, Senior Supervisor and Students Representative	Question Papers are stored in strong room of university and distributed confidentially to various Examination centres
5	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	Principal, Senior Supervisor and Students Representative	Question Papers are stored in strong room of university and distributed confidentially to various Examination centres
6	Shivaji University, Kolhapur	Senior Supervisor	1) Smooth conduct of examination and timely declaration of results has been appreciated by

			H.E.Hon.Chancellor and Governor of Maharashtra 2) Shivaji Univ has effectively implemented the mechanism of Digital University Digital College (DUDC). Name list, summary and hall tickets are prepared for 13 exams under DUDC. Other exams also included phase wise under DUDC.
7	Mahatama Phule Krishi Vidyapeeth, Rahuri, Ahmednagar	Principal, Senior Supervisor and two students representatives	All Agricultural universities have the common curriculum and common question paper set by MAUEB, Pune for the semester-end examinations
8	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola	Principal, Senior Supervisor and two students representatives	All Agricultural universities have the common curriculum and common question paper set by MAUEB, Pune for the semester-end examinations
9	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Ratnagiri	Principal, Senior Supervisor and two students representatives	All Agricultural universities have the common curriculum and common question paper set by MAUEB, Pune for the semester-end examinations
10	Sant Gadge Baba Amravati University, Amravati	Officer In-charge, Co-officer Incharge and two students at that shift	Univeristy Question Papers are stored in Push Pull Compactor Storage System (Strong Room)
11	Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad	Sr. Supervisors	Unitary type of university, Question Papers are printed just one day before the examination
12	North Maharashtra University, Jalgaon	Senior Supervisor, Internal Supervisor and Junior Supervisor	Centre Code-Subject Code wise Student Capacity is given to Security Printer in soft form along with

			selected Question Paper Packets with Subject Code is mentioned. Security Printer Sealed boxes and make sealed packets centre code wise. Further it will be distributed by Confidential Section as per Time Table to respective Examination Centre.
13	Swami Ramanand Teerth Marathwada University, Nanded	Chief Superintendent/Joint Chief Superintendent	<ol style="list-style-type: none"> 1. Additional Examination for fail student conducted in the month of June. 2. MCQ results are declared within fifteen days after completion of Examination. 3. To prevent malpractice during Examination University appoints squads for every centre and every day.
14	Maharashtra University of Health Sciences, Nashik	Center In-charge and Center Observer appointed by the University	Fool-proof result processing system
15	Maharashtra Animal and Fishery Sciences University (MAFSU)	Principal of the Institute	CAP Examination for the students who have failed in maximum 2 subjects in veterinary faculty
16	Solapur University, Solapur	Internal and External Senior Supervisor	Hon. VC received appreciation letter from Rajbhavan for result of Oct/Nov 2011 are declared within stipulated time
17	Gondwana University, Gadchiroli (M.S.)	OIC, External supervisor appointed by University and two students appearing for Examination and signed an packets with name, date and Roll No. etc.	Planned to dispatch the Question Papers on the same day of Examination from University Head-Quarter

Chapter 3: Issues and Challenges in Examination system in Universities

Universities today face challenges in various aspects of examination process including Administrative, Infrastructure, Resource Allocation, Security etc. Some of the challenges faced by the universities are listed below:



Administrative Challenges

- i. **Mushrooming of Affiliated Colleges with inadequate infrastructure and Human Resources:** In past two decades, the number of affiliated colleges and courses have increased manifold. Some of these colleges do not have adequate infrastructure and/or faculty. This sometimes leads to malpractices during examinations.
- ii. **Multiple Visits by students to University/College:** Students have to visit universities/colleges multiple times for information or processing of application forms, examination date, results and syllabus etc., thus wasting his/her precious time and money. Students have to wait for in long queues to take examination forms, deposit examination fee, to get hall tickets and to get know the status of their results.
- iii. **Improper Packaging:** The Universities provide the details of packages to be made to their printers. The Printers then package the printed question papers and dispatch to respective examination centers. In this process, improper packaging may pose a great threat to examinations process in universities.
- iv. **Delayed/Erroneous Delivery of Question Papers:** Delays in receiving sealed packets by the respective examination centers may lead to serious concerns and anxieties among personnel involved.
- v. **Delay in Assessment:** Result declaration is an area that directly affects students' future careers, especially final year results. While state mandated Rules do exist, results are sometimes delayed, and are unpredictable in terms of release date. Students are most often not informed and authorities fail to specify accurate declaration details. The consolidation of marks is delayed due to inconsistencies

Administrative Challenges

Mushrooming of Affiliated with inadequate infrastructure and Human Resources

Multiple Visits by students to University / College

Improper Packaging

Delayed / Erroneous Delivery of Question Papers

Delay in Assessment

Cancellation of exams

Printing errors

- in internal marks, delays in second round of assessment, disputes in merit list creation, etc.
- vi. **Cancellation of Exams:** Due to leakage of papers, the exams are cancelled. This adversely affects the students in many ways like increased stress, anxiety, loss of time and money etc. Further, due to delay in exams students pursuing higher studies or jobs or other career opportunities maybe adversely affected
 - vii. **Printing errors:** Printing Errors or errors due to insufficient proof reading are also one of the biggest issues faced by universities. These errors lead to cancellation of questions and providing marks to students in lieu of that.

Infrastructure Challenges

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> i. Increased Workload: Number of Affiliated Colleges, Courses and thereby examinations have increased multifold. This has led to increased workload in the examinations cell/Divisions in Universities. | <div style="background-color: #d9e1f2; border-radius: 10px; padding: 10px; width: 150px; margin: 0 auto;">Infrastructure Challenges</div> |
| <ul style="list-style-type: none"> ii. Lack of Dedicated Examination Cells/Divisions: In Agricultural universities, there is no separate establishment for Examination Cell/Division. During examinations, deputed/pooled staff carries the duties of examinations. These resources lack adequate experience for carrying out the examination related activities which may sometimes lead to inadvertent mistakes. | <div style="background-color: #d9e1f2; border-radius: 10px; padding: 10px; width: 150px; margin: 0 auto;">Increased Workload</div> <div style="background-color: #d9e1f2; border-radius: 10px; padding: 10px; width: 150px; margin: 0 auto;">Lack of Dedicated Examination Cells</div> |
| <ul style="list-style-type: none"> iii. Lack of secured facilities: There is lack of proper secured facilities in select colleges/institutes for storing the sealed packets of Questions papers. Insecure custody/storage facilities are prone to break-ins/ theft etc. | <div style="background-color: #d9e1f2; border-radius: 10px; padding: 10px; width: 150px; margin: 0 auto;">Lack of Secured Facilities</div> |
| <ul style="list-style-type: none"> iv. Non Availability of appropriate ICT infrastructure: Many colleges/institutes especially the non-technical colleges/institutes in remote areas lack basic ICT infrastructure. This is a key challenge in implementation of ICT initiatives. | <div style="background-color: #d9e1f2; border-radius: 10px; padding: 10px; width: 150px; margin: 0 auto;">Non – Availability of appropriate ICT Infrastructure</div> |

Resource Allocation

- i. **Lack of staff in select courses:** No constituent colleges for some of the streams like Biotechnology, Food Science, Agri-business Management. It affects the examination related work viz. setting of question papers and moderation of question papers due to lack of permanent staff in university.
- ii. **Lack of Adequate Number of Trained Permanent Staff in Examination Cell/Division:** Growing number of affiliated colleges has overburdened the staff of University and Examination Board. In numerous universities, Examination cells/divisions are runs on temporary/contract staff or pooled posts.
- iii. **Non Availability of Eligible Faculty for assessment:** There is a gross shortage of qualified lecturers, readers and professors in concerned courses for assessment of papers.
- iv. **Lack of adequate technical staff including data entry operators, system analysts, programmers etc.:** There is need for technical staff including system analysts, data entry operators, programmers etc. in Examination cells/divisions for implementation and maintenance of IT initiatives in Examinations system in Universities.

Resource Allocation

Lack of staff in select courses

Lack of Adequate Number of Trained Permanent Staff in Examination cell

Non Availability of Eligible Faculty for assessment

Lack of adequate technical staff including data entry operators, system analysts , programmers etc.

Security Challenges

- i. **Leakage of Papers during Setting of Papers:** Sporadic instances have been noticed where the Paper Setters/ Proof Readers/Staff in charge of setting papers leak the paper for commercial benefits or entrust their juniors with the job who can leak it.
- ii. **Security Threat at Printers:** While printing and packaging of the question papers, the question papers pass through various hands. In this process, proper supervision and confidentiality needs to be maintained.

- iii. **Distribution of Papers:** During the distribution of papers, there are serious threats faced by the Universities of leakage of papers. In this process, the examination papers exchange hands of various personnel thus increasing the risk of leakage.
 - Security Challenges
 - Leakage of Papers during Setting of Papers
 - Security Threat at Printers
 - Distribution of Papers
- iv. **Malpractice in Examinations:** Malpractices like possession of incriminating materials for the purpose of copying, Actual copying, Invigilators dictating or writing answers on the blackboard and Misuse of Technology (mobile phones/earplugs/ Bluetooth devices etc.) is also a great concern.
 - Malpractice in Examinations
- v. **Impersonation/Tampering with hall ticket:** There are many instances of student impersonations in large universities, which rely on external examiners to supervise Examination conduct of actual. Final year exams are more prone to such malpractices.
 - Impersonation / Tampering with hall ticket
- vi. **Tampering with Answer books:** Insertion of duplicate answer books in place of original before valuation or at the time of re-valuation of scripts. Re-writing the answers once again in between wherever space is available in the answer sheets before valuation/re-valuation of scripts. All these pose serious threat to sanctity of examination process.
 - Tampering with Answer books
 - Tampering with Certificates / marksheets etc.
- vii. **Tampering with Certificates/Mark sheets etc.:** Tampering of Mark sheets and certificates by unscrupulous elements of the society is a great challenge faced by the university.
 - Generation of Fake Certificate / Degrees
- viii. **Generation of Fake Certificate/Degrees:** Issuance of Fake Certificates in connivance with officials/staff of Universities or creation of fake certificates by students and other mischievous elements is another issue which needs to be addressed. Such practice makes waste of effort and hard work put by meritorious students.

Other Challenges

- i. **Paper Chasing:** Some students may try to influence emotionally or financially to give more marks to them and a few examiners may oblige them.
- ii. **Quality of Question Papers (Measuring of Rote Memory rather than analytical/application skills):** The examination system in Universities places great stress on rote memory rather than practical application of knowledge or analytical skills.
- iii. **Geographic Limitations (Remote Centers having transport/electricity/internet/security challenges):** There are known geographic limitations to large Universities to conduct examinations, like colleges located in distant and remote places, hilly areas and dense forest covered areas etc. This poses a threat to security of examination papers. Leakage at one location can lead to jeopardizing of examination process throughout the university.

The above section details various issues faced by the Universities in the examination process. In further sections, many of these issues are addressed and recommendations provided.

Other Challenges

Paper Chasing

Quality of
Question Papers
(Measuring of
Rote Memory
rather than
analytical /
application
skills)

Geographic
Limitations
(Remote Centers
having transport
/ internet /
security
challenges)

Chapter 4: Good Practices Study of ICT initiatives

Information and Communication Technology is increasingly playing an important role as an enabling mechanism for the delivery of efficient and effective government services. Accordingly, Many Universities are now embracing the use of Information Technology in search for more efficient and competitive processes both in delivery of services as well as in administrative processes. The onset of Information and Communication Technologies (ICTs) is changing the way universities work.

This section outlines select examples of successful implementation of IT in examination Management System across India and Maharashtra.

Case Study 1: Secure Delivery of Question Papers in SNDT University, Maharashtra

Shreemati Nathibai Damodar Thackersey Women's University (SNDT) is a women's university in the city of Mumbai, India. The university headquarters are situated at Churchgate in South Mumbai, while the main campus is in Santacruz–Juhu area of Mumbai. SNDT has three campuses: two in Mumbai and one in Pune. The University has affiliated colleges in Maharashtra, Gujarat, Assam, Uttar Pradesh, Bihar, Madhya Pradesh and Goa, as well.



Prior to automation of examination system, SNDT University was facing challenges like Question paper leakage, on time delivery of question papers, huge operational expenditure and logistic issue, pressure for faster processing of examination and result declaration.

The automation of Examination process led to

- ✓ Online question paper printing
- ✓ Distribution of the question paper on the day of examination
- ✓ Reducing a huge amount of Operational Expenditure and logistics issues.
- ✓ Faster Process of Examination System and Result Declaration.
- ✓ Assuring smoother delivery of Examination process.
- ✓ Entire Process management from University Head office without any delay or mistakes.
- ✓ Designed to bring transparency in system.

- ✓ Reducing all the Malpractices with the use of technology, resulting in a quality branding of the Institution.

The security of the web application was achieved by having

- ✓ User Authentication: Every user who upload /publish /download paper is having unique username and highly encrypted password
- ✓ MAC address restriction: To access the application
- ✓ Upload/download rights: Paper upload /download is also protected with permission according to admin user only
- ✓ Password protected documents: Paper PDF which is uploaded is password protected with highly encrypted password
- ✓ Different Security privileges: Set different security privileges for anonymous and authenticated users
- ✓ Group based access: According to centers, access right has been defined e.g. BCA centers can access BCA papers only

The online (e-mode) transfer of question papers has been successfully implemented by SNTD for past three years. It involves the following process:

- Readiness check of all Examination centers – 100% availability of all IT infrastructure
- Gap Analysis – Finding the gap between required and available infrastructure
- Gap Filling – Preparation with alternatives. e.g.: Electricity, Connectivity etc.
- Mock sessions before actual Examination – Dummy Question Papers Generation and circulation of the same
- On-site support
- Paper Distribution
- Paper Printing – Password Delivery through automated system
- Monitoring and Execution – Monitoring of question paper downloading and printing through online tool be the centralized service desk team for any instant support needed.

Case Study 2: Implementation of Digital Evaluation and Question Paper Delivery in Visvesvaraya Technological University

As a pilot project, Visvesvaraya Technological University successfully implemented secure delivery of question papers to 27 colleges in Belgaum region during December 2011-January 2012 examination. Now the University is planning to deliver question papers online to all its 193 affiliated engineering colleges from June/July semester examination this year.



The Registrar (Evaluation) logs in to the examination portal through a registered system. He selects the examination, date of examination, session, and chooses the question paper folder to be uploaded.

The question papers are uploaded 45 minutes before the commencement of the examination. The software allocates the relevant question papers to each college based on the examination application data received from each college.

A secret key to access the question papers is delivered to each college around 30 minutes before the examination. In each college, the principal, deputy chief superintendent and a system administrator appointed by VTU are responsible for the QPDS.

“Online delivery of question papers to affiliated colleges a mere 30 minutes before the scheduled time of examination introduced by Visvesvaraya Technical University (VTU) has yielded rich dividends and put an end to the threat of question papers getting leaked.” – Deccan Herald, April 2012

Also, the question papers cannot be stored in the form of a soft copy as it is completely destroyed once the printing is completed.

The University was also the first university in India to introduce digital evaluation system from 2011-12. More than 20 lakh answer scripts of both undergraduate and postgraduate students were digitized for evaluation every semester.

Case Study 3: Integrated Examination Management System at Anna University of Technology, Coimbatore

Anna University Coimbatore is an affiliating type of University. It was established Under Act No. 42 of 2006 by the Government of Tamilnadu on 01-02-2007 vide G.O.Ms.No.13, Higher Education (1-2), dated 1st February 2007. The University has its Head Quarters at Coimbatore.

Anna University Coimbatore has jurisdiction covering eight districts namely Coimbatore, Dharmapuri, Erode, Karur, Krishnagiri, Namakkal, Salem and the Nilgiris.



The University also offers higher education in Engineering, Technology, Management and allied Sciences relevant to the current and projected needs of the society. Besides promoting research and disseminating knowledge gained there, it fosters cooperation between the academic and industrial communities.

Anna University of Technology, Coimbatore has implemented end to end Examination Management System that automates the complete life cycle of Examination Management which includes online registration of candidates, examination fee management, internal marks uploading, online hall ticket generation, distributed authoring of question papers, question bank management, question paper generation, secure delivery of question papers, digital evaluation, tracking of students performance and performance analysis to publication of results, printing of mark sheets and certificates and certificate authentication system.

In April/May 2011, this system catered to more than 150 colleges and lakhs of students. In this term the university was successful in delivering and printing various documents as follows covering 40 lakhs pages for this cycle of examinations:

- Printing of Hall Tickets : 163210 numbers
- Printing of Mark Sheets: 163210 numbers
- Printing of Total Copies of Question Papers: 11,16,302 (minimum 4 pages in each Question Paper)
- Printing of Provisional Certificate : 41762 numbers
- Printing of Consolidated Mark Sheet: 8230 numbers

Case Study 4: Good Practices in Shivaji University, Kolhapur

Good Practices followed by Shivaji University, Kolhapur include:



- a) *Synoptic Answers and Marking Scheme*
 - i. Synoptic answers and marking scheme was made mandatory
 - ii. Before commencement of assessment, the paper setter/moderator assess minimum 20 answer books each in the light of synoptic answers/ marking scheme. There is scope to modify the synoptic answers/ scheme and the assessment - moderation progress simultaneously with constant interaction of examiners and moderators throughout the period of assessment

- b) *Minimization of Errors at Various Levels*
 - iii. Up-to-date database of teachers' profile helps in appropriate appointment of paper setters, moderators, examiners and re-evaluators
 - iv. Barcoding, coding-decoding of answer books, direct scanning of marks, scrutiny after assessment to maintain quality and confidentiality of the assessment process
 - v. The university has introduced a system of scrutiny, direct entry of marks in computers through direct scanning to reduce clerical errors so as to ensure efficient, fast and more accurate processing of results

- c) *Student Friendly Reforms*
 - i. Computerization of most steps in the examination system
 - ii. Introduction of October-to-October batch for external students and their online registration
 - iii. Online application for entrance examination
 - iv. Issue of hall ticket with photograph, PRN and Seat Number and personalized Examination Schedule

- v. Various reforms at administrative level to ensure speedy processing of examination steps, complaints, correspondences, issue of various certificates
- vi. Online application forms for degree certificates

Case Study 5: Good Practices in Agricultural Universities (Mahatma Phule Krishi Vidyapeeth, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth and Marathwada Agricultural University)

Good Practices followed by all four Agricultural Universities include:

- a) A Credit based semester pattern has been adopted.
- b) A system of experimental learning and hands-on training has been established during Semester VIII at UG Level.
- c) Library:
 - Digitization of Ph.D. Theses (e-Granth Project at MPKV, Rahuri)
 - Online journal facility (CeRA – Consortium of electronic Resources in Agriculture)
 - Computerized database for library records



Case Study 6: Good Practices in Solapur University, Solapur

Good Practices followed by Solapur University include:

- a) *Administrative and Facilitation Services*

This initiative was implemented in the year 2007. The benefits include:

- | | |
|--------------------------------------|------------------------------------------------------------------------------------------------|
| • Personal Login | • Complete Track Record |
| • Profile Change Requests | • Personalized Eligibility and Enrolment Forms |
| • Examination Forms and Hall Tickets | • Exams Schedule and Time Table |
| • Results | • Applications for: Subject Change, Photocopy of Answer Books, Re-Evaluation, Re-verification, |



Transcripts, Ordinance and Grace
Cancellations, Exemption
Cancellation

- Resume for Campus Placements

- SMS and Email Alerts

b) *Benefits to colleges*

Benefits to colleges include:

- Student Data Capture at source,
- Integrated Electronic Data Exchange with university
- Automation of Campus Administration

- Instant Statistical Report Generation
- Secured Login for Each College
- Graphical MIS Dashboard for Principals

c) *Services for Students*

The benefits and services for the students include:

- Personalized Login
- Information availability and transaction services

- Job Opportunities and Career Advancement
- Social connectivity for collaboration

Case Study 7: Good Practices in Mumbai University

Good Practices followed by Mumbai University include:

a) Document Management System: A Tracking system for all documents and folders related to the university.

b) On line Question Paper distribution:

- Question papers are sent to centers through web link with password protection and encrypted system before one hour of examinations.
- A call center was established for providing support to colleges during the process.



- Downloading of Question Papers in presence of Chief Conductor and Joint Chief Conductor. The Joint Chief Conductor appointed by the University.
- c) On line Enrollment System: Colleges are connected to University through digital university portal colleges are filling online information of admitted student
- d) Use of OMR and Barcoded answer books for all examinations
- e) Submission of online marks for internal and practical examinations by the affiliated colleges
- f) Declaration of results along with Provisional copy of mark sheets online
- g) University has initiated the Question Bank Preparation for faculty of Engineering and Education

Case Study 8: Good Practices in Gondwana University, Gadchiroli (M.S.)

Good Practices followed by Gondwana University include:

- a) Online Affiliation
- b) Online Processing of proposals of new colleges/subjects
- c) Ph.D. Registration PET Examination
- d) Recruitment of staff and online communication with affiliated colleges and staff.



All the initiatives implemented in the year 2012-13.

Case Study 9: Good Practices in Dr. Babasaheb Ambedkar Technological University, Lonere

Good Practices followed by Dr. Babasaheb Ambedkar Technological University, Lonere include:

- a) Digitization of Examination Data: Implemented in the year 2011.
- b) Result processing and printing: Implemented in the year 2011.
- c) ERP based Accounting software: Implemented in the year 2011.
- d) Choice based credit system and relative grading system.
- e) Printing of grade reports and degree certificates with security features.



- f) Online Admissions of M.Tech and Ph.D. programs.
- g) Online payments of various fees.
- h) The university has proposed the process wherein the examiners for Ph.D. students are selected automatically by the software on basis of competencies of the faculty and research topic of the students. Following this, the students submit the Ph.D. thesis online to streamline and speed up the process of evaluation of thesis submitted by PhD scholars.

Case Study 10: Good Practices in Sant Gadge Baba Amravati University, Amravati

Good Practices followed by Sant Gadge Baba Amravati University, Amravati include:

- a) Intelligent Character Recognition System: Implemented in 2001, uses a scanning based system for Pre and Post Examination Work.
- b) Computerized Re-assessment, Answer Book Photocopies and Redressal System: Implemented in 2007, helps in declaring results in stipulated time.



Case Study 11: Good Practices in North Maharashtra University, Jalgaon

Good Practices followed by North Maharashtra University include:

- a) Digital University Digital College Project (e-Suvidha): Implemented in year 2007, has facilitated a paperless online examination process.
- b) Barcoded Answer sheets: Implemented in the year 2008, has facilitated scanning of Answer Books providing security and confidentiality.
- c) EDPS Software for Examination Process: Implemented in the year 2009, has facilitated Result Processing with accuracy.



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Case Study 12: Good Practices in Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Good Practices followed by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur include:

- a) Pre examination data processing.
- b) Result processing.



Case Study 13: Good Practices in Maharashtra Animal and Fisheries Sciences University (MAFSU), Nagpur

- Grade cards are provided to students at the end of every semester.
- Intranet Portal for students wherein question bank, lectures and practical schedules, extra reading material are uploaded.
- In Select colleges, virtual classrooms have been established.
- Academic Audit is carried out every year.



Case Study 14: Good Practices in Maharashtra University of Health Sciences, Nashik

Good Practices followed by Maharashtra University of Health Sciences, Nashik include:

- Computerized Result Processing System. Computerized result processing system and printing mark sheets/certificates/hall ticket is in effect since inception as the University i.e. from 1998. The University is able to maintain schedule in each case, due to computerization of Results Processing system resulting in speedy and accurate execution. Consequently, the examinations are conducted and results are declared as per schedule.
- Certificate Courses in MUHS by the authorities of the University ranging from 3 months to 12 months.



Case Study 15: Good Practices in University of Pune

Good Practices in University of Pune include:

- Online Results Processing and Ledger Scanning done in-house. Digitized data available till year 2010.
- Online verification, re-evaluation, convocation, certification section functions enabled since 2009.
- Student Facilitation center has been automated for various services.
- Online Examination for first year Engineering faculty for all branches.



- e) Entire Pre-Examination process automated from online Examination form filling, fee calculation, college interface for verification of data and submission to university, online bank challan enabled.
- f) Internal marks submission enabled online.
- g) Post Examination Activities such as Results Processing also online.
- h) Other Online Features: BCUD automation – all features, Finance Automation with customized online payment, Administrative Automation, Election, Vidyavani – Online Radio etc.

Case Study 16: Good Practices in Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Good Practices in the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad include:

- a) Use of ICT from Registration to generation of hall tickets with the help of eSuvudha application powered by MKCL. All the Student/Examinees are supplied with the relevant information through university website.
- b) University has established a Student facility center (SFC) for resolving student grievances.
- c) In spite of inadequate number of approved teachers in some branches of study and short of non-teaching staff, the university with the help of existing staff declares the result within 45 days and of some of the examinations within two months.
- d) University has instituted awards for best examination center and of Best Joint Chief Superintendent.
- e) University has decentralized the UG First year i.e. I and II sem. Assessment program at college level and for II and III year decentralized the CAP at four Districts.
- f) Provision of Technical/ICT Training to administrative staff.
- g) Online Ph.D. registration and PET examination.
- h) Automation of functions of BCUD and Academic Section of University.



Case Study 17: Good Practices in Symbiosis Centre for Distance Learning

Symbiosis Open Education Society's Symbiosis Centre for Distance Learning (SCDL) runs post graduate programs and has 200,000+ active students from all states of India and over 40 different countries.



Conducting the examination for all SCDL programs with such large number of students is a challenging task. To effectively handle this challenge, SCDL developed a Computerized Examination System (ICT based) in 2004 to conduct all examinations and pre and post examination processes. The examination system is world class and SCDL holds its international copyrights.

Today, SCDL offers complete flexibility and convenience to students through on demand computerized examination system which is tamper proof and highly accurate. SCDL successfully conducts over 60,000 examinations each month and approx. 8 lakhs examinations each year.

The examination system has following modules/subsystems:

- 1) Examination Paper Management System: All model questions (objective and subjective) are entered in the system to form a question bank. Along with this large bank/database of questions, the Rules for setting a particular question paper pattern is given as input parameter to the system. Question paper is randomly generated with the input parameters from valid question bank.
- 2) Examination Delivery System: Each question paper is delivered securely (encrypted) to the student. The question paper pattern is a combination of multiple choice and subjective questions and can be conducted in online, semi-online as well as offline mode. With this system, malpractices like leakage of question papers, cheating etc. have been drastically reduced. For additional security, finger printing and video capturing facility is also available.

Examination Booking and Hall Ticket Generation System: Student uses this sub-system to book the examination slot. A hall ticket with the photograph of the student is printed, which student needs to carry along with I-Card for appearing for examination.

- 4) Results Processing and Publication System: Result processing and publication is done by computer software. Moderation and grading activity is also possible during result processing. Once the results are declared, mark sheet is auto generated and printed. Along with that, degree certificate is also printed from the system. This automation has helped SCDL to reduce the manpower required for compilation and declaration of result.

- 5) MIS and Reporting System: At a click of a button, MIS and other important reports can be generated from the database.
- 6) End-to-end computerized system of Examination has helped SCDL to conduct large volume of examinations with maximum accuracy and minimum manpower. This Examination system has been developed by SCDL with 10 years' experience of conducting successful examinations using ICT and hence it addresses the various administrative, infrastructural, human resource allocations, security and other mal practice challenges effectively.

Symbiosis has developed its own software which is capable of handling computerized, online, conventional/traditional examinations for a large number of students across India.

Case Study 18: Good Practices in Swami Ramanand Teerth Marathwada University, Nanded

Good Practices in the Swami Ramanand Teerth Marathwada University, Nanded include

- a) Those who have made malpractice, university declared their result in WPC (Whole Performance Cancelled). This system implemented since 1996 in this university.
- b) Only 25% ATKT facility provided to the students.
- c) University Examination Department successfully conducted 3 PET Examination.
- d) OMR Evaluation System used in B.A., B.Com, BBA & B.Sc. Examination. 80% MCQ and 20% LAQ at graduation level. I & II year and reverse for III year.
- e) CGPA to P.G. courses in campus schools.
- f) Additional examination conducted within one month after declaring the summer result for graduate student in same year and result given in 15 days. There is no scope for loss of year. Result that the percentage of passing is increased. It is a unique pattern.
- g) MCQ Pattern examination system is enabling to students for competitive examination preparation.



Chapter 5: Technology Recommendations

The objective of the report is to recommend an examination management system that is reliable, efficient and transparent. With introduction of information technology, greater efficiency can be added to the universities by automating some of the activities which are conducted manually. The envisioned system should also aid in timely decision making and disseminating of information to the students, colleges and other agencies.

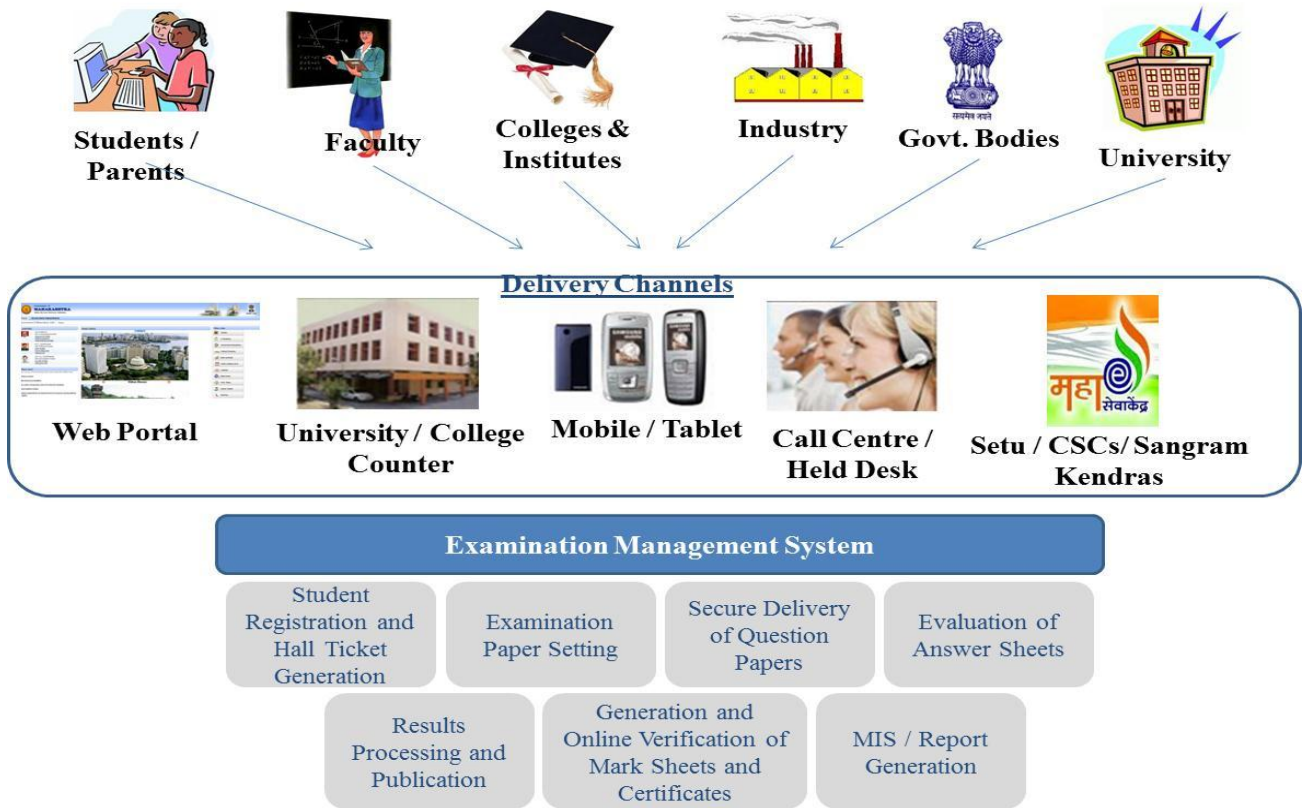
In this report along with the Technology, the committee has provided recommendations on Administration, Academia, Resource Allocation etc. for successful implementation of the system.

Overview of the Solution

Recommendation 1: Effective end-to-end use of ICT for reforms in Examinations: Information and communication Technology (ICT) should be effectively used for management of examinations system in Universities to usher in greater efficiency, transparency and reliability. Use of ICT should also lead to improvement in quality of services being provided to the students/colleges/ departments etc. by introducing services through online web portal, computerized counter at college/university, mobile, helpdesks and Common Service Centers (Setu, eSangram Kendras), etc. and online availability of information. The end-to-end integrated examination management system can manage the entire operation of examinations in Universities. The comprehensive examination management solution typically includes modules as follows:

- Student Registration to issuance of Hall Ticket
- Question Bank/ Question Paper Bank Generation
- Secure Delivery of Question Papers
- OMR and Barcode Technology in Answer Sheets
- Digital Scanning and onscreen evaluation of Answer Sheets
- Results Processing and Publication
- Online Application for Reevaluation
- Dematting of Degrees and Certificates

Examination Management System



Through implementation of this solution, there can be great improvement in the speed, reliability, efficiency and accuracy of the entire process of the examination process in Universities. Students can be benefited the most with availability of accurate information in click of a mouse and timely declaration of results. University Staff can also be benefited as the process will be more efficient, data handling will be easy and tedious manual tasks should be replaced by technological solutions. This will also bring more credibility to the examination system of the universities.

Therefore, Universities should strive to increase the usage of ICT in management of examinations systems in a phased manner as elaborated in this report in later sections.

Depending on the present status of computerization, the solution may be end-to-end from one service provider or may involve different service providers implementing various modules.

Use of IT in Student Registration for Examinations to Issuance of Hall tickets

Recommendation 2: Online student registration for examinations to issuance of hall ticket:

Every University should adopt ICT for online student registration for examinations from academic year 2013-14 and conduct few pilots for online issuance of hall ticket by first half of 2013. The universities may decide the service providers from among the following options:

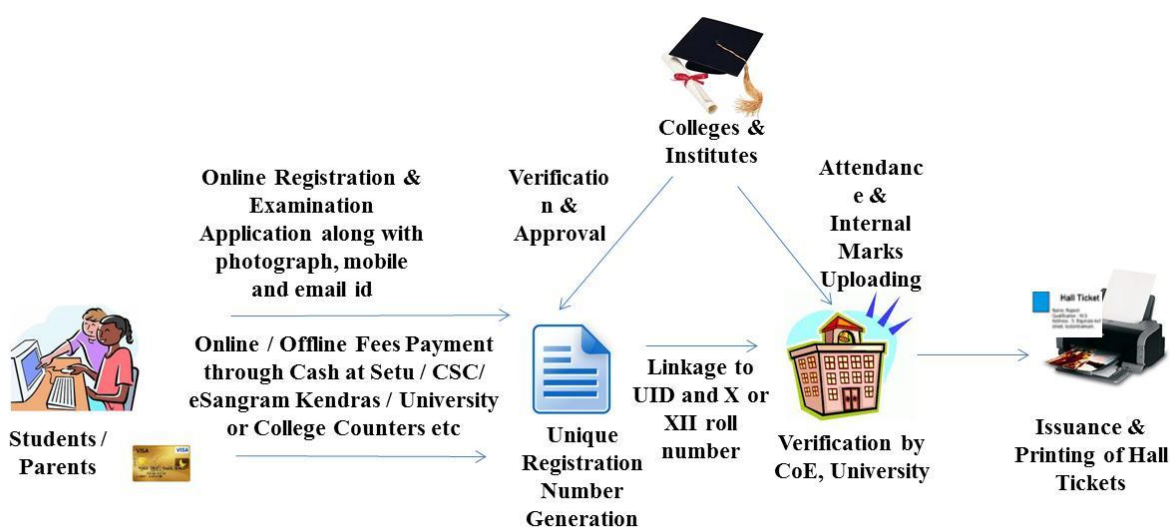
- i. In-house Development of this module in the University.
- ii. MKCL's *eSavidha* application.
- iii. Selection of service provider through tendering.
- iv. Smaller Universities may approach Larger Universities for either knowledge transfer or collaboration for combined tendering so as to reduce costs.

The solutions developed by aforementioned methods should however have the bare minimum requirements/features as follows:

Student Registration and Hall Ticket Generation

- Students register themselves for examinations with Photograph, Program name, Branch, Part time/Full time, Personal Details and Male or Female etc. (This data maybe imported from other modules of college, if applicable) During the registration, students can have option of providing mobile numbers and email ids.
- Adherence to e-gov standards, linkage to UID number and linkage to Class X or XII examination seat number should be ensured. To avoid vendor lock-in, all the data should be exportable to open standards so that other software solutions can use it.
- Students pay the fees online through credit cards/net banking etc. or offline through cash at Setu/CSCs/ eSangram Kendra/University Counter/College Counter etc.
- Verification of application by respective college/institute and approval of Registration.
- Validation of eligibility of students.
- Registration Number Generated after verification by Controller of Examinations of University.
- Unique Registration Number created comprising of codes of Program/ Branch/ Year of Entry/ Number of years of Program/ College code/ Part time or Full time/ Male or Female/ Roll number etc.

- Attendance data and internal marks uploaded by institutes/colleges
- Hall Tickets Generated Online with printed photograph of student and approved by CoE
- Available on the server and on students page for printing
- Throughout the process, Students should be sent status updates on the registered mobile numbers/email ids regularly
- Audit Trails and Reports



Illustrative Process of Student Registration and Hall Ticket Generation

This system shall automate the hall ticket generation process, thus reducing the errors in hall tickets and speedy processing of hall tickets. This system also reduces the scope of malpractices related to hall ticket tampering, replacement of photograph in hall tickets etc.

The committee recommends that Government of Maharashtra should issue guidelines for creation of unique ids for students across the state. This can ensure easier migration of students between universities.

Question Bank/Question Paper Bank Creation

Many universities have already initiated pilot implementation of Question Bank/Question Paper Bank solutions with very encouraging results. During discussions, most of the members committed to start such pilots in their respective universities.

Recommendation 3: Question Bank/Question Paper Bank Creation: The Committee unanimously recommends that Question Bank Approach or Question Paper Bank Approach should be followed by Universities for setting universities examination papers. The universities may decide as per their requirements from among the two approaches.

For ensuring quality and systematic generation of Question/Question Paper Banks, training and orientation needs to be provided to paper setters on various frameworks like Andersen/Bloom's taxonomy (Refer to Annexure D: Development of 'Blue Prints' of a Question Paper: Importance and Methodology).

The number of questions in the question bank should be at least 100 times the number of questions required in a question paper. The Question bank should be available on website of the university as well as the libraries of universities and affiliated colleges. In case of Question Papers bank, the number of Question papers should be at least 30-50 times. But these Question Papers should be kept confidential.

At least one third of the questions in Questions bank should be changed every year in courses like medicine, agriculture, technology etc. to keep pace with the rapid changes in the respective fields. In subjects like Arts, History etc., at least 10-15% of Questions in the Questions bank should be changed every year. In case of Question Paper Bank, whenever the curriculum is modified all the questions papers in the Question papers bank should be changed/ modified.

Question Paper Setting

Option 1: Question Bank Creation and Question Paper Generation

In Question bank creation, Universities can assign senior faculty from respective subject to create question banks with model answers and grading. These questions and model answers would then be passed to the moderator who would approve it to pass in the database to form Question bank. At the time of Examination, the software would itself create the question paper from the available database. The key specifications of the module include:

- Suitable web interface for distributed question bank authoring with multi-level approval system
- Registration of authors of question banks with multi-level approval system.
- Question bank creation and Section management as per the course syllabus.
- Provision for review and approval of question banks authored by individual authors.

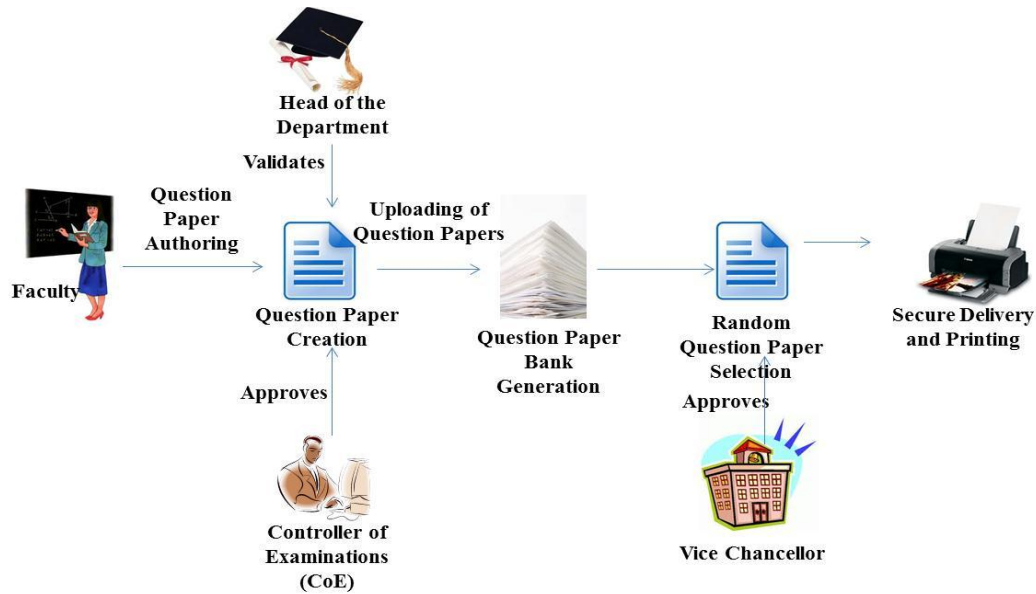
- Facility to author question of different types – Subjective, objective, fill in the blanks, comprehension type, matching column type, true false type, assertion-reason type, single choice type, multiple choice type of questions etc.
- Facility for authoring individual questions as well as bulk uploading of questions.
- Facility for validation, deletion, modification of questions authored by the authors.
- Provision for payment processing of question bank authors.
- Generation of question papers in multiple sets from the question bank.
- Question paper generation multiple times for a particular subject.
- Separate question paper generation system for regular and arrear examination.
- Encryption of uploaded and generated question papers in the database.
- Audit Trails and Reports.

Option 2: Question Paper Bank Creation

In Question Paper bank creation, Universities can assign senior faculty from respective subject to create Question Papers with model answers and grading. These question papers and model answers would then be passed to the moderator who would approve it to pass in the database to form Question Paper bank. At the time of Examination, the software would itself select the question paper from the available database.

- Suitable web interface for distributed question paper bank authoring with multi-level approval system.
- Registration of authors of question paper banks with multi-level approval system.
- Provision for review and approval of question paper banks authored by individual authors.
- Facility to author question of different types – Subjective, objective, fill in the blanks, comprehension type, matching column type, true false type, assertion-reason type, single choice type, multiple choice type of questions etc.
- Facility for authoring individual question papers as well as uploading of question papers.
- Facility for validation, deletion, modification of question papers authored by the authors.
- Provision for payment processing of question paper bank authors.

- Random selection of Question papers from the Question Paper bank.
- Encryption of uploaded and generated question papers in the database.
- Audit Trails and Reports.



Illustrative Process of Setting Examination Paper

Evaluation of Alternatives

	Option 1: Question Bank Creation and Question Paper Generation	Option 2: Question Paper Bank Creation
Pros	<ul style="list-style-type: none"> - Creation of database of questions which can be shared between different universities 	<ul style="list-style-type: none"> - Requirement of experts on the day of examination during examination paper generation is eliminated - Replacing of a question paper during the examination process, if warranted, will be an easy and smooth affair
Cons	<ul style="list-style-type: none"> - Need experts on the day of examination during examination paper generation to verify the examination paper - Need foolproof logic in the system for creation of examination papers in the system 	<ul style="list-style-type: none"> - If sample size or number of question papers in the bank is small, there is a possibility of leakage of question papers

The Universities may select one of the two mentioned alternatives (i.e. Question Bank or Question Paper Bank) as per their individual needs, requirements and constraints.

The universities are currently utilizing the Section 32 (3b) of the Maharashtra Universities Act 1994 (or equivalent section of their respective universities Act/Rules and regulations) that allows universities to undertake exercise and experiment in examination reforms. However, to make this reform a practice rather than experimentation, it would be better if the state government makes necessary provisions in the Act.

On implementation of this system, Question paper can be generated/selected directly by the IT system few hours before the examinations. Therefore, issues related to setting of question papers like leakage of question papers, printing errors, etc. can be greatly reduced.

Secure Delivery of Question Papers

In order to combat the leakages during the distribution process, some universities like Mumbai University have already started experimenting with secure delivery of question papers over a secure web link and then printing at examination centers with high speed printers etc. SNDT, VTU etc. are using this system successfully for past few years.

Recommendation 4: Secure Delivery of Examination Papers: In order to eliminate the threats and challenges faced in distribution and delivery of Question Papers to the respective institutes, the universities should adopt Information Technology Solution for Secure Delivery of Question Papers.

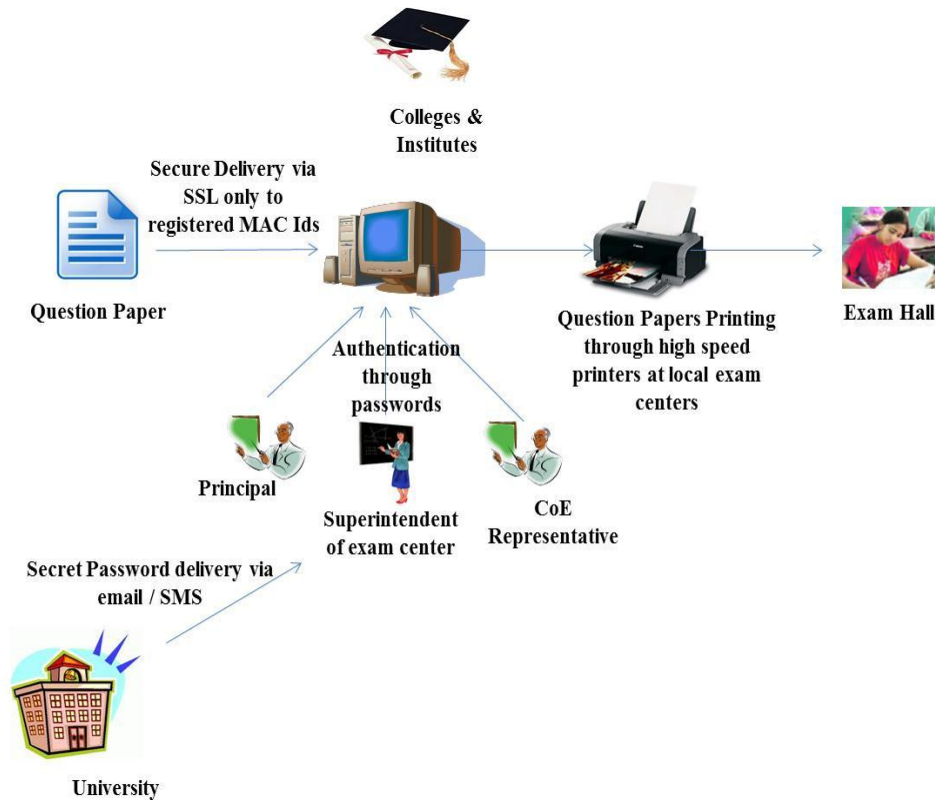
The committee also recommends that each university should implement this system on pilot/experimental basis for exams conducted in first half of 2013. Following this, by 2014, it should become a matter of practice. However, if any university can implement this system fully before the suggested dates, it would be a very welcome step.

The key features of this module are as follows:

The Question paper once randomly selected/generated from the bank is encrypted and transmitted over secure channel to the examination centers just one hour before the Examination. At the examination center it is decrypted with the key/password and printed. This will overcome the leakage of question paper during transportation and printing. The key specifications include:

- Suitable encryption system and fail safe system for the transmission of Question Papers to Examination halls at the allotted time.
- MAC ID registration of the machines used for question paper printing at Examination hall.
- Approval and tracking of access points from Central Monitoring Center.

- Question Paper printing at examination centers within the time window prescribed.
- Tracking of Question Paper printing and audit management through suitable surveillance system.



Illustrative Process of Secure Delivery of Question Papers

- Secret key should be generated by the system and delivered securely to the concerned persons before the Examination.
- Provision to have secret keys for individual papers or a particular Examination.
- Provision to delivery secret keys by email, SMS or using the system.
- Secret key verification system for printing of question papers.
- Well defined time durations for question paper upload, secret key delivery and question paper printing.

- Viewing of Question Paper printing logs for every subject.
- Provision of help desks at the Central Monitoring Centers to support Examination halls in decryption, downloading and printing of question papers at the time of examination.
- Ability to deliver multiple sets of question papers to examination centers as per the Examination schedule and batch allocation.
- Suitable Security protocol to be implemented for encryption, Decryption of question papers, authentication of access points and secret key delivery.
- Alternate arrangements through secured encrypted CDs, Pen drives etc. especially at remote locations should be built –in.
- Audit Trails and Reports.

In case of automatic generation of question papers through question banks, an alternative approach is to put the whole question bank and the paper generation software on local desktops at the Examination centers. On the examination day, rather than transmitting the question paper, only the password/seed value can be transmitted to generate the question paper locally.

Benefits

Through implementation of this system, the following benefits can be achieved:

- Designed to bring transparency in system.
- Reducing all the Malpractices with the use of technology resulting in quality branding of the Institution.
- Reduction of threats and challenges resulting in leakage of question papers during manual distribution of Question Papers.
- Assuring On time and smoother delivery of Examination process.
- Entire Process management from University Head office without any delay or mistakes.

Hardware Requirements at each Examination center

At the College/Institute Centers the following standard Infrastructure is required. The hardware requirements may vary depending on the modules being implemented, number of users, number of courses etc.

	Personal Computers / Laptops <ul style="list-style-type: none"> • Standard PCs and Laptops with basic s/w like latest operating system , anti virus, etc.
	Software Application <ul style="list-style-type: none"> • Examination Management System • Supporting Software like Internet Browser, Office Suite , PDF readers etc.
	USB Port
	High Speed Printer
	LAN Connectivity <ul style="list-style-type: none"> • Standard Internal Network
	Internet Connectivity <ul style="list-style-type: none"> • Dial up / Broadband / Cable/ Wireless
	UPS and Generator

The financial implications are covered in the Chapter 10: Financing ICT initiatives.

OMR and Barcode Technology in cover page of Answer sheets

Many Universities in Maharashtra including Mumbai University and North Maharashtra University, Jalgaon are successfully using OMR and Barcode Technology in Cover page of Answer Booklets for Masking and post-evaluation for synchronization of results against students' personal details.

Recommendation 5: OMR and Barcode Technology in cover page of Answer sheets: The committee unanimously recommends that by first half of 2013, all universities should use OMR (Optical Mark Recognition) and Barcode Technology in cover page of answer booklets of University Examinations on pilot/experiment basis. Following this, by 2014, universities should use this technology for all examinations.

In this solution, the cover page of the Answer Booklet is divided into two OMR sections, each having the unique barcode of the answer booklet. The first section contains OMR sheet for capturing student's personal details like roll number, course code etc. The second section contains OMR sheet to be used by examiners for entering firstly the individual marks obtained in each answer and finally the total marks obtained by the student in the answer booklet.

Post examination, the first section containing students' details can be torn off and sent separately to the Examination cell/division for data entry. This personal data can be directly read by the scanners and stored against the unique barcode of the answer sheet.

After evaluation, the examiners should enter the marks obtained by students in each answer individually as well as total marks achieved by the student in the OMR sheet. The software can automatically read these entries and provide alerts in case of totaling mistakes. These marks can be entered against the unique barcode of the answer booklet and synchronized with the personal details of students automatically.

Main Features of the solution

In Universities, traditionally answer sheets were masked manually with a black paper so that the candidates' details are hidden. Post evaluation, the masks were removed and students data along with results entered into the results sheet. There were many challenges faced in this process as anyone could remove the masks and know the personal details. Further, post evaluation when students' marks were entered along with the student details, there was scope for malpractices arising due to fraudulent data entry.



Through use of OMR and barcode technology, the aforementioned issues in traditional masking process could be overcome.

OMR Sheets are special sheets containing circles or elliptical bubbles or boxes used as marking areas where the candidate marks using a blue/black pen or pencil. These sheets can then be directly read with the help of scanner devices thereby eliminating the need for data entry.

Barcodes are unique data string which is encoded in an optical machine-readable representation of varying widths and spacing of parallel lines.



The Universities should adopt OMR and Barcode technology in cover page of answer booklets as follows:

- i. In this solution, the Cover page of the Answer booklet can be divided into two sections, each containing the unique id of the answer booklet encoded in a bar code.
- ii. First section of the OMR Sheet in the cover page can be used for capturing basic information of students like Roll No., Course Code etc. Students can fill in information like the subject code, question paper code, unique code, hall ticket number etc. by coloring the bubbles on the optical mark reader answer sheet. This data can directly be read by the scanners. This can

eliminate the need for data entry by university staff and eliminate errors in data entry of students's details as well.

- iii. Second Section of the OMR sheet in the cover page can be used by examiners for entering marks gained in each question and finally the total marks achieved in the answer sheet. OMR sheets can also be used for giving fraction of a mark like 0.5 marks. The software can automatically read these entries and provide alerts in case of totaling mistakes. It would be better practice if there is additional space for examiners to write marks in hand in figures and total marks both in figures and words. This technology can greatly reduce errors in totaling and malpractices at data entry level can be eliminated.
- iv. After examinations, the answer booklets carrying unique barcode are collected and the first section of the answer booklets with personal details of the student is detached and stored separately. These personal details of the students are entered/stored against the unique barcode on the answer sheet.
- v. Following this, the Answer booklets without any personal details of the students are sent to moderator for evaluation.
- vi. After evaluation, marks are entered in the second section of the cover page in the OMR sheet. The marks of individual answers as well as total marks obtained by the student are entered by the examiner.
- vii. The marks entered in the OMR sheet are directly read by the scanners and entered against the Barcode of the answer booklet. Thereafter, the system automatically matches and stores the results against the personal details of the students appearing for the Examination with help of same barcodes.

This solution can greatly eliminate the issues related to data entry errors/handwriting recognition/incorrect data entry by operators during results data entry etc. It can greatly reduce the workload of university employees in terms of checking the totaling in answer sheets and data entry of results. Further malpractices arising due to insecure masking, fraudulent data entry etc. can be eliminated.

This solution of incorporating OMR and bar code on the answer books will fulfill the requirement of maintaining the confidentiality of the candidate, bring about transparency and process results quickly.

Barcode in each page of the Answer Booklets

In the Harper and Misra's researches reported in "Research on Examinations in India" in 1976, it was found that when photocopies of the same 10 History answer scripts were sent to Nine experienced examiners, the average marks awarded to the 10 scripts by each of the nine examiners ranged from 8 to 22 out of 50. Similarly, multiple studies show evidence that there is variation in marks of the same answer due to variation in examiners. In order to reduce this variation, the following recommendation is explored.

Recommendation 6: Barcode in each page of the Answer Booklets: Some universities may implement this solution on pilot basis in professional courses. Following this, the government may collate the data on pilot implementation and decide on further action depending on results of the pilot studies.

In this solution, each page of the answer booklets should contain the unique code of the answer booklet. Each question paper and answer booklet should then be divided into multiple sections such that the student can write answers on first section of question paper in first section of answer booklet only and so on. Following this, the different sections should be separated and sent to different CAP centers for assessment ensuring that all "Section one" of the answer booklets of all students are assessed by one CAP center, all "Section two" of the answer booklets are assessed by second CAP center and so on.

In each CAP Centre, the marks should be entered against the bar code of the answer script enabling the IT solution to synchronize the marks against the student details.

This can ensure that same set of examiners verify the same section of answers for all students in that course, thus reducing the variation in marks due to variation in examiners. This is also useful when different sections requires highly specialized different faculty for grading.

Key Features of the Solutions

- In this solution, each paper of the answer booklet should contain the unique barcode of the answer booklet.
- The Question paper and the answer sheet should be divided into multiple sections.
- Students should be instructed to write the first section of answers in the first section of answer booklet (Example: pages 3 – 6 of the answer booklet), the second section of answers in second section of the answer booklet (Example: pages 7 – 10) and so on.
- Post Examinations, all the first sections of answer booklets should be sent to one CAP center, the second sections of answer booklets should be sent to second CAP center and so on.

- Post verification, the results should be entered by the respective CAP centers against the barcode of the answer sheet which can enable the IT solution to automatically match the student details against the marks achieved.
- Apart from reducing the variation in marks due to differences in examiners, it can also eliminate scope of malpractices like insertion of pre-written answer papers, replacement of original answer papers etc.

Digital Scanning and Onscreen Evaluation of Answer Sheets

Recommendation 7: Digital Scanning and Onscreen evaluation: On Pilot basis, each university should also conduct Digital Scanning and Onscreen evaluation of Answer Sheets in few courses/examinations. In this system, the answer sheets should be firstly scanned in secure premises. Following this, the scanned answer sheets are assessed on computers/laptops/Tablets by the appointed examiners at the CAP center. The Physical Answer sheets should be destroyed with time as per the Rules of the respective universities. The digital answer sheets can also be stored for the same period.

After one year, the universities and state government may collate the experience gained and take a call on whether to further expand the usage of this solution.

Through this system, the issues related to secure transport of answer sheets, replacement of answer sheets, delay in assessments etc. are reduced. Further, the time for re-evaluation is greatly reduced as answer sheets are available online and can be re-assessed immediately by the respective examiners. This can also facilitate providing copies of answer sheets to students online rather than tracing the physical answer sheet and then photocopying it.

Key Features of the Solution

The scanning of answer booklets will take place for onscreen evaluation. This will do away with marks manipulation during the assessment phase. The key function requirement specifications of this module include:

Digital Scanning

- Answer Scripts scanning and transmitting to server
- Automatic generation of random numbers for each scripts
- Question paper and scheme of valuation should be scanned and made available during valuation
- Anonymous Scripts: Scripts with all candidate information masked out for evaluators

- Copies of the scanned images are to be distributed electronically or manually and valuated on screen by evaluators
- Scanned scheme of evaluation to be provided during valuation along with answer script

Digital Evaluation

- Options for centralized and distributed evaluation
- Allocating specific subject to specific examiners who are expert in the respective subject as per the instructions of the CoE
- Provision to carry out multiple valuations simultaneously
- The software should be user friendly and Answer Script, Question, Scheme, and making can be provided on screen in single window
- For Re-valuation, the specified scripts should be extracted and can be made available for valuation to the evaluators
- After valuation final scores are to be tabulated automatically and should be provided as digital output to the existing examination server for result processing in the format required by the university
- Provision to show evaluated answer copies to the students
- Option for archival of digitally evaluated answer copies for a period of few years
- Question paper and answer key reference during evaluation
- Authentication: Providing suitable authentication for accessing the onscreen evaluation system by evaluators
- Security: Suitable Security measures to ensure reliable evaluation process in centralized, distributed as well as mobile evaluation modes
- Flexibility to examiners by enabling valuation of answer scripts from anywhere in a secure manner
- Final marks calculated for every script should be based on the regulations of respective University
- Digital signature on marks sheet valuated by the evaluator

Results Processing and Publication

Recommendation 8: Results Processing and Publication: By first half of 2013, each university should mandatorily display results online *including complete breakup* of marks. Each student should be able to register on website and check his/her results. Further, a provision for sending the results by SMS/email to those students who have registered their mobile numbers/emails on the site should also be ensured.

Key Features of the Solution

The key functionalities of this module should include:

- Practical and internal marks entry directly from the colleges with multi-level approval
- Provision to upload individual candidate marks as well as bulk upload of marks
- Student ranking list/program wise/course wise/college wise
- Online publication of results
- Result analytics and reporting using dashboards and other tools
- Multi-level approval system for result processing and moderation
- Facility for students to view their previous semester results, arrear examination, grades and marks obtained
- Audit trails and reports

Online Application for Re-evaluation

Recommendation 9: Online application for Re-evaluation: By first half of 2013, the universities should enable online application for re-evaluation on pilot basis and by 2014, it should be mandatory. Students should be able to apply online for re-evaluation of answer sheets and pay the fees online through credit cards/debit cards/net banking etc. or offline through cash at CSCs/Setu/eSangram Kendras/Universities Counter/College Counter etc.

Key Features of the Solution

The Key functionalities of this module include:

- Online application by students for re-evaluation before the cutoff date

- Option for Single as well as multiple applications for re-evaluation
- Payment of Fees as per universities guidelines through various modes: Online through credit cards/debit cards/net banking etc. or Offline through cash at CSCs/Setu/eSangram Kendras/Universities Counter/College Counter etc.
- Status of the re-evaluation to be send through SMS/email to students regularly

This should reduce need for multiple visits by students to universities/colleges and results in faster processing of re-evaluation results.

Dematting of Degrees and Certificates

Recommendation 10: Dematting of Degrees and Certificates: The Vision of the Universities in Maharashtra should be to ultimately shift to ‘demat’ degrees and certificates. In the proposed system, dematerialization of certificates, to a technology-based solution that would ensure confidentiality, authenticity and fidelity, enabling online verification and easy retrieval of academic qualifications is envisaged.

The committee recommends that from first half of 2013 some universities should *start pilot of this*. And from 2014, it should be made mandatory. Also the previous data (Mark sheets/Degrees/Ledger records) from at least 2000-2001 awards should be digitized.

Through this solution, Industry and other stakeholders should be able to verify the degree of students online. This can greatly reduce the malpractices associated with issue of fake certificates, tampering of certificates etc.

Proposed Act at National Level

Government of India has introduced National Academic Depository Bill, 2011, that proposes to create a national-level database of all academic qualification in electronic or DEMAT format. The major highlights of the bill are:

- The Bill seeks to establish a national database of academic awards in electronic format, which can be verified and authenticated. The central government can appoint a depository as the National Academic Depository to establish and maintain the national database.
- The Bill makes it mandatory for every academic institution (colleges, universities, and boards that award Class X and XII certificates) to lodge every academic award with the depository.
- The database will help the administration to effectively deal with forged certificates and fake degree rackets.

- It will also enable online verification and easy retrieval of particulars of academic qualifications.
- Every student, employer and institute will be able to take a print of a degree and check its veracity online.

Key Features of the Solution

The Key Features of the Solution Include:

- Establishment of a state database of academic qualifications (degrees/certificates from graduate/postgraduate level including professional degrees) created and maintained in an electronic format by an identified, registered depository.
- Each degree/certificate should carry a unique id in the form of a unique data string and encoded in a bar code. These degree certificates should also be stored electronically in a repository.
- Employers will be allowed to online verify a particular candidate's degree authenticity on payment of a fee etc.
- Option for Bulk verification of mark sheets by employers/Industry
- Government of Maharashtra should issue standards to be used by university for unique id and barcodes. This should ensure that no two students from any universities have same unique id. Following this, a common repository for all universities may be established by Government of Maharashtra.
- Universities should switch to 'demat' degrees and certificates within one year from issuance of guidelines from Government of Maharashtra.
- Employers should also be able to verify the degrees through mobiles. By texting "MH Verifydegree Degreenumber" to a designated number, the employer should be able to get return SMS with existence of degree certificate (Yes/No), University Name, Student Name, Passing Year, total percentage etc.
- Provision to issue duplicate mark sheets/degree certificate using the system on payment of fees.

Dematting the degrees/certificates would be highly beneficial to students, alumni, colleges/institutes and employers by enabling online access of academic qualifications, eliminating the need for persons to approach college/university for verification. The system can also eliminate fraudulent practices such as forging of certificates and mark sheets through facilitating online verification.

Other Technologies for reducing Malpractices

Recommendation 11: Other Technologies for reducing Malpractices: Technological interventions in conduct of examinations should not be limited to use of Computing Technologies. Any Technological advancement including tamper evident security tapes that detect any kind of tampering with sealed packages, Digital Locks that transmit signals in case of tampering etc. are examples of usage of technology for reducing malpractices in examinations.

Wide ranges of Tamper Evident Security Tapes are available in market which can used to detect tampering of physical packets. After applying the security tape, removal will cause the tape to self-destruct, leaving words or symbols (Void, Beehive, Checkbox etc.) on both the affixed surface and in the security tape. Therefore, the tampering by removal of tape and resealing should be detected at once. Universities should encourage use of such technological advancements for reduction in malpractices.

Use of IT for Teaching – Learning Practices

Recommendation 12: Use of IT for Teaching–Learning practices: The Universities should not limit the usage of Information Technology to Examinations Management system. It should extensively use technology for

- Increasing access of higher education through online universities/courses, virtual class rooms, distance education centers etc.
- Enhance quality of higher education through use of audio/visual IT aids, softwares, Knowledge Networks etc.
- ICT can also be used to improve the transparency, efficiency and effectiveness of Higher Education institutes.
- Universities to make best use of existing projects/schemes of Government of India, UGC etc. like NMEICT, NKN, A-View etc.

Key Features of the Solution

Universities should extensively use Information and Communication Technology for

1. **Increasing Access:** Increasing the access of higher education, imparting education to those who couldn't join regular education due to various reasons (medically unfit, handicapped, living in remote rural areas, bias against girl education, etc.), reduction in cost of education etc. through distance learning, Virtual Classrooms etc.

16 of the world's better ranking universities have got together and set up a \$ 50 million joint venture called **Universitas 21 Global**, an online MBA business school. These universities include McGill, British Columbia, Virginia, Edinburgh, Sweden and Melbourne of Australia. Universitas 21 Global aims to tap markets of potential students from UAE, Singapore, Malaysia, India, Korea and China. It has already enrolled 1000 professionals from 45 countries for its graduate programme. It has also offered an M.Sc. in Tourism and Travel Management recently. The online degree of Universitas 21 has been well received in the world market and the degree certificate awarded by it bears the crest of all the 16 top ranked participating universities.

The various modes in which online education can be provide are

- Distance Study Centers/Virtual Class rooms.
 - Online Universities/Courses.
2. **Enhancing Quality:** Improve the quality of education and effectiveness by:
 - Knowledge network to share, disseminate, collaborate and generate information.
 - Virtual/Simulated Classrooms with Audio Visual aids.
 - Use of ICT for quality teaching, learning, effective management, examinations etc.
 - Online Student/Teacher Training resources/ modules.
 3. **Bringing Transparency, Efficiency and Effectiveness:** ICT can also be used to improve the transparency, efficiency and effectiveness of institutes:
 - Software Solutions with Admissions Management Module, Employee Module, Examination Management Module, Library Management Module, Hostel Management, Finance Management, online application, Online Management Information system etc. can greatly reduce the tedious work of administrative force providing them quality time for value adding initiatives.
 - Email solutions for students and faculties bridges the communication gap.

- Online Website broadcasting updated notifications, schedules, events can greatly help various stakeholders including parents, students etc.
- Wi-Fi Enabled Campus for Students.

4. **Existing Schemes/Projects:** Universities should make best use of existing schemes/ projects Government of India, UGC, State Government etc. to enhance their functioning including the following.

National Mission on Education through ICT: The objectives of the National Mission on Education through ICT include (a) the development of online knowledge modules; (b) research in the field of pedagogy for development of efficient learning modules; (c) standardization and quality assurance of contents to make them world class; (d) building connectivity and knowledge network among and within institutions of higher learning in the country; (e) availability of e-knowledge contents, free of cost to Indians; (f) spreading digital literacy for teacher empowerment; (g) experimentation and field trial in the area of performance optimization of low cost access/devices for use of ICT in education; (h) providing support for the creation of virtual technological universities; (i) identification and nurturing of talent; (j) certification of competencies of the human resources acquired either through formal or non-formal means and the evolution of a legal framework for it; and (k) developing and maintaining the database with the profiles of our human resources.

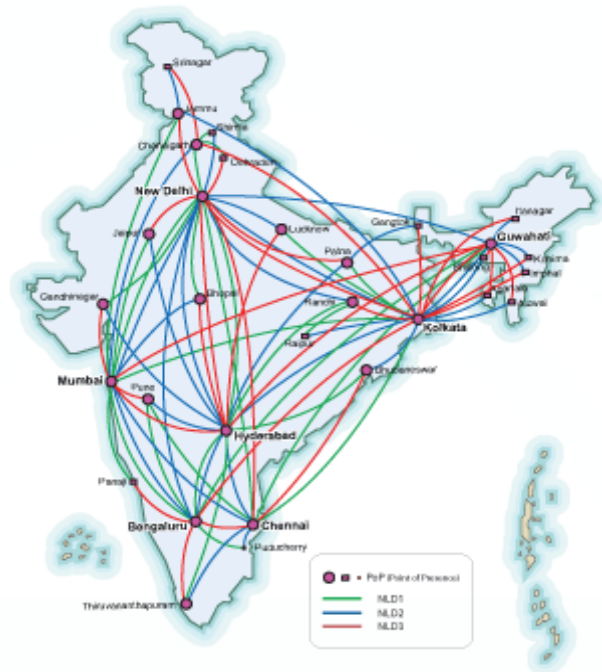
Amrita Virtual Interactive E-Learning World (A-VIEW) is an ambitious project undertaken by the Ministry of Human Resource Development (MHRD) for providing and promoting quality education within the Nation. A-VIEW is a state-of-the art e-learning tool to leverage India's best faculties for the benefit of student at all educational institutes, free of cost, across India by providing a near class room experience based on NME-ICT mission.

Sakshat: A One Stop Education Portal launched on October 30, 2006 by His Excellency, the then President of India to facilitate lifelong learning for students, teachers and those in employment or in pursuit of knowledge free of cost to them. The content development task for 'SAKSHAT' was looked after by the Content Advisory Committee (CAC) for the respective subject, which consisted of representatives from educational institutions like IGNOU, Delhi University, Kendriya Vidyalaya Sangthan (KVS), Navodyaya Vidyalaya Sangthan (NVS), National Institute of Open Schooling (NIOS) and National Council for Educational Research and Training (NCERT) and prominent academicians in the field. In addition, some NGOs had also provided the contents developed by them free of cost for this portal.

National Knowledge Network (NKN):

The NKN is a state-of-the-art multi-gigabit pan-India network for providing a unified high speed network backbone for all knowledge related institutions in the country. The objectives of NKN:

- Establishing Connectivity for Knowledge and information sharing.
- Enabling Collaborative Research in emerging areas such as Climate Modeling.
- Facilitating distance education in specialized fields such as medicine, emerging high tech areas covering info-bio-Nano technology.
- Facilitating an ultra-high speed e-governance backbone for information sharing



NKN has already connected 640 institutions and aims to connect over 1500 Institutions/Organizations/Laboratories under various categories throughout the country.

Data Centre Facilities

Recommendation 13: Data Centre Facilities: In order to host their IT Solutions, Universities should require data center facilities. The various options for availing Data center facilities are described in following section. Universities may choose the option as per their requirements and constraints.

Option 1: Usage of State Data Centre

The University may host their application at the State Data Centre (SDC) built by the Government of Maharashtra in Mumbai. SDC is shared, reliable and secure infrastructure services center for hosting and managing the e-Governance Applications of State and its constituent departments. SDC established robust infrastructure to enable the Government to deliver the services quickly and effectively to its stakeholders. The State Data Centre, connected to the State Wide Area Network (SWAN), provides access to the e- Governance applications and Services to Government employees through Intranet and to the citizens through public Internet/CSCs etc. Through such a Shared Service Centre implemented and managed by a competent Implementation Agency, the individual departments can focus more on the service delivery rather than on the issues surrounding the Infrastructure.

The University may avail the services of SDC provided:

- The university is responsible for sizing the hardware and determining the specifications to support the performance requirements of the solution.
- University should ensure that effective Remote Management features exist in solution so that issues can be addressed by the University in a timely and effective manner and frequent visits to Data Centre /DRC can be avoided.
- State will provide the premises for Primary Data Centre (DC) for hosting the solution. The solution should be hosted in a collocation model in the Data Centers.
- The following common data Centre services will be available to the SI through the Data Centre Operator/Data Centre Service Provider (DCO): Rack, Power and Cooling, UPS, DG set power backup, Bandwidth and Connectivity, LAN, VPN, Firewall, Intrusion Protection System, Fire prevention, Physical security surveillance, Network Operation Centre, Common Data Centre facility Maintenance and Support.
- The University is responsible for the below at the Data Centre: Servers (Web, Application, Database, Backup, Antivirus, EMS, etc.), Enterprise Management System (EMS), Antivirus Software, SAN Storage, SAN Switches, Tape Library, All necessary software

components including but not limited to Operating System, Backup Software, and SAN Storage Management Software. Initially, on a limited scale, some of these things can be made available by SDC.

- State data center can enable use of common SMS gateway, payment gateway, e-procurement system, linkage with UID database etc.

Option 2: Dedicated Data Centre in Universities

Several Universities have built their dedicated data centers. Therefore the Universities may host their applications at the dedicated data centers established in Universities. The University should ensure that:

- Sizing of the hardware and determining of the specifications to support the performance requirements of the solution is correctly done.
- The basic Data Centre facilities including Power Backup, Power and cooling, Bandwidth and Connectivity, Fire Prevention, Physical Security system, Maintenance and support etc. should be created.
- University should have adequate hardware/software including servers, racks, EMS, Antivirus software, SAN storage, Tapes etc.

Option 3: Sharing of Data Centers by Universities

Smaller Universities may collaborate with Larger Universities and use the data center facilities of larger universities at a fee or otherwise. Therefore the smaller universities will be able to host their applications in the shared data center of the Larger Universities.

In this option, both the participating universities have to ensure that the roles and responsibilities are clearly defined.

Evaluation of Alternatives

Option 1: State Data Centre	Option 2 and 3: Dedicated Data center/Sharing of Data Centre
<p>Pros</p> <ul style="list-style-type: none"> - Infrastructure available at minimum investment. The University can therefore focus on their functions - Infrastructure managed by professionals and experts in this field - Round the clock support available 	<ul style="list-style-type: none"> - More control over the Data Centre Operations and server deployment
<p>Cons</p> <ul style="list-style-type: none"> - University situated at a considerable distance from the SDC may find the distant deployment of software an inconvenience. 	<ul style="list-style-type: none"> - Significant Investment in developing Infrastructure and capabilities for maintenance of Data Centre - Maintenance of Data Centre to require technical staff

Physical Security Measures

Recommendation 14: Physical Security Measures: Universities should employ necessary physical security measures for protecting confidential data from unscrupulous individuals. University should implement security measures like biometric access control, closed-circuit television system (CCTV), Fire Resistant File Compactors etc. in **Examination Strong Room, Assessment Centers and Data Centers**. Senior officials including Vice Chancellor and Controller of Examinations and/or Director of Evaluation should be able to monitor from their room the CCTV footage and biometric access records.

Some Universities have or are setting up dedicated Examination Building/House (*Pariksha Bhavan*) whereas others have converted some rooms to Examinations Strong Rooms and Cells/Divisions. Government of Maharashtra is requested to review the funding available with universities through varied sources like Own Sources, Examination Fees, UGC/ICAR/ICMR/CSIR/DST funds etc. and provide the gap funding through state support for establishing and strengthening of infrastructure for Examination Building/House.

Biometric access control: Biometric Access Control system scans the biological information like fingerprints of an individual who is attempting to access a building, computer network or other information system that is restricted. Since Biological components such as fingerprints are totally

unique to each individual, these make for exact and unchanging elements concerning the identification of any single person.

A biometric access control system authenticates someone by examining the fingerprint pattern, which it then matches to data existing in programmable microchips or a central server. If that person's external characteristics fails to meet the biometric system's information, that individual is immediately denied access to wherever or whatever they were attempting to infiltrate.

As highly affordable systems, biometric access control systems provide a secure way of restricting access to confidential premises.

CCTV System: CCTV or closed circuit television security system is a monitoring device meant to continuously scan the premises and maintain close observation of areas. With a CCTV, images are captured and transmitted to off-site monitors, where they can be viewed at that time or recorded for later viewing. Representing a timely and accurate method for revealing the presence of anyone who should not be within a particular area, CCTV implementation is an excellent method with which to deter potential malpractice.

File Compactors with locking system: File Compactors offer fire proof and secure way of storage of articles in an organized and compact manner. The File Compactors should have individual as well as central locking system.

IT related Capacity Building and Handholding Support

Recommendation 15: IT related Capacity Building and Handholding Support: For successful implementation of any IT solution, capacity building, training and handholding support for all the users is a critical necessity. The universities should ensure

- **Training** including Computer Awareness Training, Role based Training, Technical Training, Refresher Training etc. is provided to all the staff of the universities.
- **Handholding support:** one qualified and trained person per one college/institute or one qualified and trained person for multiple colleges is available to handhold the staff in the college/institutes office.
- **Mock Drills** especially for secure transmission and high speed printing is conducted to measure the preparedness of the solution and provide training.
- **Training to paper setters in development of Question Bank/Question Papers Bank** including Objective of Assessment, Blooms Taxonomy, Blue print of examination paper etc.

Key Features

Training of Trainers

The University should identify qualified Trainers with relevant IT experience and training competency within their staff who will be directly trained and will be responsible for all the Capacity Building Initiatives. These Trainers will be responsible for implementing the Capacity Building interventions in the University.

The University should further identify the Trainers within each cluster of 5-10 colleges/institutes in the State who will be directly trained. These trainers will be responsible for imparting the training on module to the other colleges/new recruits and current personnel (refresher training) at the Colleges.

Best Practice: Maharashtra University of Health Science, Nashik has medical education technology cell in every college, regional centers and at headquarters for continuous training of faculty. These cells are recognized by the Medical Council of India, Dental Council of India and World Health Organization (WHO).

Training Pattern

The following trainings need to be imparted from time to time as and when required to ensure success of the initiative:

- i. Computer awareness training: General Computer Awareness Training may be required among various categories of employees.
- ii. Role-based training should be carried out for the identified officers at Universities/Colleges and Institutes by the University.
- iii. Refresher training, subsequent training to the remaining employees in the University and colleges/institutes can be carried out by the internal trainers.
- iv. Technical training should be carried out for the technical staff responsible for maintaining and operating the examination management system.

Handholding Support

The University should ensure that one qualified and trained person per one college/institute or one qualified and trained person for multiple colleges is available to handhold the staff in the college/institutes office and ensure that the staffs in that college/ institute are able to use IT solution on their own by the end of the handholding period. Handholding support would be required only after the successful commissioning of application and the necessary infrastructure and completion of capacity building and change management initiatives in respective colleges/institutes.

Mock Drills

Mock Drills should be conducted wherever applicable to test the preparedness of the hardware, software and human resources involved.

In case of Secured Delivery of Question papers especially, Mock drills should be firstly be conducted after successful installation of necessary infrastructure at all colleges/ institutes. Following this, the mock drills should be started prior to 3 days before the commencement of examinations on daily basis if needed or at least once before the actual Examination starts.

Training to paper setters in development of Question Bank/Question Papers Bank

In case of Question Bank/Question Paper Bank Development, adequate training and orientation should be provided to the Paper Setters/Faculty to help them develop meaningful questions/question papers. The training may include

- Purpose of Question Bank/Question Paper Bank
- Major Steps in Question Banks Development
 - Blue print of question paper
 - Identification of Personnel and organizing question writing workshops
 - Pre-Validation and Review: Editing of Question Banks
 - Test Constructions: Using Question Banks for setting Question Papers
 - Post Validation: Test and Item Analysis
- Bloom's Taxonomy
- Roles of the Faculty
- Next steps etc.

This training should not be a one-time exercise but should be conducted periodically at regular intervals.

Decentralized, Customized, Interoperable software rather than centralized solution

Recommendation 16: Decentralized, Customized, Interoperable software rather than centralized solution: The committee is deliberately not suggesting highly centralized uniform and single software across the universities in Maharashtra, so that various universities come up with different solutions suitable for them and innovation and creativity is ensured. However all these systems should adhere to e-governance standards and policy as issued from time to time, have linkages to UID number, should be interoperable so that there are no vendors dependent and the data should be exportable to open standards so that other vendors can use it and business continuity is maintained.

All Information Technology Solutions implemented by the University should also have the following features:

- i. **Availability:** A system's availability, or "uptime," is the amount of time that it is operational and available for use. The system should be designed to remove all single point failures. Appropriate redundancy should be built into all the critical components to provide the ability to recover from failures. The University should perform various tests including network, server, security, DC/DR fail-over tests to verify the availability of the services in case of component/location failures. The university should also verify the availability of services to all the users in the defined locations.
- ii. **Interoperability:** Interoperability between various solutions of different universities should be ensured. So that in future data may be migrated from one university to another when needed e.g. when a student migrates from one university to another, the digital data of the student should be easily transferable between universities. Further, MKCL data, if any, should be available and should be integrated with the system.
- iii. **Performance:** Certain tasks or features of the system can be more time-sensitive than others; the system should ensure that these tasks are completed timely at all time.
- iv. **Robustness:** The system should be able to handle error conditions gracefully, without failure. This includes a tolerance of invalid data, software defects, and unexpected operating conditions.

- v. **Scalability:** The Software should be scalable and have the ability to handle a wide variety of system configuration sizes. It should be able to scale up when there is increase in hardware, capacity, extra machines, etc.
- vi. **Usability:** Ease-of-use requirements address the factors that constitute the capacity of the software to be understood, learned, and used by its intended. The Software should be user friendly.
- vii. **Customization:** Even when universities use COTS (Commercial off the Shelf) solutions, they may need to get it customized to meet their requirements. The IPR and Copyright rights of the Customized components should be with the university.
- viii. **Pilot:** Even after choosing a vendor through an open and transparent tendering system, Universities must insist on small pilot at no cost before signing contract with the service provider. Only after successful implementation of the pilot should the universities enter into contracts with these vendors.

Hardware and Software updation with latest versions:

Recommendation 17: Hardware and Software updation with latest versions: With rapid changes in technology, life of any hardware or software item is on an average five years. In order to ensure that the IT solution runs smoothly for these five years, Universities should at the time of procurement, purchase hardware with five years warranty/maintenance support and softwares with five years software assurance and maintenance support.

Hardware Warranty/Maintenance: In order to ensure smooth functioning of hardware device, universities should procure hardware with five years of warranty/maintenance. Under this, the service providers should provide qualified engineers for managing and providing diagnosis, repairing and maintenance of hardware components of the IT infrastructure under the hardware maintenance service.

The University should ensure that

- Warranty/Maintenance support is available even at remotest location of IT infrastructure.
- Warranty/Maintenance support is available round the clock in case the solution has to run round the clock.
- Strict Service level agreement in terms of call logging, visit by engineer, issue resolution should be agreed prior to taking the services of the service provider.

Software Assurance and Maintenance

Software Assurance and Software Maintenance contracts ensure that all the latest updates and releases of the softwares are available to clients for the span of the contract. It should also ensure that universities have access to service provider's team of technical support experts, either directly or via the system integrator.

At the time of purchasing the software, Universities should include five years of software assurance and maintenance support. It should include:

- **Free upgrades:** Subscribers may upgrade to newer versions of the software
- **Technical Support:** Availability to technical support within with quick response time based on the SLAs.
- **Maintenance:** During the support period, any bug or error detected in the software should be fixed.

Universities should keep pace with the technology and write off the IT hardware and software solutions in time.

Quality and Cost Based Selection of IT Solutions

Recommendation 18: Quality and Cost Based Selection of IT Solutions: Universities should follow transparent and competitive bidding procedure for procurement of any IT solution. Cost Based (L1 based) Selection should be used only when the IT solution is simple, common and standardized. In case of innovative, complex and pioneering IT solutions, Quality and Cost based Selection should be used. The committee recommends that Government of Maharashtra should accordingly change the account code for enabling Quality and Cost Based Selection.

Quality and Cost based selection takes into account the quality of the proposal and the cost of the services in the selection of the successful firm. Typically in this selection; the technical proposals are allotted weightage of 70% while the financial proposals are allotted weightages of 30%.

However, till the government changes the account code, universities may implement the following procedure in cost based (L1) selection. There should be three levels of selection:

- **Eligibility Criteria:** Only firms that fulfill the eligibility criteria of minimum turnover, experience, number of people employed etc. should be qualified for the next level.
- **Technical Qualification:** The proposals of the vendors are evaluated by a technical committee. Only proposal which attain more than 70 marks may be qualified for opening the financial bids.

- Financial Evaluation: Among the financial bids opened, the L1 should then be chosen for implementing the solution.

Key Criteria of Selection of Firm

Cost Based Selection

This method will be used when the assignment is simple and can be precisely defined, and when the budget is fixed. In this case, the Universities should be cautious about the risk that bidders who have not understood the scope of work OR may be targeting to get the work order without having the technical competence to execute the project. This risk can be mitigated by having a rigorous evaluation of the technical bid and fixing a high score as minimum qualification for opening of financial bid.

Quality Cum Cost Based Selection (QCBS)

QCBS uses a competitive process among firms that takes into account the quality of the proposal and the cost of the services in the selection of the successful firm. Cost, as a factor of selection, is to be used judiciously. The relative weight to be given to the quality and cost will be determined for each case, depending on the nature of the assignment.

Depending on the needs, the weight associated with Quality i.e. Technical Proposal and that associated correspondingly with cost i.e. Financial Proposal may be 70:30 or 50:50 or 30:70 (Technical Score weightage: Financial Score Weightage).

Chapter 6: Academic Recommendations

Examinations and Evaluations are meant to assess the progress of students and their achievements so that firstly they know of their achievements and secondly feedback may be provided for further enhancements.

Therefore continuous and comprehensive assessment should be included that assess not only the theoretical knowledge but the practical application of the knowledge, creativity, performance levels, qualities like punctuality, sense of responsibility, etc.

The committee recommends the following options for reforming the examination system in Universities:

Decentralization of Examination Activities

Recommendation 19: Decentralization of Examination Activities:

The Universities may adopt the following procedure for decentralization of all Examination Activities:

- Colleges/Institutes with proven academic record and examination conducting reputation should be allowed to conduct their own examinations for all years. The universities should, on regular basis, grade the affiliated colleges/institutes on basis of their academic strength, faculty, infrastructure, previous performance, placement records etc. Colleges that attain Grade “A” should be allowed to conduct examinations on their own for all years. These institutes should also evolve their own methods of assessment of students’ performance, the conduct of examinations and notification of results. Universities should evolve proper supervisory capacity (including measures like third party audit) to ensure proper conduct of examinations by such colleges.
- For other institutes, the university can conduct the final year examinations and may consider decentralizing the examination process for pre-final years. Already, Mumbai University for more than 20 years has been following this practice successfully.

In this solution, the decentralization of examinations may be as follows:

S.No.	Duration of Course	Examinations by Universities of Annual/Semester Exams in following years	Examinations by Colleges of Annual/Semester Exams in following years
1.	1 year	1 st Year	-
2.	2 years	2 nd Year	1 st Year
3.	3 years	3 rd Year	1 st and 2 nd years
4.	4 years	3 rd and 4 th Years	1 st and 2 nd years
5.	5 years	4 th and 5 th years	1 st , 2 nd and 3 rd years

- In the above option, few Universities have raised concerns that not all Institutes have qualified and high quality staff to set standard questions paper. As a result, the academic standard of Question papers set by these institutes may be low, thereby affecting the quality of education. In order to overcome this issue, the committee suggests empanelment of a list of teachers who are qualified for setting these pre-final years' examination question papers. The colleges should set the papers only through these empanelled qualified teachers. In some cases, the universities may even set question papers on its own and pass on the question papers to these colleges for conducting the examinations, assessment and declaration of results in a decentralized manner. This can reduce the workload of Universities in terms of examinations without affecting the quality.

Recommendation 20: Increasing CAP Centers: As per provisions of the Maharashtra Universities Act, 1994, there can be multiple CAP Centers for a single examination. Therefore, Universities should develop necessary CAP centers considering number of students and cluster of colleges.

Increasing the number of CAP centers should lead to timely evaluation of answer sheets and enable faster results processing and declaration.

Timely declaration of Results

Recommendation 21: Ensuring timely declaration of results and strong penal action against staff defaulting in examination related duties:

It should be made mandatory for all the universities in Maharashtra to declare the dates of result of various examinations in advance and adhere to the declared dates. To ensure this, the clause stating the work of examination which is obligatory to all the teaching and non-teaching staff should be strictly implemented and adhered to. Those who fail to do so should be punished as per the existing provision.

Stringent Evaluation Criteria

Recommendation 22: Stringent evaluation criteria:

Every university has its set of Rules for examination, evaluation, grace marks and ATKT (Allowed to Keep Terms) norms. It is proposed that due care be taken to ensure that design and revision of various Rules and ordinances for grace marks and ATKT should not lead to dilution of evaluation of teaching-learning outcome.

Industrial Training, Practicals and Application Oriented Projects

Recommendation 23: Increased Emphasis on Industrial Trainings, Practicals and Application oriented Projects in Evaluation:

Industrial Trainings, Practicals and Application oriented Projects should become an integral part of curriculum and greater emphasis should be given to them in final assessment of students.

Students' exposure to industrial practices through internships should be made mandatory in professional courses. Upon completion of the industrial training or project, the student should be graded by a committee of faculty members on basis of final products of the project (i.e. presentation, reports, feedback from industry etc.). This should add greater credence and meaning to the industrial trainings and internships.

Industrial orientation and job oriented training allows students to apply what they have learnt in the classroom to real-world situations, and in doing so not only makes them better prepared for their own entry into the world of employment or academic research, but also strengthens their understanding of the underlying concepts they have learned.

Online Examinations

Recommendation 24: Online Examinations:

The committee unanimously recommends that universities should implement online examinations for internal examinations or as a part of external examinations on pilot basis in certain courses/examinations.

In the last few years, many Universities in India have adopted online examinations for entrance tests or university examinations including: BITSAT by BITS Pilani, Manipal University's UGET, CAT by the IIMs, GCET Online by Gujarat Technological University, IIT Bangalore's Online Entrance exams, Delhi University online exams etc. Various large scale internationally recognized examinations like GRE, GMAT, TOEFL etc. are also conducted online at specialized dedicated examinations center in an outsourced manner.

In Maharashtra too, Symbiosis has been effectively using online examinations in distance learning for assessing the students for years. Pune University has also started online examinations for 45000 – 60000 first year engineering students. In Pune University, out of total of 100 marks, 50 marks of all 6 subjects in each semester in first year are conducted online by respective colleges.

Universities should leverage technology in changing the landscape of examinations process.

Key Features of the Solution

Online Examinations is a modern method through which exams are conducted on computers instead of the traditional paper and pen based Examination. It can be conducted either offline or online.

In the traditional pen-paper based manual examination, it takes long time to re-evaluate and declare results, but in case of online Examination student will get an immediate result of their performance.

In this system, a large database of questions is created, from which the system automatically randomly selects questions and creates question paper such that no two students have the same question paper. This eliminates malpractices in examinations like copying/cheating by students, Leakage of Question Papers etc.

This system should also prepare students for taking international and national competitive examinations for higher studies like CAT, GMAT, GRE, SAT, TOEFL etc.

Online examinations offer manifold benefits and address many challenges faced in conventional examination process. They include:

- Potential enjoyment in taking examinations leading to enhanced learning.

- Immediate feedback to students on homework assignments and examinations.
- Exams can be continuously updated through the elimination of inappropriate questions and addition of new questions.
- On demand examinations and assessments may be conducted.
- Reduction or elimination of paper, copying, and distribution expenses etc.

Wholesome Education by universities through Non-Credit/Certification Courses, Extra Marks/Credits, Self-Certification, MOOC etc.

Recommendation 25: Wholesome Education by universities through Non-Credit/Certification Courses, Self-Certification, Extra Marks/Credits, MOOC etc.:

In order to ensure wholesome development of youth of India, Universities should not just impart subjectual knowledge to students but also encourage multi-disciplinary development of students through study in Basic Sciences, Humanities, Social Sciences, Moral Conduct, Character Building, Personality Development, Civic Duties and Social upliftment etc. These may be imparted through Non-Credit/Certification Courses, Extra Marks/Credits, Self-Certifications, MOOC (Massive Open Online Courses), etc.

Through these courses, students may also be encouraged to pursue education in their areas of interest/hobbies, etc.

Best Practice: Maharashtra University of Health Science, Nashik has mandatory but non-credit courses in moral education and communication skills. Similarly, many Universities like MAFSU, BATU, Agricultural and Pune University have made compulsory credit/non-credit courses like Human Rights, Social Sciences, and Disaster Management, etc.

Non-Credit/Certification Courses and Self-Certification

Universities may conduct certification courses ranging from few weeks to months for wholesome development of students including personality development, public speaking, civic duties, social upliftment, etc. Students may pursue these courses after college hours for all-round development.

Through these courses, Universities should also imbibe strong moral values in students and educate them on civic duties, Humanities, Social upliftment, etc.

Universities may also encourage students to develop their hobbies through these courses. For example: Large Universities like Mumbai University have department of Communication and Journalism, that can offer photography hobby courses to students from engineering, medicine, law, etc.

Extra Credits

Students should be offered opportunity to gain additional marks/credits to boost their grades by undertaking additional work. Extra Marks/credits should allow students to improve their performance by putting in greater efforts in studies. Extra Marks/ credits may be given for publishing papers in reputed journals, research projects, dedicated social work and any other work as may be decided by faculty.

- Individual faculty will determine whether or not there will be extra Marks/credits opportunities in their subjects.
- The extra Marks/credits policies should be stated clearly at start of the academic session.
- The same extra marks /credits opportunities to be provided to all students.

MOOC (Massive Open Online Courses)

Universities may leverage the information technology and conduct online courses on massive scale. MOOC (Massive Open Online Courses) is a recent innovation in online courses wherein large numbers of students, sometimes several thousands, take courses at same time online. MOOC encourages greater interaction and discussions between students from different geographies leading to greater information sharing and content development.

Typically, participation in a MOOC is free; however, some MOOCs may charge a fee in the form of tuition if the participant seeks some form of accreditation.

Some examples of MOOCs include: Coursera, Academic Room, edX, Khan Academy, Udacity, WizIQ, etc.

Innovations in Assessments: Online Ph.D. Thesis evaluation, Plagiarism Checker/Open Book Examinations etc.

Recommendation 26: Online Thesis submission and evaluation for Post Graduate and Doctoral Degrees:

In order to streamline and speed up the process of Post Graduate and Doctoral Degrees, Online Thesis submission and evaluation should be implemented. In this solution, the evaluators of the thesis papers should be selected automatically by the software on basis of competencies of the faculty and research topic of the students. Following this, the students can submit the thesis online, from where it should be accessed by the evaluator with the help of a code or password. The hard copies of the thesis may also be submitted to the evaluators.

In order to implement this recommendation, necessary amendments in the corresponding universities Acts/Rules may be required in some universities.

This solution eliminates the laborious, tedious and a time consuming process of sending the hard copies of thesis, delay and sometimes losing of the thesis — sent to the evaluator — by post, delay in the evaluation process etc. This solution should prescribe clear timelines for the complete activity end to end. Therefore, Online Thesis submissions should be adopted to provide the service of submission of thesis in a soft copy and online access and evaluation of the same.

This Solution should also assist in building online database of all theses of students across the universities in Maharashtra for ready access and prevention of plagiarism.

Best Practice: In Maharashtra University of Health Science, Nashik, students registered for Ph.D. upon publishing of minimum five research papers in the indexed peer reviewed international journals on the same topic become eligible for the award of Ph.D. Degree even without submitting the Thesis.

Best Practice: BATU, Lonere has decided to implement Online Ph.D. Thesis submission and evaluation system. In this system, evaluators of the Ph.D. Thesis are selected automatically by the software on the basis of area of interest of the faculty and research topic of the students. Following this, the Ph.D. students submit the synopsis online from where it is accessed by the evaluators.

Recommendation 27: Plagiarism Detection Software:

Universities should strive to adopt plagiarism detection software. This software checks for potential unoriginal content and instances of plagiarism within a document by comparing submitted papers/assignments to several databases. This software scans its own databases, and also has licensing agreements with large academic proprietary databases as well as internet based documents.

The detection and penalizing of plagiarism is important as:

- The whole point of giving assignments/ papers/projects to students can be lost if they plagiarize.
- Giving degrees to students on basis of plagiarized work lowers the quality of university and risks damaging of brand name of the university.
- Dedicated students producing original content get be discouraged if plagiarism is not punished.

Therefore universities should extensively use plagiarism detectors to check for unoriginal content in assignments, projects, papers etc.

Some examples of plagiarism detection softwares include: Shodhganga, Turnitin, duplichecker, iThenticate etc.

Recommendation 28: Innovative methods of examinations like Open Book Exams, Take Home Exams etc.:

The central goal of Universities is to build knowledge of students and equip them to apply available knowledge to solve problems and make intelligent decisions. The main focus of teaching should shift from rote learning to the application of knowledge.

In order to achieve it, it is necessary to reform the way of examinations. The Examinations shouldn't be a test of the memory of students but should test the understanding and application of knowledge by the students. The following methods of examinations may be explored by universities:

Open Book Examinations: An "open book examination" is one in which students are allowed to consult their class notes, textbooks, and other approved material while answering questions. This practice is not uncommon in law examinations.

Open Book Examinations are of two types: the restricted type and the unrestricted type. In the restricted type of open book examinations, students are permitted to bring into the examination room one or more specific documents approved by the course instructor. In the unrestricted type of open book examinations, students are free to bring whatever they like.

Take Home Examinations: Take Home examinations are another form of examinations which is extensively used in international universities. In these exams, the Question(s) are handed out to students and students are given deadline for submission such as within one week. Students are then required to attempt answers without help from others and return the answer sheets within the deadline.

Universities may experiment with these non-traditional types of examinations in certain subjects on pilot basis. It will take some time and effort on the part of students and teachers to adapt themselves to the approach of these examinations. But such changes are inevitable. When combined with the mode of teaching that focusses on application oriented learning and thinking skills, these examination reforms can transform the landscape of education.

Best Practice: MA, Cafeteria course by SNDT Women's University is an innovative example of allowing students to pick and choose topics of their interest in obtaining the M.A degree within three years.

Chapter 7: Recommendations for Amendments in Maharashtra Universities Act, 1994 and other relevant Universities Acts

In order to successfully implement some recommendations of the report, modifications in the current Universities Act including Maharashtra Universities Act, Dr. Babasaheb Ambedkar Technological University Act and Maharashtra Agricultural Universities Act are required. This section lists some of the modifications which may be undertaken to facilitate reforms in examination systems across Maharashtra.

However, till the changes are made in the act, the non-agricultural and non-technological universities may utilize the Section 32 (3b) of the Maharashtra Universities Act that allows universities to undertake exercise and experiment in examination reforms. Under this clause, the universities can on pilot basis implement recommendations of the reports.

Recommendation 29: Enabling Use of Question Banks/Question Paper Banks: There is a need to modify clause 32 (5e) of the Maharashtra Universities Act to allow Question Bank System or Question Paper Bank System. The Clause 32 (5e) of the Maharashtra Universities Act states that “The Committee can obtain three sets of question papers in sealed covers in the respective subject. The Chairman of the committee can draw at random one of such sealed covers containing question papers. This sealed cover with seals intact should then be sent to the press.” Different universities like MAFSU, Technical University, MUHS etc. have variations to the above mentioned clauses in their corresponding Acts but to the similar effect.

These clause need to be modified to allow usage of IT in setting question papers. The following modification may be added: “Provided that, in case the university is using Information Technology for generation or selection of Question Papers, then the committee should ensure that adequate security measures are built in the system and the final question paper generated or selected by the system is distributed after approval of the Chairman of the committee”

Recommendation 30: Responsibility of imparting IT training to teaching and administrative staff: In order to impart training to teachers and administrative staff on usage of Technology, the following clause may be inserted:

“The Pro Vice-Chancellor/Dean (Faculty as in MAFSU, Agricultural Universities, DBATU etc.)/Director, Evaluation (As in the Proposed Act) should be responsible for organizing workshops for Teaching and Administrative staff about new trends in the assessment processes such as cognitive and summative assessment, creation and use of repository of questions, use of technology in paper setting and conduct of examination”

Recommendation 31: Involvement of CoE and Director, IT in the decision making process: As per the prevalent provisions in the Maharashtra Universities Act, Controller of Examination is just an invitee for all the committees. This poses difficulty in decisions regarding recruitment of staff or availing the finances pertaining to the Examination Section. The Controller of Examination /and/or Director, Evaluation (As in the Proposed Act) should be made a member with all the privileges.

The proposed Act has a provision of Director, IT. Since the role of IT is becoming pervasive in functioning of Universities, therefore Director, IT should be part of the decision making. Consequently, he should be involved in the Management Council either as an invitee or member as decided by Government. Similarly, Other Universities Acts should also be amended to have a post of Director, IT.

Recommendation 32: Empowerment of Differently abled students: In order to empower differently abled students and ensure their inclusion in higher education, the committee has made some recommendations in Chapter 9: Ensuring Accessibility to Differently Abled Students. Accordingly, the necessary Acts/Rules of the Universities should be modified to implement these recommendations.

Chapter 8: Resource Allocation Recommendations

The Challenging task of conducting examinations in a smooth and timely manner requires a dedicated team of qualified officers and employees with clearly defined roles, responsibilities and powers to carry out these responsibilities.

Present Scenario

The Committee studied the Staffing pattern in examination cells/Divisions of all the universities. The following table lists the current scenario of staffing requirement:

S. No	Name of the University	No.of Permanent Staff		No. of Temporary Staff	Additional Future Requirements as desired by respective University
		Sanctioned	Filled		
1	Mumbai University, Mumbai	287	124	400	350
2	SNDT Women's University, Mumbai	46	30	32	35
3	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	148	122	33	61
4	Pune University, Pune	158	147	0	Technical Staff including programmers, data entry operators, system analysts
5	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	NP	43	49	55 with technical and administrative staff
6	Shivaji University, Kolhapur	NP	90	NP	In proportion of 5000 students : 1 clerk at actuals, plus proportionately other support staff
7	Mahatama Phule Krishi Vidyapeeth, Rahuri,	Nil	Nil	-	19

Ahmednagar					
8	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola	Nil	Nil	NP	19
9	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri	Nil	Nil		19
10	Sant Gadge Baba Amravati University, Amravati	99	99	10	121 with technical and administrative staff
11	Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad	Nil	Nil	8	4
12	North Maharashtra University, Jalgaon	85	82	150 at the time of CAP	117
13	Swami Ramanand Teerth Marathwada University, Nanded	NP	87	29	27
14	Maharashtra University of Health Sciences, Nashik	12	12	84 employees on daily wages	87
15	Maharashtra Animal and Fishery Sciences University (MAFSU)	10	3 permanent + 4 pooled	2	19
16	Solapur University, Solapur	NP	22	34	65
17	Gondwana University, Gadchiroli (M.S.)	40	20	NP	35

Strengthening of Examinations Cells/Divisions at Universities

Recommendation 33: Strengthening of Examinations Cell/Division at Universities: The committee recommends establishment of dedicated examination cell/division in Universities. The Examination Cell/Division should be headed by Controller of Examinations/and/or Director of Evaluation, full time officers with five years tenure appointment. The Controller of Examinations/and/or Director of Evaluations should be supported by well-equipped and trained permanent staff in sufficient numbers. Based on the number of colleges, number of courses and the number of students, dedicated faculty/staff should be appointed. Further, Coordinators representing each faculty in the university should be part of the examination Cell/Division and assist in question bank generation, paper setting and other related activities for smooth conduct of examinations.

Several committees have already emphasized the importance of strong examination cell/division. The committees headed by Anil Kakodkar and Arun Nigavekar have recommended establishment of Autonomous Examinations boards in Universities to conduct examinations in accordance with the stipulations of the university. Therefore, the strengthening of examination cells/divisions is key to successful reforms in examinations system in universities.

Key Features of the Recommendation

In Maharashtra, the Universities face several challenges in terms of resources in Examinations Cells/Divisions:

- Agricultural Universities do not even have dedicated examinations cells/divisions. They have a common MAUEB (Maharashtra Agricultural University Examination Board), that is being run on pooled posts from the four agricultural universities.
- In some other universities, the position of Controller of Examinations/Director of Examinations has been assigned as an additional charge to other officers of the University. There is no full time dedicated officer as Controller/Director of Examinations.
- Temporary Staff are largely employed in the Universities for carrying out the duties due to lack of Permanent Staff.

In order to overcome these deficiencies, there is a clear need to have a dedicated examination cell/division in Universities. The Examination Cell/Division should be headed by Controller of Examinations and/or Director of Evaluation, full time officers with five years tenure appointment. The Examination Cell/Division run by a dedicated full time officer would bring in greater commitment and henceforth efficiency to the examinations process. The Controller of Examinations /and/or Director of Evaluation should be supported by a well-equipped and trained staff in sufficient

numbers. The Examination cells/divisions should have necessary powers and autonomy to carry out its responsibilities in the desired manner.

Best Practice: In Pune University no temporary staff is appointed in examination cell. When this policy was implemented, no shortage of staff was felt as the productivity of permanent staff increased through use of ICT systems.

Further, Coordinators representing each faculty in the university should be part of the examination cell/division and assist in question bank generation, paper setting and other related activities for smooth conduct of examinations.

The officers of the examinations cell/division should have well defined and precise functions to safeguard their autonomy without breaking the necessary links with others. They should have powers and skills to use ICT in conducting of examinations.

Capacity Building of Faculty for effective handling of ICT based applications

Recommendation 34: Capacity Building of Faculty for effective handling of ICT based applications: Faculty development is the foundation for any successful reform in teaching and assessment. To help teachers keep pace with changing processes, pedagogy and technology, there needs to training and orientation program for all teachers.

- There needs to be a lifelong skill enhancement platform for faculty
- Training in use of advance teaching aids including Audio/Visual Aids, Multimedia and ICT aided tools should be provided
- Frequency of training should be increased.
- Online courses and online learning material should be made available for ready reference.
- Web enabled discussion forums and communities should be encouraged for increased interactions between teachers community.
- Training on effective creation of question banks/question papers should be imparted.

Technical Staff

Recommendation 35: Equipping Examination Cells/Divisions with appropriate Technical Manpower: With greater use of Information and Communications Technology in conducting examinations process, there is an urgent need to equip examination cells/divisions with required technical manpower.

Every Examination Cell/Division should have a dedicated IT team comprising of Project Manager, System Analysts, Programmers, Data entry operators etc. with clear mandate of using technology to drive greater efficiency, transparency and smoothness in examinations process. This technical team should support Controller of Examinations/and/or Director of Evaluations in implementation of different IT initiatives for reforming of examinations process in Universities.

Further, the non-technical staff should also be given suitable orientation and training in usage of Information Technology for carrying out their day to day tasks.

Chapter 9: Ensuring Accessibility to Differently Abled Students

IT Solutions compliant to WCAG 2.0

Any IT solution implemented in the universities should be easily accessible to Differently Abled Students including visual, auditory, physical, speech, cognitive, and neurological disabilities.

Recommendation 36: WCAG Compliance of IT Solutions: The committee recommends that every IT solution implemented by the Universities should be compliant to Web Content Accessibility Guidelines (WCAG) 2.0 Level A or the latest version of WCAG as issued from time to time as per the e-governance policy of Government of Maharashtra.

It is essential that IT solutions are accessible in order to provide equal access and equal opportunity to differently abled people. An accessible solution can also help differently abled people more actively participate in process.

There are many tools/websites available that test the preliminary WCAG compliance. However Manual Testing along with automated testing tools may be conducted to ensure complete compliance.

Users having different types of disabilities may also test the solution to ensure that the IT solution is truly accessible by different user groups. Differently abled persons can actually test the application using their assistive technology which might be a screen reader, screen magnifier, reading writing tool, on-screen keyboard, etc.

Government of India has issued GIGW (Guidelines for Indian Government Websites) that span the software lifecycle of a web portal/application. NIC (National Informatics Centre) has defined these Guidelines with an objective to make the Government websites, portals and web applications fulfill the UUU trilogy i.e. Usable, User-Centric and Universally Accessible.

The guidelines emphasize on making the IT solutions Web Content Accessibility Guideline (WCAG) 2.0 to ensure that differently abled people can perceive, understand, navigate, and interact with the application, and that they can contribute to the application. Web accessibility also benefits others, including older people with changing abilities due to aging.

Universities should ensure compliance to WCAG 2.0 Level A or any other guidelines issued by government from time to time for following reasons:

- Social (i.e. acknowledging the right of differently abled persons to have equal access to information and opportunities offered by the internet)
- Legal reasons (i.e. complying with national guidelines, policies or laws)

- Technical (i.e. ensuring increased interoperability, reducing server load, time taken in website maintenance and better quality websites)
- Service Delivery (i.e. better service delivery to differently abled students)

Innovative Techniques for Examinations for Differently abled Students

Recommendation 37: Use of ICT to Empower differently abled students: The committee recommends that technology should be leveraged to self-empower differently abled students enabling them to take examinations independently. Leading Universities including Mumbai University and Pune University should undertake pilot projects on the same. The alternate methods of assessments that may be adopted are as follows:

- Use of Screen Readers and online examinations, like currently used in *international GRE tests* may be adopted for giving tests to students who are visually impaired. These students may be allowed to give the examinations on computers with a screen reading speech software (screen readers).
- Use of Braille embosser or printers, for printing of examination material including question paper, examination guidelines etc. for visually challenged students instead of scribes reading out the question papers and other examination related material.
- Some students who are deaf or hard of hearing may be more comfortable with sign language rather than written text. In those cases, Question papers may be video recorded in sign language and shown to students. Similarly, students may be allowed to provide answers in Sign language which may be recorded and then sent to experts for evaluation.
- For students with upper body disabilities, audiotape recorders may be used for recording the answers provided by students.
- Similarly, other innovations should be encouraged for self-empowerment of differently abled students in giving examinations.

Best Practice: North Maharashtra University, Jalgaon provided an opportunity to an Ortho-cerebral disabled girl student to complete her BBM (E-Commerce) degree in 2011-12 through computer based examination.

Historically the Differently abled students especially visually impaired candidates have been appearing in the examinations with a scribe. However, with technological revolution, this facility needs to be extended to induce self-empowerment in differently abled students.

Necessary changes in the Universities Acts/Rules may be done for implementing the above suggestions.

Enabling Physical Access in Examination Centers

Recommendation 38: Accessibility of Examination Centers: Every differently abled person has a right to higher education. Since examination is an important component of education, the universities should ensure that every differently abled student appearing for examinations has adequate, necessary and appropriate support for the purposes of such examinations. Select provisions that the universities should ensure are as follows:

- Examination centers are adequately equipped for reasonable accommodation of differently abled students and to guarantee that differently abled students are not disadvantaged in any manner. The measures should include but not be limited to the provision of necessary aids and equipment, adequate healthcare facilities, necessary physical changes (physical ramps, accessible lifts, bathrooms, comfortable seating space/desks etc.) in buildings to ensure accessibility at centers, continuous monitoring with regard to necessary support, or any arrangements or facilities. The university should ensure that where no modifications are possible, human assistance should be made available to differently abled students.
- Every differently abled student has the right to receive necessary, adequate and gender sensitive support for the examinations and for any other lab work/practical work etc.
- Every examination center should have trained staff who have the requisite qualifications and training to cater to the needs of differently abled students. Such Teachers/Staff should be imparted orientation and training to understand specific needs of differently abled students.
- The universities should accord due recognition to the concerns of women and girls with disabilities by making adequate gender specific provisions for them in examination centers.

The universities have recognized that differently abled students have right to equality. The right is meaningless if these persons are not provided adequate support and facilities during examination process thereby eliminating them or disadvantaging them in any manner from the higher education system. Therefore, the universities should ensure equality and non-discrimination of all differently abled students.

Necessary changes in the Universities Acts/Rules may be done for implementing the above suggestions.

Chapter 10: Financing IT initiatives

Recommendation 39: Financial Requirements and Modalities of ICT Solutions: The Committee recommends the following for financing the ICT initiatives in Universities in Maharashtra:

- Larger Universities have surplus amount left from examination related revenue that they may utilize for implementing IT initiatives.
- Smaller Universities may collaborate with Larger Universities and enter into agreement with service providers jointly. Due to large numbers of students of both the universities combined and economies of the scale, the cost per student of the IT solution can be reduced in comparison to purchase of IT solution by smaller university on its own.
- Smaller Universities can share the infrastructure like Data Centre etc. of Larger Universities or State Data Center and use in-house developed softwares of larger universities.

The universities may decide from the following models for funding the IT initiatives:

- **Traditional Capex - Opex Model:** In this model, the universities/Colleges invest upfront in the capital expenditure of deploying hardware and software solutions. In the following years, the expenditure is then limited to operational expenditure.
- **Transaction based fee:** In this model, the universities employ services of a service provider whom they pay per use on number of transactions. The fee per transaction is fixed slabs as numbers of higher students and lower rates.

The committee unanimously recommends that examination related revenue should not be used as general revenue by the universities. It should be used only for examination related expenditure.

Key Features

In implementation of ICT initiatives, initial capital investment is usually high. Therefore, if overall number of students as well as number of students per Examination center is more, the cost per student is proportionately low due to economies of scale.

All the universities confirmed that revenue from examinations fees covers the exams related costs and generates some surplus. This surplus if any should be used for IT initiatives related to examinations.

Implementation of end to end IT examinations solutions in larger universities should cost approximately ₹ 200-400 per student per semester exams/annual exams. This is assuming:

- Minimum 6 subjects per Examination.
- Infrastructure/Hardware to be provided by the service provider.

- Software and Support Manpower for handholding to also be provided by service provider.
- Taxes extra as applicable.

In the above estimation, several costs incurred by universities in examinations like remuneration to examiners/invigilators/paper setters etc., Salaries of staff, printing of answer sheets and degree certificates, material required for practical examinations etc. have not been accounted.

Therefore larger universities that collect on an average ₹ 600-800 fees from students per semester examination/annual examination, should be able to leverage this revenue for implementation of end-to-end examinations system. However, Smaller Universities and Universities that charge fewer fees should need to deliberate on funding the IT initiatives.

In the initial years, expenditure may be high due to investment in setting of infrastructure, training of staff, manual backup etc. But over the years, the expenditure should be streamlined and reduced.

In any case, the benefits of usage of Information Technology for conducting examinations management system outweigh the costs. The benefits include:

- Increased credibility of examinations process and reduction in malpractices
- Better image of Universities
- Timely execution of examinations process in smooth manner
- Reduction of manual work like distribution of papers, collating of information etc. driving greater efficiencies in employees and so on.

Universities can employ innovative methods like following to reduce costs:

1. Clustering of 2-3 adjacent centers and establishing common hardware infrastructure for this cluster can reduce the hardware costs as against establishing hardware in each college.
2. Select Colleges like Engineering Colleges etc. may already have the necessary infrastructure. Therefore, additional hardware may not be needed to be established in these centers.
3. The University may also look at hiring of infrastructure. Select infrastructure like scanners maybe needed only for limited time. Therefore, it may be hired from market for short duration instead of purchasing.
4. Smaller universities, in order to reduce costs of ICT interventions per student, may collaborate with bigger universities and enter into agreement with service providers jointly. Due to large numbers of students of both the universities combined and economies of the scale, the cost per

student of the IT solution should be reduced in comparison to purchase of IT solution by smaller university on its own.

- Further, Smaller Universities can share the infrastructure like Data Centre etc. of Larger Universities or SDC and use in-house developed softwares of larger universities.

Financing Models The universities may decide from the following models for funding the IT initiatives:

Option 1: Traditional Capex - Opex Model: In this model, the universities invest upfront in the capital expenditure of deploying hardware and software solutions. In the following years, the expenditure is then limited to operational expenditure.

Option 2: Transaction based fee: In this model, the universities employ services of a service provider whom they pay per use on number of transactions. The fee per transaction is fixed. The universities should enter into slab-wise arrangement with service providers such that when number of students increases the cost per student decreases.

Evaluation of Alternatives:

	Option 1: Traditional Capex – Opex Model	Option 2 : Transaction Based Fee
Pros	<ul style="list-style-type: none"> - One time Capex may be funded with help of grants/assistance - Greater control on the IT solution 	<ul style="list-style-type: none"> - The university can concentrate of core academic activities outsourcing the process work to external agency - Huge Capital investment can be avoided. Further issues like expiration of licenses etc. do not arise.
Cons	<ul style="list-style-type: none"> - Greater involvement in running of IT solutions 	<ul style="list-style-type: none"> - Transaction Based Fee is more expensive in long run

Chapter 11: Additional Recommendations specifically for Non-Conventional Universities like Agricultural and Technological Universities

Recommendation 40: Dedicated Examination Cell/Division: The Provision of establishing a dedicated Examination Cell/Division should be ensured by the State Government to Non-Conventional Universities like Agricultural and Technological Universities. In each Examination Cell/Division, provision for full time Controller of Examinations /and/or Director of Evaluations and at least two Deputy Registrars (Pre and Post Examinations) along with required support staff for each degree programmes separately (i.e. Graduate, Post Graduate and lower education) may be ensured.

Recommendation 41: Constituent College for each degree programme: For undertaking effective examination system in affiliated colleges, there should be at least one Constituent College in the Agricultural Universities for each Degree Programme to which affiliation has been given to unaided/private colleges.

Agricultural Universities in Maharashtra offer degree programmes in several disciplines such as Agricultural Sciences, Agricultural Engineering, Agricultural Biotechnology, Food Science, Horticulture, Fisheries, Forestry, Agricultural Business Management, etc. Amongst these, universities have constituent colleges for some of these programmes only.

The examination related activities, such as paper setting, conduct of practical examinations, moderation of question papers and answer books, supervision, result management, etc. are to be performed by the faculty members of the constituent colleges. However, particularly for the degree programmes for which there are no constituent colleges, the universities have to depend solely on the human resources of affiliated colleges for examination related activities. But as the affiliated colleges do not have proper human resources and faculties to perform the task of examination, related activities for these degree programmes becomes difficult.

In view of performing the examination related activities effectively for the degree programmes for which there are no constituent colleges there is necessity of at least one constituent college in university for each degree programme offered by the university and for which the affiliation has been given to private/unaided colleges.

Recommendation 42: Permanent Faculty in Affiliated Colleges: Some private unaided colleges, to save on costs appoint the faculty on contractual basis for eleven months. They shift the entire examination burden to the university. To implement an efficient examination programme, the appointment of appropriate full-time (regular on twelve month basis) academic faculty in affiliated

colleges and their active involvement in entire examination process should be mandatory. On non-compliance, the student admissions to these affiliated colleges should be strictly withdrawn and should be permitted only upon fulfillment of this requirement.

Chapter 12: Conclusions and Recommendations

Examinations occupy a significant place in any Education system. Examinations help in assessing students' knowledge and understanding gained in an academic session and help evolve the pedagogy based on the results.

Over the years, there has been a significant increase in number of colleges and students enrolled in Higher Education across the state, with more than a hundred colleges affiliated to some universities. This has made the logistics of examinations formidable. Large numbers of students need to be tested at same time across different locations for every paper as per the tight schedule of the examinations. During the process, maintenance of confidentiality, security and timely execution has become a serious challenge.

In order to overcome these challenges and keep abreast with the changing times, there is a need to bring in reforms in the traditional examinations systems in Universities of Maharashtra. Recognizing this, the committee constituted under GR No. संकीर्ण-२०१२/प्र.क्र२००/१२/विशी-३ dated 20th July 2012 has suggested recommendations in Technology, Academics, Resource Allocation, and Universities Act etc. to reform the existing examination system in Universities. **The Committee feels that all the recommendations should be considered as part of a single package and not treated in parts and applicable for traditional technological, agricultural and other non-conventional universities.** The specific recommendations of the Committee are given below:

Technological Recommendations

Recommendation 1. Effective end-to-end use of ICT for reforms in Examinations:

Information and communication Technology (ICT) should be effectively used for management of examinations system in Universities to usher in greater efficiency, transparency and reliability. Use of ICT should also lead to improvement in quality of services being provided to the students/colleges/ departments etc. by introducing services through online web portal mobile, computerized helpdesk counter at college/university, Setu, Common Service Centers, eSangrams Kendras, etc. and online availability of information. The end-to-end integrated examination management system can manage the entire operation of examinations in Universities. The comprehensive examination management solution typically includes modules as follows: Student Registration to Issuance of Hall Tickets, Question Bank/ Question Paper Bank Generation, Secure Delivery of Question Papers, OMR and Barcode Technology in Answer Sheets, Digital Scanning and onscreen evaluation of Answer Sheets, Results Processing and Publication, Online Application for Re-evaluation, Dematting of Degrees and Certificates etc.

Depending on the present status of computerization, the solution may be end-to-end from one service provider or may involve different service providers implementing various modules.

Recommendation 2. Online student registration for examinations to issuance of hall

ticket: Every University should adopt ICT for online student registration for examinations from academic year 2013-14 and conduct few pilots for online issuance of hall ticket by first half of 2013. The universities may decide the service providers from among the following options:

- i. In-house Development of this module in the University.
- ii. MKCL's eSuvudha application.
- iii. Selection of service provider through tendering.
- iv. Smaller Universities may approach Larger Universities for either knowledge transfer or collaboration for combined tendering so as to reduce costs.

The solutions developed by aforementioned methods should, however, have the bare minimum requirements/features as recommended in the report.

Recommendation 3. Question Bank/Question Paper Banks Creation:

Question Bank approach or Question Paper Bank Approach should be followed by Universities for setting universities examination papers. The universities may decide as per their requirements from among the two approaches.

For ensuring quality and systematic generation of Question/Question Paper Banks, training and orientation needs to be provided to paper setters on various frameworks like Andersen/Bloom's taxonomy (Refer to Annexure D: Development of 'Blue Prints' of a Question Paper: Importance and Methodology).

The number of questions in the question bank should be at least 100 times the number of questions required in a questions paper. The Question bank should be available on website of the university as well as the libraries of universities and affiliated colleges. In case of Question Papers bank, the number of Question papers should be at least 30-50 times. But these Question Papers should be kept confidential.

At least one third of the questions in Questions bank should be changed every year in courses like medicine, agriculture, technology etc. to keep pace with the rapid changes in the respective fields. In subjects like Arts, History etc., at least 10-15% of Questions in the Questions bank should be changed every year. In case of Question Paper Bank,

whenever the curriculum is modified all the questions papers in the Question papers bank should be changed.

Recommendation 4. Secure Delivery of Examination Papers: In order to eliminate the threats and challenges faced in distribution and delivery of Question Papers to the respective institutes, the universities should adopt Information Technology Solution for Secure Delivery of Question Papers.

The committee also recommends that each university should implement this system on pilot/experimental basis for exams conducted in first half of 2013. Following this, by 2014, it should become a matter of practice. However, if any university can implement this system fully before the suggested dates, it would be a very welcome step.

In this solution, the Question paper once randomly selected/generated from the bank is encrypted and transmitted over secure channel to the examination centers just one hour before the Examination. At the examination center, it is decrypted with the key/password and printed. This will overcome the leakage of question paper during transportation and printing.

Recommendation 5. OMR and Barcode Technology in cover page of Answer sheets:

By first half of 2013, all universities should use OMR (Optical Mark Recognition) and Barcode Technology in cover page of answer booklets of University Examinations on pilot/experiment basis. Following this, by 2014, universities should use this technology for all examinations.

In this solution, the cover page of the Answer Booklet is divided into two OMR sections, each having the unique barcode of the answer booklet. The first section contains OMR sheet for capturing students personal details like roll number, course code etc. The second section contains OMR sheet to be used by examiners for entering firstly the individual marks obtained in each answer and finally the total marks obtained by the student in the answer booklet.

Post examination, the first section containing students' details should be torn off and sent separately to the Examination cell/division for data entry. This personal data should be directly read by the scanners and stored against the unique barcode of the answer sheet.

After evaluation, the examiners should enter the marks obtained by students in each answer individually as well as total marks achieved by the student in the OMR sheet. The software should automatically read these entries and provide alerts in case of

totaling mistakes. These marks should be entered against the unique barcode of the answer booklet and synchronized with the personal details of students automatically.

Recommendation 6. Barcode in each page of the Answer Booklets: Some universities may implement this solution on pilot basis in professional courses. Following this, the government may collate the data on pilot implementation and decide on further action depending on results of the pilot studies.

In this solution, each page of the answer booklets should contain the unique code of the answer booklet. Each question paper and answer booklet should then be divided into multiple sections such that the student should write answers on first section of question paper in first section of answer booklet only, and so on. Following this, the different sections should be separated and sent to different CAP centers for assessment ensuring that all “Section one” of the answer booklets of all students are assessed by one CAP center, all “Section two” of the answer booklets are assessed by second CAP center and so on.

In each CAP Centre, the marks should be entered against the bar code of the answer script enabling the IT solution to synchronize the marks against the student details.

This can ensure that same set of examiners verify the same section of answers for all students in that course, thus reducing the variation in marks due to variation in examiners. This is also useful when different sections requires highly specialized different faculty for grading.

Recommendation 7. Digital Scanning and Onscreen evaluation: On Pilot basis, each university shall conduct Digital Scanning and Onscreen evaluation of Answer Sheets in few courses/examinations. In this system, the answer sheets should be firstly scanned in secure premises. Following this, the scanned answer sheets are assessed on computers/laptops/Tablets by the appointed examiners at the CAP center. The Physical Answer sheets should be destroyed with time as per the Rules of the respective universities. The digital answer sheets should also be stored for the same period.

After one year, the universities and state government may collate the experience gained and take a call on whether to further expand the usage of this solution.

Through this system, the issues related to secure transport of answer sheets, replacement of answer sheets, delay in assessments etc. are reduced. Further, the time for reevaluation is greatly reduced as answer sheets are available online and can be reassessed immediately by the respective examiners. This should also facilitate

providing copies of answer sheets to students online rather than tracing the physical answer sheet and then photocopying it.

Recommendation 8. Results Processing and Publication: By First half of 2013, each university should mandatorily display results online including complete breakup of marks. Each student should be able to register on website and check his/her results. Further, a provision for sending the results by SMS/email to those students who have registered their mobile numbers/emails on the site may also be ensured.

Recommendation 9. Online application for Re-evaluation: By first half of 2013, the universities should enable online application for re-evaluation on pilot basis and by 2014, it should be mandatory. Students should be able to apply online for re-evaluation of answer sheets and pay the fees online through credit cards/debit cards/net banking etc. or offline through cash at CSCs/Setu/eSangram Kendras/Universities Counter/College Counter etc.

Recommendation 10. Dematting of Degrees and Certificates: The Vision of the Universities in Maharashtra should be to ultimately shift to ‘demat’ degrees and certificates. In the proposed system, dematerialization of certificates, to a technology-based solution that would ensure confidentiality, authenticity and fidelity, enabling online verification and easy retrieval of academic qualifications is envisaged.

The committee recommends that from first half of 2013 some universities should start pilot of this. And from 2014, it should be made mandatory. Also the previous data (Mark sheets/Degrees/Ledger records) from at least 2000-2001 should be digitized.

Through this solution, Industry and other stakeholders should be able to verify the degree of students online. This should greatly reduce the malpractices associated with issue of fake certificates, tampering of certificates etc.

Recommendation 11. Other Technologies for reducing Malpractices: Technological interventions in conduct of examinations should not be limited to use of Computing Technologies. Any Technological advancement including tamper evident security tapes that detect any kind of tampering with sealed packages, Digital Locks that transmit signals in case of tampering etc. are examples of usage of technology for reducing malpractices in examinations.

Recommendation 12. Use of IT for Teaching–Learning practices: The Universities should not limit the usage of Information Technology to Examinations Management system. It should extensively use technology for

- Increasing access of higher education through online universities/courses, virtual class rooms, distance education centers etc.
- Enhance quality of higher education through use of audio/visual IT aids, softwares, Knowledge Networks etc.
- ICT can also be used to improve the transparency, efficiency and effectiveness of Higher Education institutes.
- Universities to make best use of existing projects/schemes of Government of India, UGC etc. like NMEICT, NKN, A-View etc.

Recommendation 13. Data Centre Facilities: In order to host their IT Solutions, Universities require data center facilities. The various options for availing Data center facilities are described in the report. Universities may choose the option as per their requirements and constraints from the following:

- Usage of State Data Centre
- Dedicated Data Centre in Universities
- Sharing of Data Centre by Universities

Recommendation 14. Physical Security Measures: Universities should employ necessary physical security measures for protecting confidential data from unscrupulous individuals. University should implement security measures like biometric access control, closed-circuit television system (CCTV), Fire Resistant File Compactors etc. in Examination Strong Room, Assessment Centers and Data Centers. Senior officials including Vice Chancellor and Controller of Examinations and/or Director of Evaluation should be able to monitor from their room the CCTV footage and biometric access records.

Some Universities have or are setting up dedicated Examination Building/House (Pariksha Bhavan) whereas others have converted some rooms to Examinations Strong Rooms and Cells/Divisions. Government of Maharashtra is requested to review the funding available with universities through varied sources like Own Sources, Examination Fees, UGC/ICAR/ICMR/CSIR/DST funds etc. and provide the gap funding through state support for establishing and strengthening of infrastructure for Examination Building/House.

Recommendation 15. IT related Capacity Building and Handholding Support: For successful implementation of any IT solution, capacity building, training and handholding support for all the users is a critical necessity. The universities should ensure

- Training including Computer Awareness Training, Role based Training, Technical Training, Refresher Training etc. is provided to all the staff of the universities
- Handholding support: one qualified and trained person per one college/institute or one qualified and trained person for multiple colleges is available to handhold the staff in the college/institutes office
- Mock Drills especially for secure transmission and high speed printing is conducted to measure the preparedness of the solution and provide training.
- Training to paper setters in development of Question Bank/Question Papers Bank including Objective of Assessment, Blooms Taxonomy, Blue print of examination paper etc.

Recommendation 16. Decentralized, Customized, Interoperable software rather than centralized solution: The committee is deliberately not suggesting highly centralized uniform and single software across the universities in Maharashtra, so that various universities come up with different solutions suitable for them and innovation and creativity is ensured. However all these systems should adhere to e-governance standards and policy as issued from time to time, have linkages to UID number, should be interoperable so that there are no vendor locking and the data should be exportable to open standards so that other vendors can use it and business continuity is maintained. All Information Technology Solutions implemented by the University should have the following features: Availability, Interoperability, Performance, Robustness, Scalability, etc.

Recommendation 17. Hardware and Software updation with latest versions: With rapid changes in technology, life of any hardware or software item is on an average five years. In order to ensure that the IT solution runs smoothly for these five years, Universities should at the time of procurement, purchase hardware with five years warranty/maintenance support and softwares with five years software assurance and maintenance support.

Universities should keep pace with the technology and write off the IT hardware and software solutions in time.

Recommendation 18. Quality and Cost Based Selection of IT Solutions: Universities should follow transparent and competitive bidding procedure for procurement of any IT solution. Cost Based (L1 based) Selection should be used only when the IT solution is simple, common and standardized. In case of innovative, complex and pioneering IT solutions, Quality and Cost based Selection should be used. The committee recommends that Government of Maharashtra should accordingly change the account code for enabling Quality and Cost Based Selection.

Academic Recommendations

Recommendation 19. Decentralization of Examination Activities: The Universities may adopt the following procedure for decentralization of all Examination Activities:

- Colleges/Institutes with proven academic record and examination conducting reputation should be allowed to conduct their own examinations for all years. The universities should, on regular basis, grade the affiliated colleges/institutes on basis of their academic strength, faculty, infrastructure, previous performance, placement records etc. Colleges that attain Grade “A” should be allowed to conduct examinations on their own for all years.
- For other institutes, the university should conduct the final year examinations and may consider decentralizing the examination process for pre-final years. Already, Mumbai University for more than 20 years has been following this practice successfully.

In this solution, the decentralization of examinations may be as follows:

S.No.	Duration of Course	Examinations by Universities of Annual/Semester Exams in following years	Examinations by Colleges of Annual/Semester Exams in following years
1.	1 year	1 st Year	-
2.	2 years	2 nd Year	1 st Year
3.	3 years	3 rd Year	1 st and 2 nd years
4.	4 years	3 rd and 4 th Years	1 st and 2 nd years
5.	5 years	4 th and 5 th years	1 st , 2 nd and 3 rd years

- In the above option, few Universities have raised concerns that not all Institutes have qualified and high quality staff to set standard questions paper. As a result, the academic standard of Question papers set by these institutes may be low, thereby affecting the quality of education. In order to overcome this issue, the committee suggested empanelment of a list of teachers who are qualified for setting these pre-final years' examination question papers. The colleges should set the papers only through these empanelled qualified teachers. In some cases, the universities may even set question papers on its own and pass on the question papers to these colleges for conducting the examinations, assessment and declaration of results in a decentralized manner. This can reduce the workload of Universities in terms of examinations without affecting the quality.

Recommendation 20. Increasing CAP Centers: As per provisions of the Maharashtra Universities Act, 1994, there can be multiple CAP Centers for a single examination. Therefore, Universities should develop necessary CAP centers considering number of students and cluster of colleges.

Increasing the number of CAP centers should lead to timely evaluation of answer sheets and enable faster results processing and declaration.

Recommendation 21. Ensuring timely declaration of results and strong penal action against staff defaulting in examination related duties: It should be made mandatory for all the universities in Maharashtra to declare the dates of result of various examinations in advance and adhere to the declared dates. To ensure this, the clause stating the work of examination which is obligatory to all the teaching and non-teaching staff should be strictly implemented and adhered to. Those who fail to do so should be punished as per the existing provision.

Recommendation 22. Stringent evaluation criteria: Every university has its set of Rules for examination, evaluation, grace marks and ATKT (Allowed to Keep Terms) norms. It is proposed that due care be taken to ensure that design and revision of various Rules and ordinances for grace marks and ATKT should not lead to dilution of evaluation of teaching-learning outcome.

Recommendation 23. Increased Emphasis on Industrial Trainings, Practicals and Application oriented Projects in Evaluation: Industrial Trainings, Practicals and Application oriented Projects should become an integral part of curriculum and greater emphasis should be given to them in final assessment of students.

Students' exposure to industrial practices through internships should be made mandatory. Upon completion of the industrial training or project, the student should be

graded by a committee of faculty members on basis of final products of the project (i.e. presentation, reports, feedback from industry etc.). This can add greater credence and meaning to the industrial trainings and internships

Recommendation 24. Online Examinations: All universities should implement online examinations for internal examinations or as a part of external examinations on pilot basis in certain courses/examinations.

In the last few years, many Universities in India have adopted online examinations for entrance tests or university examinations including: BITSAT by BITS Pilani, Manipal University's UGET, CAT by the IIMs, GCET Online by Gujarat Technological University, IIT Bangalore's Online Entrance exams, Delhi University online exams etc. Various large scale internationally recognized examinations like GRE, GMAT, TOEFL etc. are also conducted online at specialized dedicated examinations center in an outsourced manner.

In Maharashtra too, Symbiosis has been effectively using online examinations in distance learning for assessing the students for years. Pune University has also started online examinations for 45000–60000 first year engineering students. In Pune University, out of total of 100 marks, 50 marks of all 6 subjects in each semester in first year are conducted online by respective colleges.

Universities should leverage technology in changing the landscape of examinations process.

Recommendation 25. Wholesome Education by universities through Non-Credit/Certification Courses, Self-Certification, Extra Marks/Credits, MOOC etc.: In order to ensure wholesome development of youth of India, Universities should not just impart subjectual knowledge to students but also encourage multi-disciplinary development of students through study in Basic Sciences, Humanities, Social Sciences, Moral Conduct, Character Building, Personality Development, Civic Duties and Social upliftment etc. These may be imparted through Non-Credit/Certification Courses, Extra Marks/Credits, Self-Certifications, MOOC (Massive Open Online Courses) etc. Through these courses, students may also be encouraged to pursue education in their areas of interest/hobbies etc.

Recommendation 26. Online Thesis submission and evaluation for Post Graduate and Doctoral Courses: In order to streamline and speedup the process of Post Graduate and Doctoral Degrees, online Thesis submission and evaluation should be implemented in Universities. In this solution, the evaluators of the thesis papers can be selected

automatically by the software on basis of competencies of the faculty and research topic of the students. Following this, the students submit the thesis online from where it should be accessed by the evaluator with the help of a code or password. The hardcopies of the thesis may also be submitted to the evaluators.

In order to implement this recommendation, necessary amendments in the corresponding universities Acts/Rules may be required in some universities.

Recommendation 27. Plagiarism Detection Software. Universities should strive to adopt plagiarism detection software. This software checks for potential unoriginal content and instances of plagiarism within a document by comparing submitted papers/assignments to several databases. This software scans its own databases, and also has licensing agreements with large academic proprietary databases as well as internet based documents.

Recommendation 28. Innovations in Exams like Open Book, Take Home etc.: The central goal of Universities is to build knowledge of students and equip them to apply available knowledge to solve problems and make intelligent decisions. The main focus of teaching should shift from rote learning to the application of knowledge.

In order to achieve it, it is necessary to reform the way of examinations. The Examinations shouldn't be a test of the memory of students but should test the understanding and application of knowledge by the students. Universities may experiment with these non-traditional types of examinations like Open Book Exams, Take Home Exams etc. in certain subjects on pilot basis.

Recommendations for Amendments in Maharashtra Universities Act, 1994 and other relevant Universities' Acts

Recommendation 29. Enabling Use of Question Banks/Question Paper Banks: There is a need to modify clause 32 (5e) of the Maharashtra Universities Act to allow Question Bank System or Question Paper Bank System. The Clause 32 (5e) of the Maharashtra Universities Act states that "The Committee should obtain three sets of question papers in sealed covers in the respective subject. The Chairman of the committee should draw at random one of such sealed covers containing question papers. This sealed cover with seals intact should then be sent to the press." Different universities like MAFSU, Technical University, MUHS etc. have variations to the above mentioned clauses in their corresponding Acts but to the similar effect.

These clause need to be modified to allow usage of IT in setting question papers. The following modification may be added: "Provided that, in case the university is using

Information Technology for generation or selection of Question Papers, then the committee should ensure that adequate security measures are built in the system and the final question paper generated or selected by the system is distributed after approval of the Chairman of the committee”.

Recommendation 30. Responsibility of imparting IT training to teaching and administrative staff: In order to impart training to teachers and administrative staff on usage of Technology, the following clause may be inserted:

“The Pro Vice-Chancellor/Dean (Faculty as in MAFSU, Agricultural Universities, DBATU etc.)/Director, Evaluation (As in the Proposed Act) should be responsible for organizing workshops for Teaching and Administrative staff about new trends in the assessment processes such as cognitive and summative assessment, creation and use of repository of questions, use of technology in paper setting and conduct of examination”

Recommendation 31. Involvement of CoE and Director, IT in the decision making process: As per the prevalent provisions in the Maharashtra Universities Act, Controller of Examination is invitee for all the committees. This poses difficulty in recruitment of staff or availing the finances pertaining to the Examination Section. The Controller of Examination /and/or Director, Evaluation (As in the Proposed Act) should be made a member with all the privileges.

The proposed Act has a provision of Director, IT. Since the role of IT is becoming pervasive in functioning of Universities, therefore Director, IT should be part of the decision making. Consequently, he should be involved in the Management Council either as an invitee or member as decided by Government. Similarly, Other Universities Act should also be amended to have a post of Director, IT.

Recommendation 32. Empowerment of Differently abled students: In order to empower differently abled students and ensure their inclusion in higher education, the committee has made some recommendations in Chapter 9: Ensuring Accessibility to Differently Abled Students. Accordingly, the necessary Acts/Rules of the Universities should be modified to implement these recommendations.

Resource Allocation Recommendations

Recommendation 33. Strengthening of Examinations Cell/Division at Universities:

The committee recommends establishment of dedicated examination cell/division in Universities. The Examination Cell/Division should be headed by Controller of Examinations/and/or Director of Evaluation, full time officers with five years tenure appointment. The Controller of Examinations/and/or Director of Evaluations should be

supported by well-equipped and trained permanent staff in sufficient numbers. Based on the number of colleges, number of courses and the number of students, dedicated faculty/staff should be appointed. Further, Coordinators representing each faculty in the university should be part of the examination Cell/Division and assist in question bank generation, paper setting and other related activities for smooth conduct of examinations.

Several committees have already emphasized the importance of strong examination cell/division. The committees headed by Anil Kakodkar and Arun Nigavekar have recommended establishment of Autonomous Examinations boards in Universities to conduct examinations in accordance with the stipulations of the university. Therefore, the strengthening of examination cells/divisions is key to successful reforms in examinations system in universities

Recommendation 34. Capacity Building of Faculty for effective handling of ICT based

applications: Faculty development is the foundation for any successful reform in teaching and assessment. To help teachers keep pace with changing processes, pedagogy and technology, there needs to training and orientation program for all teachers.

- There needs to be a lifelong skill enhancement platform for faculty.
- Training in use of advance teaching aids including Audio/Visual Aids, Multimedia and ICT aided tools should be provided.
- Frequency of training should be increased.
- Online courses and online learning material should be made available for ready reference.
- Web enabled discussion forums and communities should be encouraged for increased interactions between teachers community.
- Training on effective creation of question banks/question papers should be imparted.

Recommendation 35. Equipping Examination Cells/Divisions with appropriate

Technical Manpower: With greater use of Information and Communications Technology in conducting examinations process, there is an urgent need to equip examination cells/divisions with required technical manpower.

Every Examination Cell/Division should have a dedicated IT team comprising of Project Manager, System Analysts, Programmers, Data entry operators etc. with clear

mandate of using technology to drive greater efficiency, transparency and smoothness in examinations process. This technical team should support Controller of Examinations/and/or Director of Evaluations in implementation of different IT initiatives for reforming of examinations process in Universities.

Further, the non-technical staff should also be given suitable orientation and training in usage of Information Technology for carrying out their day to day tasks.

Ensuring Accessibility to Differently Abled Students

Recommendation 36. WCAG Compliance of IT Solutions: Every IT solution implemented by the Universities should be compliant to Web Content Accessibility Guidelines (WCAG) 2.0 Level A or the latest version of WCAG as issued from time to time as per the e-governance policy of Government of Maharashtra.

Recommendation 37. Use of ICT to Empower Differently abled Students: The committee recommends that technology should be leveraged to self-empower differently abled students enabling them to take examinations independently. Leading Universities including Mumbai University and Pune University should undertake pilot projects on the same. The alternate methods of assessments that may be adopted are as follows:

- Use of Screen Readers and online examinations, like currently used in international GRE tests may be adopted for giving tests to students who are visually impaired. These students may be allowed to give the examinations on computers with a screen reading speech software (screen readers).
- Use of Braille embosser or printers, for printing of examination material including question paper, examination guidelines etc. for visually challenged students instead of scribes reading out the question papers and other examination related material.
- Students who are deaf or hard of hearing may be more comfortable with sign language rather than written text. In those cases, Question papers may be video recorded in sign language and shown to students. Similarly, students may be allowed to provide answers in Sign language which may be recorded and then sent to experts for evaluation.
- For students with upper body disabilities, audiotape recorders may be used for recording the answers provided by students.
- Similarly, other innovations should be encouraged for self-empowerment of differently abled students in giving examinations.

Recommendation 38. Accessibility of Examination Centers: Every differently abled person has a right to higher education. Since examination is an important component of education, the universities should ensure that every differently abled student appearing for examinations has adequate, necessary and appropriate support for the purposes of such examinations. Select provisions that the universities should ensure are as follows:

- Examination centers are adequately equipped for reasonable accommodation of differently abled students and to guarantee that persons with disabilities are not disadvantaged in any manner.
- Every examination center should have trained staff who have the requisite qualifications and training to cater to the needs of differently abled students.
- The universities should accord due recognition to the concerns of women and girls with disabilities by making adequate gender specific provisions for them in examination centers.

Financial Estimation and Innovations

Recommendation 39. Financial Requirements and Modalities of ICT Solutions: The Committee suggests the following for financing the ICT initiatives in Universities in Maharashtra

- Larger Universities have surplus amount left from examination related revenue that they may utilize for implementing IT initiatives.
- Smaller Universities may collaborate with Larger Universities and enter into agreement with service providers jointly. Due to large numbers of students of both the universities combined and economies of the scale, the cost per student of the IT solution should be reduced in comparison to purchase of IT solution by smaller university on its own.
- Smaller Universities can share the infrastructure like Data Centre etc. of Larger Universities and use in-house developed softwares of larger universities.

The universities may decide from the following models for funding the IT initiatives:

- **Traditional Capex - Opex Model:** In this model, the universities invest upfront in the capital expenditure of deploying hardware and software solutions. In the following years, the expenditure is then limited to operational expenditure.

- Transaction based fee: In this model, the universities employ services of a service provider whom they pay per use on number of transactions. The fee per transaction is fixed slab.

The committee unanimously recommends that examination related revenue should not be used as general revenue by the universities. It should be used only for examination related expenditure.

Additional Recommendations specifically for Non-Conventional Universities like Agricultural and Technological Universities

Recommendation 40. Dedicated Examination Cell/Division: The Provision of establishing a dedicated Examination Cell/Division should be ensured by the State Government to Non-Conventional Universities like Agricultural and Technological Universities. In each Examination Cell/Division, provision for full time Controller of Examinations/and/or Director of Evaluations and at least two Deputy Registrars (Pre and Post Examinations) along with required support staff for each degree programmes separately (i.e. Diploma, Graduation ,Post-Graduation and lower education) may be ensured.

Recommendation 41. Constituent College for each degree programme: For undertaking effective examination system in affiliated colleges, there should be at least one Constituent College in the Agricultural Universities for each Degree Programme to which affiliation has been given to unaided/private colleges.

Recommendation 42. Permanent Faculty in Affiliated Colleges: Some private unaided colleges, to save on costs appoint the faculty on contractual basis for eleven months. They shift the entire examination burden to the university. To implement an efficient examination programme, the appointment of appropriate full-time (regular on twelve month basis) academic faculty in affiliated colleges and their active involvement in entire examination process should be mandatory. On non-compliance, the student admissions to these affiliated colleges should be strictly withdrawn and should be permitted only upon fulfillment of this requirement.

Maharashtra, with its large young population, is well positioned to seize the unfolding opportunities for economic development and prosperity. However, it needs to enhance the education and training system and in particular reform the examination systems in higher Education.

Select Universities have already taken steps to reform the existing examinations process to meet the demands of the society. But now, there is a need to have uniform and united efforts in this direction. This report is one such step towards the goal. This report serves as a guide towards achievement of excellence, efficiency, credibility and timely execution in examination process in Universities in Maharashtra.

Recommendation 43. Sharing of best practices: In the past, universities have been working in silos, with minimal or no interaction or sharing of best practices. While working on this committee, it was seen that sharing of best practices and deliberation has led to meaningful and clear recommendations which can change and upscale the education system in Maharashtra. Once the recommendations are adopted by the universities, it can ensure the much needed robust system without any loop holes. To facilitate continuous learnings and process improvements in the system and adoption of these recommendations, all the universities including agricultural universities of Maharashtra should review once every quarter by meeting at the respective universities on rotation basis on the progress on the implementation and share best practices.

Glossary

BCUD	Board of College and University Development
CAP	Central Assessment Programme
CAT	Common Admissions Test
CCTV	Closed Circuit Television
CoE	Controller of Examinations
CSC	Citizen Service Centers set up by DIT in various villages
eSangram Kendras	Citizen Service Centers set up by Rural Development Department in village panchayats
GIGW	Guidelines for Indian Government Websites
GMAT	Graduate Management Admission Test
GR	Government Resolution
GRE	Graduate Record Examinations
ICT	Information and Communications Technology
IT	Information Technology
LAN	Local Area Network
LAQ	Long Answer Questions
MAUEB	Maharashtra Agricultural Universities Examination Board
MCQ	Multiple Choice Questions
MIS	Management Information System
OMR	Optical Mark Recognition
PG	Post Graduate
SAQ	Short Answer Questions
SDC	State Data Centre
Sem	Semester
Setu	Citizen Service Centers set up by DIT in Collectorates and Tahsildar Offices
SNDT	Shreemati Nathibai Damodar Thackersey Women's University
UG	Under Graduate
Univ	University
VPN	Virtual Private Network
WCAG	Web Content Accessibility Guideline

Annexures

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Annexure A: University Management System

The University Management system should be used for better service delivery and for carrying out the day to day administration procedures. A university management system would take all the academic and administrative processes of the University on IT backbone. The objective of University Management system would be:

- To make a paperless university
- To provide a fully automated system
- To automate all the processes of the university
- To lead the university on to a path of flexible work environment i.e. work from anywhere
- To monitor different functions and processes



A University Management System would comprise of following modules:

1. Admission Module
2. Examination Module
3. Affiliation Module
4. Finance Module
5. Administrative Module
6. Human Resource Module

7. Payroll Module
8. Inventory Module
9. Assets Module
10. Hostel and Guest house Module
11. Meeting Management Module
12. Visitors Module
13. Research Management Module
14. Electronic Tender Management System Module
15. RTI Module
16. Library Management Module
17. SC/ST Data Management Module
18. Placement Module
19. Student Interaction Module
20. Alumni Module
21. Donation and Grants Module
22. Mobile Solutions

1. Admission Module

The admission module has following functionalities. The online admission module eases the process of admission where in students apply online. The Module based on the merit of the student provides the colleges that one can opt for students confirmation.

- Admission management
- Application fee management system
- Online application system for programs offered by university
- Course management system
- Program course mapping

- Candidate Merit list generation
- Merit based allocation of colleges
- College selection based on one's merit number

2. Examination Module

The Examination module has been already covered in the report in detail.

3. Affiliation Module

An institute that wants to get affiliated with the university fills up an online registration form available at the university's website. The institute further can upload the required documents mandated by the University for Affiliation and pay the affiliation fees using the integrated payment gateway. After successful affiliation the institute would get the access details to log in to the university portal. The affiliation module has following functionalities:

- Institute Affiliation process
- Workflow authorization for affiliation
- Integrated with Payment Gateway for affiliation fee
- Provision to upload mandatory documents
- System generated username and password for the institute after affiliation approval

4. Finance Module

The finance department is the backbone of a University's operations and processes. It records operating transactions, analyzes them and prepares financial statements that inform top management and regulators about a university's economic health. Finance employees also ensure that internal mechanisms and policies comply with regulatory standards, industry practices and human resources policies.

The finance module comprises of accounts receivable and payable. All the payments that are done to the university via the payment gateway come directly in the accounts receivable. Maintenance of Ledger becomes easier as there is no manual entry to be done. The maintenance of account payable also becomes easier as purchase order would be first released via the system before procurement actually happens; hence the finance management becomes much easier. The finance module has following functionalities:

- Budget Preparation

- Budget Administration
- Financial Management
- Investments by Institute
- Management of Taxes
- Financial Risk
- Billing
- Fee Management

5. Administrative Module

The administration module manages the administrative work of university and helps in easing the work. The administrative module has following functionalities:

- Assigning access rights to all the users (Faculty, students, employees, alumni etc.)
- Facility of blocking rights and updating rights
- Updation of business rules
- User Administration (Addition and deletion of users)

6. Human Resource Module

The Human resource department deals with management of people within the university. The Human resource module keeps track of the number of employees in the universities, the salary and the salary structure of the employees. It provides following functionalities:

- Manpower planning
- Recruitment process
- Joining formalities
- Employees personal file maintenance
- Training and development
- Exit Formalities

- Improving University's culture
- Performance appraisal
- Employee Benefits (Health care, Life insurance etc.)

7. Payroll Module

The primary mission of the payroll department is to ensure that all employees are paid accurately and timely with the correct withholdings and deductions, and to ensure the withholdings and deductions are remitted in a timely manner. This includes salary payments, tax withholdings, and deductions from a paycheck. It provide functionalities like:

- Sick and Vacation Leave balances
- Timesheets
- Employee compensation & disbursement
- Salary Receipt
- Provident Fund
- Loans and Advances

8. Inventory Module

The inventory module keeps track of all the inventories of the universities. All the consumables and durable goods of university/institution can be managed by this module. It helps in preparing reports that shows the exact expenses, consumption and availability of stocks and items. The inventory module keeps all the payment details. It has the record of vendors with their goods. It keeps track of current level of stock with the university.

- Maintain and track records of inventory
- Inventory orders
- Stock availability and maintenance
- Inventory report

9. Asset Module

The purpose of the asset management function is to provide resources and expertise to support the acquisitions, in-service support and disposal of physical asset required by the university. The asset module keeps track of the entire assets in the universities. Every asset is assigned a code and an entry for the same is done in the asset tracker.

- Acquisition
- In-service logistic support and procurement
- Asset status knowledge and reporting
- University wide asset systems and practices

10. Hostel and Guest house Module

The Hostel and Guest Module keeps track of the entire guest who visited the university. The allocation of the guest house is done by the module. Some of the functionalities are listed below:

- Track of Guest
- Allocation of Guest house
- Hostel allocation for students

The hostel management module administers the management of hostel by

- Maintaining the records of the students staying in the hostel
- Room allotment
- Registration
- Facilities provided
- Daily attendance of the student and their in time and out time
- Hostel inventory management
- Student Clearance management

11. Meeting Management Module

The meeting management module has following functionalities:

- Booking of meeting room
- Availability of meeting room
- Meeting expenses incurred

12. Visitor Module

The visitor module keeps track of all the visitors who visit the university. It records the date of visit, Name of the visitor, Purpose of the visit, contact details of the visitor, time of visit and etc. It does complete visitor management.

13. Research Management Module

The research management module provides functionalities like:

- Approval work flow for research
- Creation of research paper
- Online notification alerts to research authors
- Online research search

14. Electronic Tender management system module

The electronic tender management module provides following functionalities:

- Creation of Tender Notice
- Approval work flow for notification and tender documents
- Online display of Tender Notification
- Creation of Tender document
- Online notification alerts to bidders
- Tracking of notifications and tenders
- Online Tender search
- Access to online tender document
- Payment Mechanism

- Pre-bid meeting

15. RTI Module

The Right to Information Act 2005 (RTI) is an Act of the Parliament of India "to provide for setting out the practical regime of right to information for citizens. The RTI module provide following functionalities:

- Filing of RTI
- Status tracking of filed RTI
- RTI search

16. Library Management Module

The Library management module provides following functionalities:

- Acquisitions
- Cataloguing (classification)
- Serials (tracking books, magazines, newspapers)
- Issuance
- Search functionality

17. SC/ST Data Management Module

The SC/ST data management module keeps track of

- Number of SC/ST candidates taken admission in the university
- Number of SC/ST candidates appeared for the Examination
- Number of SC/ST candidates passed the Examination

18. Student Interactive Module

It provides functionalities like:

- Eligibility: Students can check their eligibility online for the university in which they are seeking admission. If they are eligible, they can generate the eligibility certificate by uploading the necessary

documents prescribed by the university and by paying the amount via integrated payment gateway for eligibility certificate

- Student Enrolment: Students can enrol themselves online or through the institute and can get generated enrolment ID and access details for the university portal. Once enrolled the students details are available in the university portal. This generated enrolment ID will be the unique ID which remains valid throughout the life cycle of the students association with that university.
- Examination Form Filling: A student will login to the university portal with his enrolment ID and a pre-filled Examination form will open for the semester he is supposed to take up the Examination. In case the student has to fill Examination form for backlog subjects even that will appear in his login. The student just needs to verify the fields and pay the required Examination fee via payment gateway.
- Certificate verifications, duplicate, transcripts, Equivalence: A student can request online for verification by paying the prescribed fee set by the university. The student has to login to the university portal and click on the verification link, the subjects that he can apply for verification will appear and he needs to select the subject for which he wants to go for verification. Similarly he can raise a request for transcripts and equivalence by paying the fee online.
- Hall Ticket generation
- Students service request management system

19. Placement Module

Placement Management module helps in facilitating the most important procedure for any institution/university and that is placements. Good placements are beneficial for students and it also improves the reputation of institutions. Placement module provides functionalities like:

- Company Registration for on campus placement
- Placement scheduling
- Placement information
- Student module: Students can update their profile, Create CVs in PDF format, Accept or reject jobs, Receive communication via SMS or email, practice online test, register for online events
- Placement provider module: A placement office can filter students using various criteria with a click of a button; move students to various placement stages such as filtered, selected, offered, rejected and communicate with students in different stages through SMS or email
- Placement Report: Export Placement record from the database

20. Alumni Module

The Alumni module provides functionalities like:

- Alumni management
- Alumni Registration
- Alumni meets

21. Donations and Grant Module

The Donations and Grant Module keeps track of all the grants received from the government and various donations.

22. Mobile Solutions

The mobile solution provides functionalities like:

- Result information
- Examination Schedule update

Annexure B: Minutes of Meeting of Committee Meetings

1st MEETING OF COMMITTEE FOR PREVENTION OF LEAKAGE OF EXAMINATION PAPERS

Date: 8th August, 2012

11:00 AM to 4:00 PM

Venue: Meeting Room, SET Guest House, Pune University

Members Present
<ul style="list-style-type: none">• Shri.Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman• Dr. Subhash Deo, Director, Examinations, Mumbai University - Member Secretary• Dr.P.N.Mandhare, Controller of Examinations, SNDT University, Mumbai• Dr.D.J.Salunkhe, COE, Solapur University, Solapur• Dr.A.M.Paturkar, Associate Dean, Bombay Veterinary College, Parel, Mumbai• Dr. Sameer Narkhede, Special Officer for Exams, Uttar Maharashtra University, Jalgaon• Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik• Dr.Sampada Joshi, Controller of Examinations, University of Pune, Pune• Dr. R.K.Kamat, Senior Librarian, Shivaji University, Kolhapur• Dr.R.P.Kate, Senior Controller of Examinations, Dr. BATU, Lonere• Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri• Dr. R.W.Ingle, Deputy Registrar, Dr. Panjabrao deshmukh Agriculture University• Dr.N.S. Kakode, Director, BCUD, Gondwana University, Gadchiroli• Dr. Dilip Ukey, Pro VC, Swani Ramanand Teerth Marathwada University, Nanded• Dr. Swati Mujumdar, Principal Director, Symbiosis Open Education Society, Pune• Dr.Sanjay S.Pawar, SNDT Women's University
Others present
<ul style="list-style-type: none">• Dr.Ashok Chavan, Controller of Exam, BAMU University, Aurangabad• Dr.D. B. Pathak, Programmer, Dr.Babasaheb Ambedkar Marathwada University, Aurangabad• Prof.L.C.Mohatkar, COE, Maharashtra Agricultural Universities, Examination board, Pune• Dr.Satnam Singh, COO, Mahaonline Ltd• Shri.Vinod P.Patil, Deputy Registrar, Mumbai University, Mumbai• Smt. Aarti Harbhajanka, Consultant, Accenture Services Pvt Ltd.

1. Dr. Sampada Joshi, Controller of Examinations, University of Pune welcomed Shri. Rajesh Aggarwal, Secretary IT and all the members present for the meeting.

2. The Meeting commenced with Shri. Subhash Deo, Member Secretary apprising the committee of the objectives of the meeting and discussing the proposed plan for preparation of the report as follows:
 - a. All Committee members shall meet in four universities in span of one month namely Pune, Aurangabad, Nagpur and Mumbai respectively for preparation of report.
 - b. In the meantime, subcommittees shall be formed, that may visit the rest of the universities in this span of one month.
3. Shri. Rajesh Aggarwal, Secretary IT then welcomed all the members of the committee. He directed that a group space must be formed online, where in the members can share, upload and edit documents of the committee on real-time basis.

He then invited the members of the committee to give their presentations on process of examinations system and key issues & challenges faced.
4. Dr. Rajderkar, Pro-Vice Chancellor, Maharashtra Health University, Nashik explained the examination system in his university. He submitted that the key issues faced in examination systems are: Printer's Mistakes, Improper Packaging of Question Papers, Delayed Delivery of papers, well in advance delivery etc. He suggested that in order to overcome these challenges, the following measures may be used: Preparation of Question Paper Bank, Online Secure Transmission of Question Paper, Password Use, Password Validity and Agreement for execution of online transmission.
5. Following this, Dr. R. S. Patil, Dean, Mahatma Phule Agriculture University, Rahuri explained the key processes in the examination system in the Agriculture University. In the issues faced during the examination, he added the following issues:
 - a. There are no constituent colleges for the Biotechnology, Food Science, Agri-business Management etc. This affects the examination related work viz. setting of question papers, moderation of question papers and evaluation of the answer papers due to lack of recognized staff in university.
 - b. Further, Mushrooming of affiliated colleges has overburdened the staff of University and Examination Board. Presently Examination Board is run on the pooled posts. No separate establishment for Examination Board
6. Dr. R. P. Kate, Senior Controller of Examinations Dr. Babasaheb Ambedkar Technology University, Lonere described the examination process in his University. He added that one of the key reasons for leakages is readily available answers. The Question papers should test the application of concepts & understanding of the student rather than demanding theoretical answers. He suggested that a large question bank

should be created. 4-5 experts should then select questions from this question bank and prepare 4-5 sets of Questions papers. From these, any one set of question papers should be chosen at random.

7. Dr. Deo, Member Secretary of the Committee presented the examination process in traditional Universities, pointing out the problems faced which are common to all traditional Universities. He then elaborated the pilot initiatives adopted by Mumbai University for prevention of leakage of examination papers including online delivery of question papers in engineering/technology colleges, restructuring 32 (5) modalities etc.
8. Dr. Ukey, Pro-Vice Chancellor, Swami Ramanand Teerth Marathwada University, Nanded appraised the members about the examination reforms initiated by his University. He mentioned that in Art, Science & Commerce courses, the University has changed the examination pattern such that in first two years the Semester exams which have weightage of 80% are purely MCQ (Multiple choice questions) and internal exams carrying weightage of 20% are descriptive papers. In the final year, the pattern is reversed such that external papers are descriptive and internals are MCQ based. This has greatly reduced the burden of university for evaluation and revaluation.
9. Dr. Kakode, Director, BCUD, Gondwana University submitted that though ICT should be extensively adopted, Remote areas like Gadchiroli , Gondia etc face connectivity problems. Solutions need to be designed to overcome these problems.
10. Dr. Swati Mujumdar, Principal Director, Symbiosis Open Education Society, apprised the committee on the successful implementation of ICT in her institute for education and examination. She emphasized on need for training of examiners/faculty on development of questions of different levels of difficulties that evaluate the understanding & application of concepts rather than rote learning. She elaborated the different types of exams conducted by her institute: Online, Semi-online, Offline, On demand examination etc. She also cited the best practice adopted by her institute wherein students are given opportunity to improve their scores in select assignments by retaking the assignments
11. Shri. Rajesh Aggarwal, Chairman summarized the key points discussed by various committee members and then the committee broke for lunch.
12. The post lunch session commenced with Dr. Paturkar describing the examination system adopted in Bombay Veterinary college. He endorsed the suggestion given by the earlier speakers

13. Dr. Sampada Joshi spoke about the ICT mode adopted by Pune University and enablement of application of examination form online. She also stated that Hall ticket generation and results processing is conducted online through a system which has been developed in house in University of Pune. She also indicated that the question papers delivery mechanism currently followed by University of Pune is with sufficient security and there has been no instance of malpractice.
14. The concluding session was deliberation on all the issues and ideas therein floated by the members. It was decided that the report shall focus on three key areas:
- a. Firstly, the report shall provide detailed recommendation on establishment of IT system for prevention of leakage of examination papers.
 - b. Secondly, the report may provide recommendations on comprehensive IT solution in the Universities including:
 - i. Online Admissions management system
 - ii. Student Life Cycle Management System
 - iii. Online Affiliation Management system: New Colleges, New subjects, Additional Divisions, etc.
 - iv. Audit Management System
 - v. Migration Management system
 - vi. Examination Management System: Schedule, Hall Ticket Generation, Pre-examination Management etc.
 - vii. Results Processing system
 - viii. Computerization of Administrative Functions like: Employee Management System, Recruitment Management, Document Management System, Meeting Management etc.
 - ix. E-learning , virtual classrooms etc
 - c. Finally, the report may address the common IT infrastructure issues faced by various universities and institutes.
15. The meeting closed with the announcement of next meeting to be hosted at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad on 22nd August 2012 at 11.00 a.m. The need to ensure that the report is completed within one month time was reiterated. It was also proposed that meeting at Aurangabad would include presentations by service providers on examination automation to give idea on various ICT solutions available in market.
16. The meeting ended with vote of thanks to the chair.

2nd MEETING OF COMMITTEE FOR PREVENTION OF LEAKAGE OF EXAMINATION PAPERS
Date: 22nd August, 2012
11:00 AM to 5:30 PM
Venue: Seminar Hall, Examination House, BAMU University, Aurangabad

Members Present
<ul style="list-style-type: none"> • Shri.Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman • Dr. Subhash Deo, Director, Examinations, Mumbai University - Member Secretary • Dr. Vijay Pandripande, Vice Chancellor, Dr. BAMU University , Aurangabad • Dr.D.J.Salunkhe, COE, Solapur University, Solapur • Dr.R.P.Kate, Senior Controller of Examinations, Dr. BATU, Lonere • Dr. S.P.Kane, Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University • Dr. R.W.Ingle, Deputy Registrar, Dr. Panjabrao deshmukh Agriculture University • Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri • Dr.P.N.Mandhare, Controller of Examinations, SNDT University, Mumbai • Dr.Sanjay S.Pawar, SNDT Women's University • Dr.N.S. Kokode, Director, Director, BCUD, Gondwana University, Gadchiroli • Dr.Sampada Joshi, Controller of Examinations, University of Pune, Pune • Dr. Sameer Narkhede, Special Officer for Exams, Uttar Maharashtra University, Jalgaon • Dr. Nitin koli, HOC, Sant Gadge Baba, Amravati University • Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik
Others present
<ul style="list-style-type: none"> • Dr.Ashok Chavan, Controller of Exam, BAMU University, Aurangabad • Dr. U.D.Umrikar, Associate Professor, Bombay Veterinary College, • Dr. Neeraj Salunkhe, Nodal Officer, Dr.BAMU, Aurangabad • D.V.Wankhade, Asstt. Registrar, SGBAU • Dr. R.P.Andhale, TO to Dean, MPKV, Rahuri • Dr. Garkal KL, COE, MUHS, Nashik • Mr.Sachin Satpute, MKCL • Mr. Hemant Gudhe, Eqlsoft • Mr. Dipankar Choudary, Ygen • Mr. Vikrant Chand Singh, Mindlogicx Ltd, Bangalore

- Mr. Nikhil Garg, GA Content Solutions
- Mr. Rakesh Bhat, Pears Technologies
- Smt. Aarti Harbhajanka, Consultant , Accenture Services Pvt Ltd.

1. Dr. Vijay Pandripande, Vice Chancellor, Dr. BAMU welcomed Shri. Rajesh Aggarwal, Secretary IT, Dr. Subhash Deo, Director, Examinations, Mumbai University and all the members present for the meeting.
2. The Vice Chancellor, Dr. BAMU appreciated the initiative taken by the Government of Maharashtra for prevention of leakage of university examination papers and suggested that complete examinations process including evaluation and results processing should be covered by the committee. He gave following suggestions:
 - a. Question Paper Bank rather than Question Bank should be prepared by universities
 - b. The Universities should switch to Continuous evaluation where in faculty teaching the students does continuous evaluation of students through assignments, projects, monthly tests, extent of class participation etc.
 - c. Strengthening of Exam Branch in Universities by having additional CoEs for PG, Addtl CoE for UG, etc.
3. Shri. Rajesh Aggarwal, Secretary IT suggested that colleges may be graded by Universities on basis of their academic strength. Accordingly, Grade A colleges may be given freedom to set their own exams & conduct their own assessment. Grade B colleges may be given the question papers prepared by universities but they may evaluate using their internal staff. In Grade C colleges, universities shall conduct the complete examination.
4. Dr. Kane, COE, Nagpur University mentioned that there are three major sources of leakage of papers. The first source is during examinations setting process, second source is at printers and lastly when the examination papers are in custody of respective examination centres. He further added that IT intervention is needed for results processing too as there is great scope for malpractice in it.
5. Following this Dr. Subhash Deo, Member Secretary read the minutes of First Meeting of Committee held in Pune and the committee confirmed the same.
6. Dr. Subhash Deo then informed the committee that next meeting of the committee shall be held on 30th August in Nagpur University and this shall be followed by 2 day meeting in Mumbai University on 6-7th September 2012. He then informed the agenda of the meeting to the committee members as follows:
 - a. Presentation by Vendors on examination management system

- b. Finalization of sub groups for visiting all universities in Maharashtra
 - c. Any other topic with permission of the chair
7. Following this, the following vendors presented their solutions to the committee members one by one:
- a. MKCL
 - b. GA Content Solutions
 - c. eq|Soft
 - d. ygen
 - e. Pears Technologies
 - f. Mindlogicx

The committee understood the available IT solutions and options for examination management system through these presentations. Further, all these presentations were collected from the respective service providers to be shared with all the committee members and uploaded on group space.

8. The committee then broke for lunch.
9. Post lunch, five minutes was provided to each of the service provider to provide details on their experience & tentative costing to the committee.
10. Following this, the committee deliberated on various issues and ideas therein floated by the members.
11. Shri. Rajesh Aggarwal, Secretary IT suggested that
- a. The report should include recommendations on not only pre examinations process but also post examination process including reevaluations, prevention of false certificates etc.
 - b. The report should contain a section on Cost Benefit Analysis of various IT solutions / options recommended. Estimated Costs may be provided slab-wise, so that as the number of students/ exams increase, the cost per student decreases.
 - c. The report should contain academic recommendations like decentralizing the examination process such that Universities conduct only the final year examination and the previous examinations are conducted by the colleges on their own. This shall introduce continuous evaluation mechanism and also reduce the burden of universities.

- d. Every University has different ordinances, characteristics, mandates, resources (financial & human), structure etc. Therefore, though the committee shall recommend the best solution, it should also provide alternate solutions in case any university can't implement the recommended solution due to some constraint. Therefore the report should contain various alternate options of each solution. The university on basis of their circumstances may choose among the options.
 - e. Further, interoperability between various solutions of different universities should be ensured. So that in future data may be migrated from one university to another when needed. Eg: When a student migrates from one university to another, the digital data of the student should be easily transferable between universities
 - f. The report should also provide recommendations on staffing requirements especially technical staff in examination cells. The committee may, during their visits to various universities, tabulate the current staff deployed (Temporary & Permanent) and staffing requirement. The committee shall then finally decide on the staff needed together.
 - g. The report should provide recommendations on not only IT but also Administrative, Academic, Staffing, Costing, etc. for reforming examination process in Universities.
 - h. The universities must insist on small pilot at no cost before signing contract with the service provider. Only after successful implementation of the pilot should the universities enter into contracts with these vendors.
 - i. Persons with Disabilities (PWD) including visually impaired students should not be ignored. The report should also address the needs and requirements of these students.
12. Dr. Sampada Joshi added that in Pune University no temporary staff is appointed in examination cell. When this policy was implemented, no shortage of staff was felt as the productivity of permanent staff increased.
13. Dr. Subhash Deo then in consultation divided the committee members into sub group. Each sub group was directed to visit universities and study the following:
- a. The Committee shall study the examination process of the university and identify key features/differentiating factors of the examination process
 - b. Key issues faced in Examination Process
 - c. Technology used in Examinations as well as other university functions
 - d. Identify best "IT initiatives" taken by the university

- e. List the current staffing (Temporary & Permanent) in the examination cell and future staffing requirements

The groups and respective universities were assigned as follows:

S.No	Group Members	Universities to be Visited
1.	<ul style="list-style-type: none"> • Dr.P.N.Mandhare, • Dr.R.P.Kate, • Dr.Subhash Deo 	<ul style="list-style-type: none"> • SNDT University, • Bombay Veterinary College Parel, • BATU Lonere
2.	<ul style="list-style-type: none"> • Dr. D.J.Salunkhe • Dr. Dr. R.K.Kamat 	<ul style="list-style-type: none"> • Solapur University • Shivaji University, Kolhapur
3.	<ul style="list-style-type: none"> • Dr. Sameer Narkhede • Dr. Shekhar Rajderkar 	<ul style="list-style-type: none"> • Uttar Maharashtra University, Jalgaon
4.	<ul style="list-style-type: none"> • Dr. R.S.Patil 	<ul style="list-style-type: none"> • Maharashtra Health University, Nashik
5.	<ul style="list-style-type: none"> • Dr. N.S. Kokode • Dr. R.W.Ingle • Nitin Koli 	<ul style="list-style-type: none"> • Sant Gadgebaba University, Amravati • Dr. Panjabrao deshmukh Agriculture University, Akola • Gondwana University, Gadchiroli
6.	<ul style="list-style-type: none"> • Dr. Sampada Joshi • Dr. R.S.Patil 	<ul style="list-style-type: none"> • Mahatma Phule Krishi University, Rahuri
7.	<ul style="list-style-type: none"> • Dr. Dilip Ukey • Dr. Ashok Chavan 	<ul style="list-style-type: none"> • Swani Ramanand Teerth Marathwada University, Nanded • Marathwada Agricultural University, Parbhani
8.	<ul style="list-style-type: none"> • Dr. R.P.Kate 	<ul style="list-style-type: none"> • Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
9.	<ul style="list-style-type: none"> • Dr. S.P.Kane • Dr. A.M.Paturkar 	<ul style="list-style-type: none"> • MAFSU: Maharashtra Animal & Fishery Sciences University, Nagpur

All members were requested to conduct these visits before 30th August so that the reports of these visits could be discussed in Nagpur Meeting.

14. The committee then discussed the IT initiatives implemented by MKCL in various universities. It was decided that the list of services to be provided by MKCL to universities at Rs 50 per

student as per the GR of Govt of Maharashtra should be enumerated. Also MKCL data should be should be made available and integrated to any IT solution provided by third party.

15. The committee also deliberated on issue of increased cost of examination due to usage of ICT. It was decided that innovations ways like following should be recommended to reduce costs:

- a. Clustering of 2-3 adjacent centres and establishing common hardware infrastructure for this cluster shall reduce the hardware costs as against establishing hardware in each college
- b. Select Colleges like Engineering Colleges etc may already have the necessary infrastructure. Therefore, additional hardware may not be needed to be established in these centres
- c. The University may also look at hiring of infrastructure. Select infrastructure like scanners maybe needed only for limited time. Therefore, it may be hired from market for short duration

16. Shri. Rajesh Aggarwal, Chairman, then presented the Group page created for the committee and encouraged the committee members to use it extensively to share, upload and edit files. The URL of the page is:

<https://docs.google.com/folder/d/0B7g7V1LrQGpWRzdFRE11dkxDT2c/edit>

17. The meeting closed with the announcement of next meeting to be hosted at Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur on 30th August. The agenda of the meeting shall include:

- a. Finalization of minutes of Second Meeting of Committee
- b. Each University to present a note on their respective examination system : Merit & Challenges
- c. Sub groups to provide their visit reports
- d. Any other agenda with permission of the chair.

18. The committee then proceeded to study the security system established at examination house in Dr. Baba Saheb Ambedkar University, Aurangabad

3rd MEETING OF COMMITTEE FOR PREVENTION OF LEAKAGE OF EXAMINATION PAPERS

Date: 30th August, 2012

10:30 AM to 5:00 PM

Venue: Mother Teresa Hall, Post Graduate Teaching Department of Education, Nagpur University

Members Present

- Shri.Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman
- Dr. Subhash Deo, Director, Examinations, Mumbai University - Member Secretary
- Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik
- Dr. S.P.Kane, Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University
- Representative of Dr. Dilip Ukey, Pro Vice Chancellor, Swami Ramanand Teerth Marathwada University, Nanded
- Dr.N.S. Kokode, Director, Director, BCUD, Gondwana University, Gadchiroli
- Dr.Sanjay S.Pawar, SNTD Women's University
- Dr.R.P.Kate, Incharge Controller of Examinations, Dr. BATU, Lonere
- Dr Upadhyay, Representative A.M.Paturkar,
- Dr.Sampada Joshi, Controller of Examinations, University of Pune, Pune
- Dr.D.J.Salunkhe, COE, Solapur University, Solapur
- Dr. R.K.Kamat, Shivaji University, Kolhapur
- Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri
- Dr. Sameer Narkhede, Special Officer for Examinations, North Maharashtra University, Jalgaon
- Representative of Dr. Nitin Koli, Head of the Department (IT Section), Sant Gadgebaba University, Amravati

Others present

- Dr. V.S. Sapkal, Vice Chancellor, RTM Nagpur University
- Smt. Aarti Harbhajanka, Consultant , Accenture Services Pvt Ltd.

1. Dr. S.P.Kane welcomed all the committee members for the 3rd Meeting of the Committee for Reforms in Examinations Process in Universities in Maharashtra. He then invited Vice Chancellor, Nagpur University to share his views with the committee members.
2. Dr. V.S. Sapkal, Vice Chancellor, RTM Nagpur University welcomed Shri. Rajesh Aggarwal, Secretary IT, Dr. Subhash Deo, Director, Examinations, Mumbai University and all the members present for the meeting. He appreciated the initiative taken by the Government of Maharashtra

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for prevention of leakage of university examination papers. He mentioned that the academic fraternity is eagerly awaiting the report of this committee.

3. Shri. Rajesh Aggarwal, Secretary IT welcomed all the members of the committee to the third meeting of the Committee. He suggested that
 - I. Universities should strive to adopt plagiarism checker software. This software checks for potential unoriginal content by comparing submitted papers to several databases using a proprietary algorithm. This software scans its own databases, and also has licensing agreements with large academic proprietary databases.
 - II. He emphasized that Universities have autonomy to take decisions in certain areas on their own. Therefore, universities shouldn't wait for directions of State Government for taking action on recommendations of this report wherever applicable. He requested universities to pick up good practices from each other and implement in their own universities.
4. Dr. Subhash Deo, Member Secretary mentioned that in order to implement the recommendations of the committee, certain amendments in the existing Maharashtra Universities Act, 1994 shall be required. Therefore there should be a section on the same in the report.
5. Dr. Subhash Deo, Member Secretary read the minutes of Second Meeting of Committee held in Aurangabad and the committee confirmed the same. He then invited the committee members to present their reports on the visits to the universities.
6. The committee members presented their reports to various universities as follows:
 - I. Dr. Sampada Joshi and Dr. R.S.Patil presented their visit report of Mahatma Phule Krishi University, Rahuri. One of the good practices adopted by Agricultural universities as mentioned by Dr.Joshi is as follows: The syllabus / curriculum across all four state agricultural universities are same. Committee of deans from all four universities revises the curriculum on regular basis. Further, the examination paper is same across all universities.
 - II. Dr. Subhash Deo and Dr. Sanjay Pawar presented their visit report on SNT University. SNT University has territorial jurisdiction throughout the country. They have successfully implemented secure online delivery of question papers across the country since 3 years.
 - III. Dr. D.J.Salunkhe and Dr. Dr. R.K.Kamat presented their visit reports of Solapur University and Shivaji University, Kolhapur. In Shivaji University, double entry system for inputting marks of students has been adopted. This has considerably reduced the chances of data entry errors.

- IV. Dr. R.P.Kate presented the report of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli & BATU Lonere. In BATU Lonere, which is a unitary university, Question Papers are printed on the same day or maximum one day in advance preventing malpractices in examinations. Further they have digitized the mark sheets enabling online verification of the same.
 - V. Representative from Sant Gadge Baba Gadgebaba University, Amravati presented the report of Sant Gadge Baba Gadgebaba University, Amravati
 - VI. Dr. Kane and Dr. Upadhyay, CoE, MAFSU presented the visit report of MAFSU
 - VII. Dr. N.S. Kokode presented the report of Gondwana University, Gadchiroli
 - VIII. Mr. Bhosale, Representative of Dr. Ukey presented the report for Swami Ramanand Teerth Marathwada University, Nanded. He mentioned that in Art, Science & Commerce courses, the University has changed the examination pattern such that in first two years the Semester exams which have weightage of 80% are purely MCQ (Multiple choice questions) and internal exams carrying weightage of 20% are descriptive papers. In the final year, the pattern is reversed such that external papers are descriptive and internals are MCQ based. This has greatly reduced the burden of university for evaluation and revaluation.
7. Dr. Subhash Deo then requested the representatives of Pune University, Aurangabad University and Nagpur University to submit their reports in the specified format by 2nd September 2012. He further requested other members who have not submitted their visit reports in the specified format to do so by 2nd September 2012.
 8. Shri. Rajesh Aggarwal, Secretary IT suggested that the report should contain recommendations on Staff requirements in examinations cells of the universities. There is a need to have technical manpower including system analysts, data entry operators etc in the examinations cells of universities
 9. The committee then broke for lunch.
 10. Post Lunch, Dr Subhash Deo, Member Secretary informed the committee members that the next meeting of the committee shall be held on 6th and 7th September 2012 in Mumbai University, Kalina Campus in Dr. Babasaheb Ambedkar Bhavan Meeting Hall. The meeting shall commence at 10:30 am.
 11. The committee then discussed the costing aspects of the IT solutions. It was confirmed the revenue from examinations through examination fee, reevaluation fee etc is the main source of revenue for universities. Further, except for smaller universities, most of the universities have sufficient surplus amount left from Examinations related revenue to implement the ICT solutions. Dr. Subhash Deo requested all the universities to work on the revenue and costs of their

examinations system and submit the same before 4th September 2012. The cost should include the recurring expenditure including salaries of the staff etc. and capital expenditure.

12. Shri. Rajesh Aggarwal, Secretary IT then suggested adoption of structured approach for finalizing the recommendations of the committee. Under his moderation, the committee in the next couple of hours suggested including the following recommendations in the Final Report:

- I. Every University shall adopt ICT for online student registration and online issuance of hall ticket by March/April 2013. The universities may decide the service providers from among the following options:
 - i. Inhouse Development of Software
 - ii. MKCL's eSuvidha application
 - iii. Selection of service provider through tendering
 - iv. Smaller Universities to approach Larger Universities for assistance / capabilities.

The solutions developed by aforementioned methods should however have the bare minimum requirements / features as decided by the committee

- II. The Committee unanimously decided that Question Bank approach or Question Paper Bank Approach should be followed by Universities for setting universities examination papers. The universities may decide as per their requirements from among the two approaches.
- III. Changes in the Act should be recommended to implement this system in Universities. However, till the changes are made in the act, the universities may utilize the Section 32 (3b) of the Act that allows universities to undertake exercise and experiment in examination reforms. Under this clause, the universities shall on pilot basis conduct atleast one third of the examinations through examination questions / paper bank approach.
- IV. The number of questions in the question bank should be atleast 20-30 times the number of questions required in a questions paper. In case of Question Papers bank, the number of Question papers should also be 20-30 times.
- V. Atleast one third of the questions in Questions bank should be changed every year in courses like medicine, agriculture, technology etc to keep pace with the rapid changes in the respective fields. In subjects like Arts, History etc, atleast 10-15% of Questions in the Questions bank should be changed every year. In case of Question Paper Bank, whenever the curriculum is modified all the questions papers in the Question papers bank should be changed.

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- VI. The committee members were unanimous in some decentralization of assessment of examinations. It was decided that the universities shall conduct examinations only as mentioned below. For rest of the examinations, the college shall internally do the assessment.

S.No	Duration of Course	Assessment by Universities	Assessment by College internally
1.	1 year	1 st Year	-
2.	2 years	2 nd Year	1 st Year
3.	3 years	3 rd Year	1 st & 2 nd years
4.	4 years	3 rd & 4 th Years	1 st & 2 nd years
5.	5 years	4 th & 5 th years	1 st , 2 nd and 3 rd years

- VII. The University shall decide as per their policies and unique circumstances on decentralization of setting of examination papers. First Option is that universities shall set all the questions papers for each semester / exam of the Universities. Second option is that the college shall set their own examination papers. In this option, Some Universities raised concerns citing that Some Private Institutes do not have qualified and high quality staff to set questions paper. As a result of this the academic standard of Question papers set by these institutes may be low, thereby affecting the quality of education. In order to overcome this issue, the committee suggested empanelment of a list of teachers who are qualified for setting the papers. The colleges shall set the papers only through these qualified teachers.
- VIII. The committee also unanimously agreed that online examinations should be explored. Symbiosis has been effectively using online examinations for assessing the students for years. Similarly, Pune University has already started online examinations for 45000 – 60000 first year engineering students. Out of total of 100 marks, 50 marks of all 6 subjects in each semester in first year are conducted online by respective colleges. The committee unanimously decided that all universities shall implement online examinations for internal examinations or a part of external examinations on pilot basis in certain courses / examinations.
- IX. The committee also decided that by March / April 2013, all universities shall use OMR sheets as following:

- i. First section of the OMR Sheet shall be used for capturing basic information of students like Roll No, Name of the student etc which shall be filled by the respective student. This shall eliminate errors in data entry of students' details.
- ii. Second Section of the OMR sheet shall be used for entering marks gained in each question and finally the total marks achieved in the answer sheet by the examiners. The software shall automatically read these OMRs and provide alerts in case of totaling mistakes. This technology shall greatly reduce errors in totaling and malpractices at data entry level shall be eliminated

Further, all universities shall adopt barcode method for masking and identification of answer sheets.

- X. On Pilot basis, each university shall also conduct Digital Scanning and Onscreen evaluation of Answer Sheets in few courses / examinations. In this system, the answer sheets are firstly scanned in secure premises. Following this, the scanned answer sheets are assessed on computers / laptops / Tablets by the appointed examiners at the CAP centre. The Physical Answer sheets shall be destroyed with time as per the rules of the respective universities. However, the digital answer sheets shall be stored for atleast 2 years.

Through this system, the issues related to secure transport of answer sheets, replacement of answer sheets, delay in assessments etc are reduced. Further, the time for reevaluation is greatly reduced as answer sheets are available online and can be reassessed immediately by the respective examiners.

- XI. By March / April 2013, each university shall mandatorily display results online including complete breakup of marks. Each student shall be able to register on website and check his results. Further, a provision for smsing the results to those students who have registered their mobile numbers on the site may also be ensured.
- XII. By March / April 2013, the universities should also enable online application for reevaluation. Students should be able to apply online for re-evaluation of answer sheets and pay the fees online through credit cards / net banking etc or offline through cash.
- XIII. The Universities should also employ necessary security measures like CCTV system, Biometric access control etc in Examination Strong room, Assessment Centres and Data Centre.
- XIV. Technological interventions should not be limited to use of Computing Technologies. Any Technological advancement including tamper evident security tapes that detect any kind of tampering with sealed packages, Digital Locks that transmit signals in case of tampering etc. are examples of usage of technology for reducing malpractices

Page 6 of 8

in examinations. Universities should encourage use of such technological advancements for reduction in malpractices.

- XV. Each University shall digitize the mark sheets and degree certificates of all students post 2000. Industry and other stakeholders should be able to verify the degree of students online. This shall greatly reduce the malpractices associated with issue of fake certificates, tampering of certificates etc.
- XVI. Eventually, the universities should shift to 'demat' degrees and certificates. Each certificate shall carry a unique id in the form of a unique data string and encoded in a bar code. These degree certificates shall also be stored electronically in a repository. Employers will be allowed to verify a particular candidate's degree authenticity on payment of a fee etc.

Government of Maharashtra shall issue standards to be used by university for unique id and barcodes. This shall ensure that no two students from any universities have same unique id. Following this, a common repository for all universities may be established by Government of Maharashtra.

Universities shall switch to 'demat' degrees and certificates within one year from issuance of guidelines from government of Maharashtra.

Employers shall also be able to verify the degrees through mobiles. By texting " MH Verifydegree Degreenumber", the employer should be able to get return sms with existence of degree certificate (Yes/No), University Name, Student Name, Passing Year, total percentage etc.

- XVII. Shri. Rajesh Aggarwal also emphasized that other non-examinations related IT enhancements like wi-fi enabled campus, National Knowledge Network (NKN) - 1 Gbps connectivity, sharing of datacenters, virtual classrooms etc. should also be explored and implemented by Universities.
- XVIII. Shri. Rajesh Aggarwal opined that smaller universities, in order to reduce costs of ICT interventions per student, may collaborate with bigger universities and enter into agreement with service providers jointly. Due to large numbers of students of both the universities combined and economies of the scale, the cost per student of the IT solution shall be reduced in comparison to purchase of IT solution by smaller university on its own.

13. Dr. Subhash Deo the informed the committee members on the actions to be taken by committee members in the following week:

- I. All the Universities should mail the information as per the provided template by 2nd September 2012

- II. All Members should study the preliminary report and provide suggestions on blank sections like Case studies etc
- III. The Universities who have their own Data Centres are requested to provide details on infrastructure set up and operations of the same
- IV. Every University is requested to provide recommendations on innovative reforms in examinations system like open book etc
- V. In page 62 of the report, each university has been suggested to propose future requirements. Along with the future requirements, universities are suggested to provide detail justification for the same
- VI. Each member shall suggest changes in the Maharashtra Universities Act 1994 required for implementation of the recommendations
- VII. Each University shall do provide details of revenues and costs of their current examinations systems and submit the same

All the above should be submitted by committee members by 4th September 2012 or before as specified.

14. The Meeting ended with a vote of thanks to the chair and hosts.

4th MEETING OF COMMITTEE FOR REFORMS IN EXAMINATIONS SYSTEM IN UNIVERSITIES
Date: 6th and 7th September, 2012
Venue: Dr. Babasaheb Ambedkar Bhavan, Mumbai University

Members Present
<ul style="list-style-type: none">• Shri.Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman• Dr. Subhash Deo, Director, Examinations, Mumbai University - Member Secretary• Dr. P.N.Mandhare, CoE, SNTD University• Dr.D.J.Salunkhe, COE, Solapur University, Solapur• Dr. A.M.Paturkar, Associate Dean, Bombay Veterinary College, Parel• Dr. Sameer Narkhede, Special Officer for Examinations, North Maharashtra University, Jalgaon• Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik• Dr. Sampada Joshi, CoE, Pune University• Dr.R.P.Kate, Incharge Controller of Examinations, Dr. BATU, Lonere• Dr. S.P.Kane, Controller of Examinations, Rashtrasant Tukadoji Maharaj Nagpur University• Dr. Nitin Koli, Head , Computer Centre, Sant Gadgebaba University, Amravati• Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri• Dr.N.S. Kokode, Director, Director, BCUD, Gondwana University, Gadchiroli• Dr. Dilip Ukey, Pro-Vice Chancellor, S.R.T. Marathwada University, Nanded
Others present
<ul style="list-style-type: none">• Dr. Rajan Welukar, Vice Chancellor, Mumbai University• Shri. Vikas Rastogi, Secretary to Hon. Governor of Maharashtra• Dr. Naresh Chandra Pro Vice-Chancellor University of Mumbai• Dr. Rupa Shah, Ex-Vice Chancellor, SNTD Women's University , Mumbai• Dr. Ashok Chavan, CoE, Dr.BAMU, Auraganabad• Dr.Sanjay S.Pawar, SNTD Women's University• Dr. S.D.Gorantiwar, HoD, Agricultural Engineering College MPKV, Rahuri• Dr. M.L.Gatre• D.M.Netke, Dy Registrar, Dr.BAMU , Aurangabad• Shri.Vinod P.Patil, Deputy Registrar, Mumbai Univeristy, Mumbai• Smt. Aarti Harbhajanka, Consultant , Accenture Services Pvt Ltd.

6th September 2012

1. Dr. Rajan Welukar, Vice Chancellor, Mumbai University welcomed Shri. Rajesh Aggarwal, Secretary IT and all the members of the committee to the 2-day committee meeting at Mumbai University. He appreciated the work carried out by the committee and suggested the following:
 - Each University should have an examination division / cell and it should be called assessment or evaluation division rather than examination division. The focus of this division should be on assessment of students progress instead of conducting examinations
 - As per Anil Kakodkar Committee & Arun Nigvekar Committee recommendations, the examination or evaluation division/cell should be autonomous.
 - Question Bank should be mandatorily implemented by universities for setting question papers and training should be provided to faculty on question design on basis of Andersen's and bloom's taxonomy. Mumbai University has already initiated this process in Engineering Colleges
 - He cited a good practice followed by YCMOU, wherein each paper of the Answer booklet is barcoded. The Students are provided instructions to answer Part 1 of the question paper in Page 3- 8 of Answer Booklet, Part 2 of the Question Paper in 9 – 12 of the Answer Booklet and so on. Following this, the Pages 3-8 of all answer sheets are separated and sent to one CAP centre, Pages 9-12 of all answer booklets are sent to another CAP centre. The objective of this exercise is to remove bias of Examiners such that the variation in marking due to leniency or strictness of examiners is removed. In this process, a set of answers of all students is evaluated by one CAP centre, another set of answers of all students is evaluated by another CAP centre thereby removing variation in evaluation due to differences in examiners.

2. Shri Rajesh Aggarwal , Secretary IT complimented the views put forward by Dr. Rajan Welukar and emphasized that
 - Training of faculty in development of questions and henceforth the question bank is very important.
 - In case of large Question bank, the Question bank may be made open to students. Further, In case of Institutes with non-reliable internet connectivity, instead of

transmitting the question papers over secure link, the Colleges/institutes may be given a program on a password protected CD to generate the question papers offline from the question bank. This program on the CD shall generate a uniform question paper throughout the colleges. The password of this CD shall be shared only an hour before the examination through sms / mobile etc such that question paper may be generated, printed and distributed on time.

3. Dr. Rupa Shah, Ex-Vice Chancellor, SNDT Women's University, Mumbai also emphasized on training of faculty and non –faculty on various aspects of examinations. She mentioned that training should be provided from setting of question papers to new emerging technologies.
4. Shri. Rajesh Aggarwal, Secretary IT, then suggested that :
 - The Draft Report should be available in English as well as Marathi
 - Both these versions of the draft report should be uploaded online to solicit feedback from different stakeholders especially students.
 - On consensus of the committee, Shri. Rajesh Aggarwal directed his team to prepare a facebook page to upload the report and an email id to receive suggestions and demonstrate the same to the committee members on 7th September,2012.
5. The committee then discussed the following:
 - In Examinations, more emphasis should be given to practical assessment, industry internships / trainings etc. Examinations should be a test of rote memory but should assess the understanding and application of knowledge by the student.
 - Additional marks / extra credits may be given to students to improve their performance by putting in greater efforts in studies and undertaking additional work. Extra marks may be given for publishing of papers in international journals, research , social work etc. The faculty to decide on number of marks to be provided.
 - Non-credit / certificate courses as run by Maharashtra University of Health Sciences ranging from 3 months to 12 months may be encouraged for enhancing the knowledge of students.
 - Every university to have a dedicated examination division, headed by Director of Examinations / Controller of Examinations. Further, coordinator from each faculty to be part of this examination division
6. Following this, the committee commenced development of the draft report on reforms in examinations system in universities. The committee finalized the Introduction section of the

report including: Foreword, Background to the Study, Members of the Committee , Scope of the Study, Methodology of the study , Limitations of the study etc.

7. Shri. Vikas Rastogi, Secretary to Hon. Governor of Maharashtra, joined the committee discussions.
 - He mentioned that over the past few years, huge delays in results processing and publication have been observed across the universities in Maharashtra. In order to overcome this issue, IT is the need of the hour.
 - He appreciated the suggestion of Shri. Rajesh Aggarwal to have plagiarism checkers in University that shall automatically search for unoriginal content in assignments / project reports / thesis of students.
 - He cited a good practice adopted by BATU Lonere, wherein the examiners for Ph.D. students are selected automatically by the software on basis of competencies of the faculty and research topic of the students. Following this, the students submit the Ph.D. thesis online for evaluation.
 - He suggested establishment of student facilitation centers for grievance redressal of students.
 - He appreciated the efforts put in by the committee members and assured complete support in implementing the recommendations of the committee.
8. The session on 6th September ended with vote of thanks to Shri. Vikas Rastogi for his valuable suggestions.
9. The committee members convened on 7th September at 9:30 am. The session started with Shri. Rajesh Aggarwal demonstrating to the committee members the facebook page: www.facebook.com/examscommittee.maharashtra created for soliciting feedback from stakeholders. The committee opined that this is a pioneer effort undertaken wherein all the working documents of the committee including minutes of meetings are updated real time for information of different stakeholders.
10. The committee then resumed the development of report and finalized the following sections of the report:
 - Examinations system in Universities in Maharashtra: Present Scenario
 - Type of Examinations conducted by Universities
 - Overview of Examination Process
 - Comparison of Examinations Process across Universities in Maharashtra

- Issues and Challenges in Examination system in Universities
 - Administrative Challenges
 - Infrastructure Challenges
 - Resource Allocation
 - Security Challenges
 - Other Challenges
- Best Practice Study of ICT initiatives
- Technology Recommendations
 - Overview of the Solution
 - Use of IT in Student Registration for Examinations to Issuance of Hall ticket
 - Question Bank / Question Paper Bank Creation
 - Secure Delivery of Question Papers
 - Other Technologies
 - Use of IT for improving Access, Excellence and Administration
 - Hardware Requirements
 - Security Measures
 - Capacity Building and Handholding Support
 - Non-functional Requirements

11. The Committee then decided to meet on 14th September 2012 at Mumbai University to finalize the draft report on reforms in examination systems in Universities.

- After finalization of report, both English and Marathi version of the report shall be uploaded online for soliciting feedback from different stakeholders for a span of two weeks
- Post this, the committee shall meet on 1st October, 2012, to review the suggestions received and incorporate the same if needed and finalize the report.

5th MEETING OF COMMITTEE FOR REFORMS IN EXAMINATIONS SYSTEM IN UNIVERSITIES

Date: 14th September, 2012

Venue: Dr. Babasaheb Ambedkar Bhavan, Mumbai University

Members Present
<ul style="list-style-type: none">• Shri Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman• Dr. Subhash Deo, CoE, Examinations, Mumbai University - Member Secretary• Dr. P.N. Mandhare, CoE, SNTD University• Dr. D.J. Salunkhe, CoE, Solapur University, Solapur• Dr. A.M. Paturkar, Associate Dean, Bombay Veterinary College, Parel• Dr. Sameer Narkhede, Special Officer for Examinations, North Maharashtra University, Jalgaon• Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik• Dr. Sampada Joshi, CoE, Pune University• Dr. R.P. Kate, Incharge Controller of Examinations, Dr. BATU, Lonere• Dr. Nitin Koli, Head, Computer Centre, Sant Gadgebaba University, Amravati• Dr. R.S. Patil, Dean, Mahatma Phule Agriculture University, Rahuri• Dr. Dilip Ukey, Pro-Vice Chancellor, S.R.T. Marathwada University, Nanded• Dr. Ashok Chavan, Controller of Examinations, BAMU University, Aurangabad
Others present
<ul style="list-style-type: none">• Shri Vinod P. Patil, Deputy Registrar, Mumbai University, Mumbai• Smt. Aarti Harbhajanka, Consultant, Accenture Services Pvt Ltd.

14th September 2012

1. Dr. Subhash Deo, Director, Examinations, Mumbai University welcomed Shri Rajesh Aggarwal, Secretary IT and all the members of the committee to the 1-day committee meeting at Mumbai University. He appreciated the work carried out by the committee till past four meetings. The committee discussed and deliberated on each recommendation in depth point by point and finalized the draft report.
2. Committee also agreed to discuss the comments and inputs received on email and the facebook page for the span of two weeks, which shall open for general feedback from public, students, professor community. The committee shall meet on 30th September, 2012, to review the suggestions received and incorporate the same if needed and finalize the report.

3. The Committee then decided to meet on 30th September 2012 at Mahatma Phule Krishi Vidyapeeth, Rahuri to finalize the draft report on reforms in examination systems in Universities.
 - After finalization of report, both English (Detailed Report) and Marathi (Summary Report) versions of the report shall be uploaded online.

6th MEETING OF COMMITTEE FOR REFORMS IN EXAMINATIONS SYSTEM IN UNIVERSITIES
Date: 30th September and 1st October, 2012
Venue: Mahatma Phule Agriculture University, Rahuri

Members Present

- Shri Rajesh Aggarwal, Secretary IT, Govt. of Maharashtra - Chairman
- Dr. P.N.Mandhare, CoE, SNDT University
- Dr.D.J.Sahunkhe, CoE, Solapur University, Solapur
- Dr. Sameer Narkhed'e, Special Officer for Examinations, North Maharashtra University, Jalgaon
- Dr. Shekhar Rajderkar, Pro. Vice Chancellor, Maharashtra Health University, Nashik
- Dr. Sampada Joshi, CoE, Pune University
- Dr. Nitin Koli, Head , Computer Centre, Sant Gadgebaba University, Amravati
- Dr. Dilip Ukey, Pro-Vice Chancellor, S.R.T. Marathwada University, Nanded
- Dr. R.W. Ingle, Deputy Registrar, Dr. Punjabrao deshmukh Agricultural Univeristy, Akola
- Dr. Ashok Chavan, CoE, Dr.BAMU, Auraganabad
- Shri S R Tripathi, Technical Officer, Sant Gadge Baba University, Amravati
- D.M.Netke, Dy Registrar, Dr.BAMU , Aurangabad
- Dr. Bushan, MAFSU, Maharashtra Animal and Fishery Sciences University, Nagpur
- Dr A.P. Gawande, Technical Officer, MAFSU, Maharashtra Animal and Fishery Sciences University, Nagpur
- Dr. S.V. Upadhye, CoE, Dr. BAMU, Aurangabad
- Shri Lokesh Bohra, Senior Consultant, Accenture Services Pvt Ltd

30th September 2012

1. Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri welcomed Shri Rajesh Aggarwal, Secretary IT and all the members of the committee to the 2-day committee meeting at Rahuri Agricultural University. He appreciated the work carried out by the committee so far.
2. Committee discussed, the email feedback and the facebook suggestion recieved. The draft report had already accounted for the suggestions received and the committee noted the same. Three new recommendations were added as part of the final report.
3. The meeting concluded with finalizing the of the report with three new recommendations. The committee agreed to finalize this report as the final version and can be published after

Page 1 of 2

making minor corrections. After the finalization, report shall be mailed to the committee members.

4. The meeting ended with vote of thanks from Dr. R.S.Patil, Dean, Mahatma Phule Agriculture University, Rahuri.

Annexure C: Sample of University Questionnaires filled by Committee Members

The Committee members visited all state universities in Maharashtra and captured data about the examinations process of the university in a standard template. One of the filled templates is shown below:

UNIVERSITY OF MUMBAI



Date: 28/8/2012

A committee has been constituted vide GR No: Misc – 2012 / Pra. Ka. 200 / 12 / Vishi-3 dated 20th July 2012 (copy of the GR enclosed herewith) for providing recommendations on implementation of end-to-end system for secure delivery of examination papers through ICT in Universities in Maharashtra. The committee has created sub-groups for visiting all universities in Maharashtra & Studying their examinations process. The sub groups are requested to capture information as per following template:

Name of the University	University of Mumbai
Name of Committee Members	Dr. Subhash A. Deo

1) Key Characteristics of University Examination Process

S. No	Parameter	Characteristic of University
1.	Territorial Jurisdiction of University	Mumbai, Sub-Urban, Navi- Mumbai, Thane, Raigad, Ratanagiri, Sindhudurg,
2.	Number of Affiliated Colleges	664
3.	Number of Students studying under the university (including university campus & affiliated colleges in all years (I, II, III & IV)	650000
4.	Frequency of University Examinations (University Conducts Examinations every semester / only final semester/ only final 2 semesters etc.)	Only Final 2 Semesters
5.	Weightage of University Examinations: Internal Examinations.	Internal 40, External 60, some exam external 100
6.	Examinations Fees	Rs. 600/-
7.	Existence of Dedicated Examination Cell in the University (Yes / No)	No
8.	Pattern of University Examinations (How many marks of MCQ, Short Answers, Long Answers etc)	Long Answers
9.	Paper Setting is done at : University Campus / Institutes etc	University Campus
10.	Location of Printing of Questions Papers (In Campus / Outside Printing Press etc)	University Press in Campus
11.	Dispatch of Questions Papers is through: university permanent staff / temporary staff/ any other agency appointed by the university	University One Permanent Staff / One Temporary Staff
12.	At the examination centre, the exam papers	Yes : Principal of the Institute / College

	are in custody of: (Principal of the institute / Treasury Office / Postal Department etc)	
13.	Sealed packets are opened in presence of:	Chief Conductor, Joint Chief Conductor, Sr. Supervisor and two student
14.	Any other characteristic of university which is unique to the university.	

2) Enumeration of Key Process Steps & Issues faced in University Examination Process

S. No	Key Process Steps	Key Issues / Challenges faced
Pre Examination Phase		
1	Collection of Teachers Information	Colleges are not sending proper information
2	Appointment of Chairman Paper Setter by 32 (5) Committee	
3	Collection of Exam Forms	
4	Preparation of Hall Tickets and Other Reports	
5	Question Paper Setting	
6	Printing of Question Paper	
7	Distribution of Question Papers to centers	Transport problem
During Examination Phase		
1	Seating Arrangement at Centers	
2	Central Assessment Programme for Assessment of Answer Books	
3		
Post Examination Phase		
1	Data Entry of Internal /Practical /Oral Marks	
2	Exemption Subject Information Entry	
3	Absent Number Entry	
4	Scanning of OMR Sheets of Bar Code Answer Books	Students/teachers are not filling proper information
5	Preparation of Result	
6	Declaration of Result	
7	Printing of Various reports and Marksheet	
8	Convocation – Distribution of Degree Certificate through Colleges	

Remarks if any:

3) Enumeration of Current Staffing & Future Requirement of Examination Cells at University (If applicable).

S. No	Designation	No. of Permanent Staff		No. of Temporary Staff	Future Requirement
		Sanctioned	Filled		
1.	Controller of Examinations / Director	1	1		
2.	Deputy Registrar	4	3		
3.	A.R., Superintendent and Clerks	130	75	200	200
4.	Peons	100	45	100	150

4) Details of IT Initiative implemented by University in Examinations Process

IT Initiative: 1

Name of the Initiative	On line Enrollment System
Implemented in Year	2009
S/w Developed by	MKCL, Pune
Details of Initiative	Colleges are connected to University through digital university portal colleges are filling online information of admitted student
Benefits of Initiative	All Enrollment form comes to University along with soft copy and enrollment processes start immediately and all communications to the colleges regarding eligibility and enrollment through digital University portal

IT Initiative: 2

Name of the Initiative	On line Question Paper distribution
Implemented in Year	May, 2012
S/w Developed by	
Details of Initiative	Question papers are sent to centers through web link with password protected and encrypted system before one hour of examinations
Benefits of Initiative	Security, confidentiality and transferencey maintained

5) Details of IT Initiative implemented by University , other than in Examination Cell

IT Initiative: 1

Name of the Initiative	Document Management System
Implemented in Year	2011
S/w Developed by	University Department of Continues Learning
Details of Initiative	All documents / folder movement trac system
Benefits of Initiative	status of documents are easily available

IT Initiative: 2

Name of the Initiative	
Implemented in Year	
S/w Developed by	
Details of Initiative	
Benefits of Initiative	

Annexure D: Development of 'Blue Prints' of a Question Paper: Importance and Methodology

Power point presentation by Dr. Rajan Welukar, Vice Chancellor, Mumbai University:



Development of 'Blue Prints' of a Question Paper: Importance and Methodology



The Student Evaluation Scenario

- Three major inter-related processes in Education: Teaching, Learning & Evaluation.
- Evaluation: Weakest link, showing greatest resistance to long-term reform.
- Society gives great importance to outcome of student evaluation: Marks / Grades



The reality about student evaluation

- Lack of availability of experts as paper-setters, examiners, moderators, etc.
- Unscientific Tools of Assessment
- 'Examiner reliability' is an issue
- Delays/ Errors in examination results
- Lack of correct and timely feedback to students

3



Some research evidence

Harper's research findings in India (1976)

Fifty Re-examined

10 Geometry teachers re-marked 50 answer books after
6 months

Findings

1st Assessment

8- First Class

2nd Assessment

1 – Distinction

4 – First Class

1- Second Class

2 -Third Class

Some research evidence

Fifty Re-examined.....

1st Assessment

- 2 – First Class
- 1- Second Class
- 4 – Pass Class
- 3 – Failed

2nd Assessment

- 10 – Third Class

Harper's Studies: Ninety marking Ten


10 History answerscripts photocopied and sent to 90 experienced examiners:

- Only 1 passed by all
- Only 1 failed by all
- 8 out of 10 passed by some; failed by others
- 1 answerscript given a distinction by 1 examiner, first class by 8 examiners and failed by 7.



Question Bank Development:


A major Exam Reform measure



Purpose of Question Banks

- Attain uniformity of standards in question papers.
- Generate a sense of participation in the teaching community.
- Introduce greater ease and speed in setting well-designed question papers
- Reduce dependence on few individuals and their availability.
- Create possibilities for multiple, equivalent sets of question papers

8

- 
- Remove inadequacies in question papers:
 - Ambiguity in Qs.
 - Unclear scope / depth of expected answers
 - Redundancy and Triviality
 - Poor and disproportionate content coverage
 - Over-emphasis on memorisation.

9



Question Bank : Concept

A scientific 'Question Bank' is a systematic collection of a large number of well-characterised and carefully edited questions of various types, testing different cognitive abilities and covering a specified content area.

Scientific Development of Question Banks: Major Steps

1	2	3	4	5
Evaluation Specifications	Preparatory Work	Pre-validation and Review	Test Constr.	Post Validation
Blue-print of Question paper	- Identification of personnel - Organising Item-writing Workshops	Editing of QBs	Using QBs for paper-setting	Test and Item Analysis

Developing 'blue-prints' of Ques. papers

A 'blue-print of a question paper is essentially a detailed structured 'plan' or a Table of Specifications for a given question paper.

'Blue-prints' may be considered from 3 points of view –

- **Format :** No. of Qs, marks per question, maximum marks, total time, type of Qs, etc.
- **Content:** Weightages assigned to each topic/ subtopic in the syllabus.
- **Ability :** Weightages assigned to different educational objectives

13

Assessment Scheme: Illustrative example

Sub. Code	Subject Name	Examination Scheme							Total
		Theory (out of 75)				Term Work	Pract.	Oral	
		Internal Assessment (out of 15)			End sem. exam (out of 60)				
		Test 1	Test 2	Average of Test 1 and Test 2					
FEC103	Applied Chemistry - I	15	15	15	60	25	-	-	100

14

Formatwise Blueprint: Applied Mathematics-I (FEC101)

- Total No. of Questions in Question paper : 6
- Marks per Question: 20
- Qs to be solved: 4
- Question No.1 : Compulsory and based on entire syllabus with sub questions of 2 to 3 marks.
- Remaining questions to be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each Module.

15

Contentwise 'Blue- print': Specimen

Progr. Name & Code
Course Name & Code
Max. marks : 100

Time: 3 hrs.

Topic No.	Sub-topic / Unit No.	Sub-topic/ Unit Title	Unitwise marks	Topicwise total marks
01	1.1	abc	15	40
	1.2	def	10	
	1.3	ghi	15	
02	2.1	jkl	10	30
	2.2	mno	10	
	2.3	pqr	10	
03	3.1	stu	10	30
	3.2	vw	10	
	3.3	xyz	10	
Grand Total			100	100

Illustrative example: Applied Maths – I (FEC101)

Topic No.	Unit No.	Unit Title	Unitwise marks	Topicwise marks
01	1.1	Complex Nos. – Powers & Roots	04	20
	1.2	Complex Nos. – Circular Functions	08	
	1.3	Separation of real & imaginary parts	04	
	1.4	Expansion of sine and cosine, etc	04	
02	2.1	Types of Matrices	12	20
	2.2	Matrices – Linear algebraic equations	08	
03	3.1	Successive Differentiation	06	20
	3.2	Partial Differentiation	10	
	3.3	Euler's Theorem	04	
04	4.1	Partial Differentiation:Maxima & Minima	06	20
	4.2	Taylor's Theorem	08	
	4.3	Partial Differentiation:Fitting of Curves	06	
	Total		80	80

Illustrative example: Applied Maths – I (FEC101)

Topic No.	Unit No.	Wtge.	Q1 (Comp)	Q2 (Op)	Q3 (Op)	Q4 (Op)	Q5 (Op)	Q6 (Op)
01	1.1	04	04	-	-	-	-	-
	1.2	08	-	03	03	03	03	03
	1.3	04	02	-	-	-	-	-
	1.4	04	04	-	-	-	-	-
02	2.1	12	03	03	03	03	03	03
	2.2	08	02	02	02	02	02	02
03	3.1	06	-	02	02	02	02	02
	3.2	10	03	02	02	02	02	02
	3.3	04	-	02	02	02	02	02
04	4.1	06	-	02	02	02	02	02
	4.2	08	02	02	02	02	02	02
	4.3	06	-	02	02	02	02	02
	Total	80	20	20	20	20	20	20

Names of experts with signatures

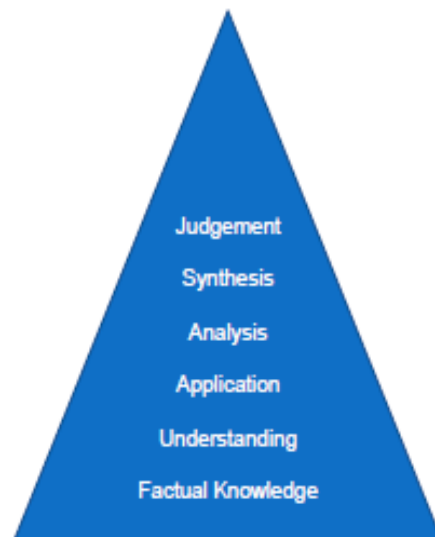
Abilitywise Blueprint

Abilities / Educational Objectives correspond to 3 domains:

1. Cognitive domain ---Ability to use the mind
2. Affective domain --- Dealing with Emotions, Attitudes and Beliefs
3. Psychomotor domain--- Dealing with actions of the body

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Cognitive Domain: Bloom's Taxonomy



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Abilitywise 'Blue-print': An Example

Programme Name & Code:

Year:

Course Name & Code:

Topic	Knowledge	Comprehension	Application	Higher Abilities	Total
01	10	02	02	01	15
02	15	05	--	--	20
03	05	03	12	--	20
04	10	10	02	03	25
05	05	10	04	01	20
Total	45	30	20	05	100

Names of Experts with signatures

Illustrative example: Applied Maths – I (FEC101)

Topic	Knowledge	Comprehension	Application	Higher Abilities	Total
01	12	04	04	--	20
02	15	05	--	--	20
03	10	04	04	02	20
04	03	12	02	03	20
Total	40	25	10	05	80




The Way Ahead: Phase I

Steps:

1. Examine your syllabus and its units/sub-topics.
2. Study the Question paper format given by the University.
3. Decide on weightages to be given to the topics and sub-topics.
4. Finalise the objectivewise weightages.
5. Prepare Question papers in adherence with these Blueprints.
[Minimum: 3 Sets per College for Compulsory courses]
6. Submit to the University official each set in Soft Copy format (Word file as well as .pdf file) with the appropriate course code appearing as the File name, followed by the QPSet No. and the respective College Code (e.g. FEC101_QP1_College Code) approx. 3 mths. before the exam.

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- 
7. Likewise, submit separately the Model Answers to each Question in the Q paper, along with the Marking Scheme and the Estimated Difficulty level and Estimated Answering Time, again in Soft Copy format (Only the letters 'QP' to be substituted by 'MA'.)
 8. A panel of 10 senior and experienced faculty to 'edit' each submitted question paper for content and language. (Activity to be organised centrally by the university)
 9. All the above activities to be completed latest 1 month before the next examination
 10. Gradually, move towards Phase II: Question Banking and Computerised generation of Question papers

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Item-sheet for Question Banking : Front view

महाराष्ट्र विश्वविद्यालय (A question item for Question Bank)

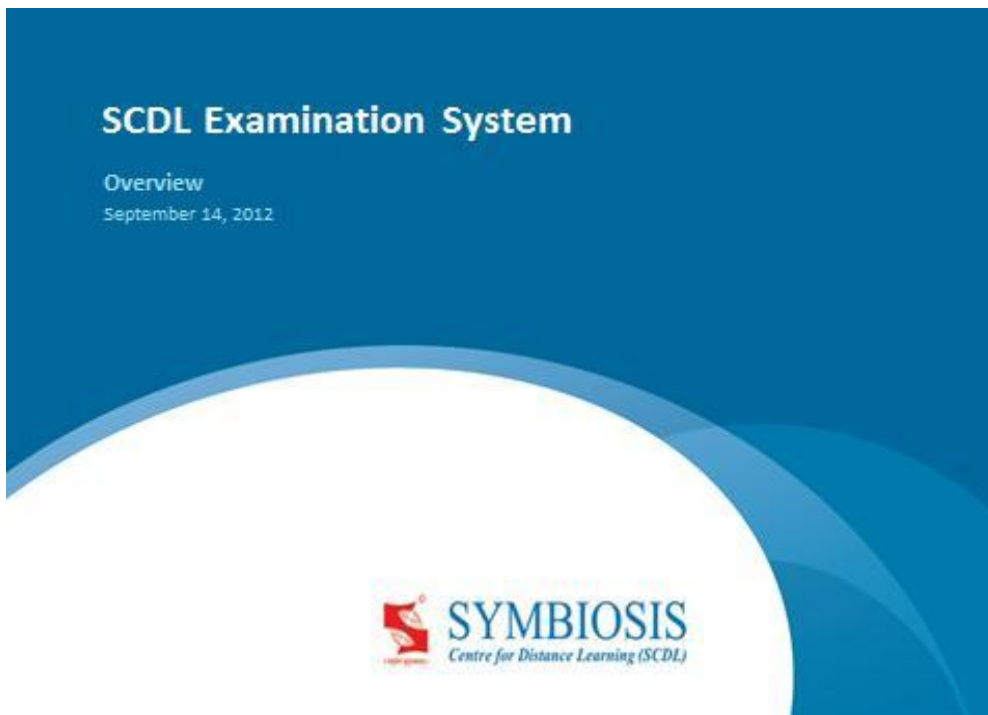
Question Number		Date		Page No. / Total	
Subject		Semester		Page No. / Total	
Author's Name					
Category	Code	Q. No.	Q. Type	Difficulty Level	Expected Answer
MCQ	MCQ	1	MCQ	Easy	10
MCQ	MCQ	2	MCQ	Medium	10
MCQ	MCQ	3	MCQ	Hard	10
MCQ	MCQ	4	MCQ	Very Hard	10
MCQ	MCQ	5	MCQ	Very Hard	10
MCQ	MCQ	6	MCQ	Very Hard	10
MCQ	MCQ	7	MCQ	Very Hard	10
MCQ	MCQ	8	MCQ	Very Hard	10
MCQ	MCQ	9	MCQ	Very Hard	10
MCQ	MCQ	10	MCQ	Very Hard	10
MCQ	MCQ	11	MCQ	Very Hard	10
MCQ	MCQ	12	MCQ	Very Hard	10
MCQ	MCQ	13	MCQ	Very Hard	10
MCQ	MCQ	14	MCQ	Very Hard	10
MCQ	MCQ	15	MCQ	Very Hard	10
MCQ	MCQ	16	MCQ	Very Hard	10
MCQ	MCQ	17	MCQ	Very Hard	10
MCQ	MCQ	18	MCQ	Very Hard	10
MCQ	MCQ	19	MCQ	Very Hard	10
MCQ	MCQ	20	MCQ	Very Hard	10
MCQ	MCQ	21	MCQ	Very Hard	10
MCQ	MCQ	22	MCQ	Very Hard	10
MCQ	MCQ	23	MCQ	Very Hard	10
MCQ	MCQ	24	MCQ	Very Hard	10
MCQ	MCQ	25	MCQ	Very Hard	10
MCQ	MCQ	26	MCQ	Very Hard	10
MCQ	MCQ	27	MCQ	Very Hard	10
MCQ	MCQ	28	MCQ	Very Hard	10
MCQ	MCQ	29	MCQ	Very Hard	10
MCQ	MCQ	30	MCQ	Very Hard	10
MCQ	MCQ	31	MCQ	Very Hard	10
MCQ	MCQ	32	MCQ	Very Hard	10
MCQ	MCQ	33	MCQ	Very Hard	10
MCQ	MCQ	34	MCQ	Very Hard	10
MCQ	MCQ	35	MCQ	Very Hard	10
MCQ	MCQ	36	MCQ	Very Hard	10
MCQ	MCQ	37	MCQ	Very Hard	10
MCQ	MCQ	38	MCQ	Very Hard	10
MCQ	MCQ	39	MCQ	Very Hard	10
MCQ	MCQ	40	MCQ	Very Hard	10
MCQ	MCQ	41	MCQ	Very Hard	10
MCQ	MCQ	42	MCQ	Very Hard	10
MCQ	MCQ	43	MCQ	Very Hard	10
MCQ	MCQ	44	MCQ	Very Hard	10
MCQ	MCQ	45	MCQ	Very Hard	10
MCQ	MCQ	46	MCQ	Very Hard	10
MCQ	MCQ	47	MCQ	Very Hard	10
MCQ	MCQ	48	MCQ	Very Hard	10
MCQ	MCQ	49	MCQ	Very Hard	10
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MCQ	MCQ	51	MCQ	Very Hard	10
MCQ	MCQ	52	MCQ	Very Hard	10
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MCQ	MCQ	54	MCQ	Very Hard	10
MCQ	MCQ	55	MCQ	Very Hard	10
MCQ	MCQ	56	MCQ	Very Hard	10
MCQ	MCQ	57	MCQ	Very Hard	10
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MCQ	MCQ	66	MCQ	Very Hard	10
MCQ	MCQ	67	MCQ	Very Hard	10
MCQ	MCQ	68	MCQ	Very Hard	10
MCQ	MCQ	69	MCQ	Very Hard	10
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MCQ	MCQ	73	MCQ	Very Hard	10
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MCQ	MCQ	77	MCQ	Very Hard	10
MCQ	MCQ	78	MCQ	Very Hard	10
MCQ	MCQ	79	MCQ	Very Hard	10
MCQ	MCQ	80	MCQ	Very Hard	10
MCQ	MCQ	81	MCQ	Very Hard	10
MCQ	MCQ	82	MCQ	Very Hard	10
MCQ	MCQ	83	MCQ	Very Hard	10
MCQ	MCQ	84	MCQ	Very Hard	10
MCQ	MCQ	85	MCQ	Very Hard	10
MCQ	MCQ	86	MCQ	Very Hard	10
MCQ	MCQ	87	MCQ	Very Hard	10
MCQ	MCQ	88	MCQ	Very Hard	10
MCQ	MCQ	89	MCQ	Very Hard	10
MCQ	MCQ	90	MCQ	Very Hard	10
MCQ	MCQ	91	MCQ	Very Hard	10
MCQ	MCQ	92	MCQ	Very Hard	10
MCQ	MCQ	93	MCQ	Very Hard	10
MCQ	MCQ	94	MCQ	Very Hard	10
MCQ	MCQ	95	MCQ	Very Hard	10
MCQ	MCQ	96	MCQ	Very Hard	10
MCQ	MCQ	97	MCQ	Very Hard	10
MCQ	MCQ	98	MCQ	Very Hard	10
MCQ	MCQ	99	MCQ	Very Hard	10
MCQ	MCQ	100	MCQ	Very Hard	10

Item-sheet for Question Banking : Reverse side

(i) Type of Question	Expected Answer
(1) MCQ (Multiple Choice)	_____
(2) MCQ (Multiple Choice)	_____
(3) MCQ (Multiple Choice)	_____
(4) MCQ (Multiple Choice)	_____
(5) MCQ (Multiple Choice)	_____
(6) MCQ (Multiple Choice)	_____
(7) MCQ (Multiple Choice)	_____
(8) MCQ (Multiple Choice)	_____
(9) MCQ (Multiple Choice)	_____
(10) MCQ (Multiple Choice)	_____
(11) MCQ (Multiple Choice)	_____
(12) MCQ (Multiple Choice)	_____
(13) MCQ (Multiple Choice)	_____
(14) MCQ (Multiple Choice)	_____
(15) MCQ (Multiple Choice)	_____
(16) MCQ (Multiple Choice)	_____
(17) MCQ (Multiple Choice)	_____
(18) MCQ (Multiple Choice)	_____
(19) MCQ (Multiple Choice)	_____
(20) MCQ (Multiple Choice)	_____
(21) MCQ (Multiple Choice)	_____
(22) MCQ (Multiple Choice)	_____
(23) MCQ (Multiple Choice)	_____
(24) MCQ (Multiple Choice)	_____
(25) MCQ (Multiple Choice)	_____
(26) MCQ (Multiple Choice)	_____
(27) MCQ (Multiple Choice)	_____
(28) MCQ (Multiple Choice)	_____
(29) MCQ (Multiple Choice)	_____
(30) MCQ (Multiple Choice)	_____
(31) MCQ (Multiple Choice)	_____
(32) MCQ (Multiple Choice)	_____
(33) MCQ (Multiple Choice)	_____
(34) MCQ (Multiple Choice)	_____
(35) MCQ (Multiple Choice)	_____
(36) MCQ (Multiple Choice)	_____
(37) MCQ (Multiple Choice)	_____
(38) MCQ (Multiple Choice)	_____
(39) MCQ (Multiple Choice)	_____
(40) MCQ (Multiple Choice)	_____
(41) MCQ (Multiple Choice)	_____
(42) MCQ (Multiple Choice)	_____
(43) MCQ (Multiple Choice)	_____
(44) MCQ (Multiple Choice)	_____
(45) MCQ (Multiple Choice)	_____
(46) MCQ (Multiple Choice)	_____
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(49) MCQ (Multiple Choice)	_____
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(51) MCQ (Multiple Choice)	_____
(52) MCQ (Multiple Choice)	_____
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(63) MCQ (Multiple Choice)	_____
(64) MCQ (Multiple Choice)	_____
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(67) MCQ (Multiple Choice)	_____
(68) MCQ (Multiple Choice)	_____
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(76) MCQ (Multiple Choice)	_____
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(85) MCQ (Multiple Choice)	_____
(86) MCQ (Multiple Choice)	_____
(87) MCQ (Multiple Choice)	_____
(88) MCQ (Multiple Choice)	_____
(89) MCQ (Multiple Choice)	_____
(90) MCQ (Multiple Choice)	_____
(91) MCQ (Multiple Choice)	_____
(92) MCQ (Multiple Choice)	_____
(93) MCQ (Multiple Choice)	_____
(94) MCQ (Multiple Choice)	_____
(95) MCQ (Multiple Choice)	_____
(96) MCQ (Multiple Choice)	_____
(97) MCQ (Multiple Choice)	_____
(98) MCQ (Multiple Choice)	_____
(99) MCQ (Multiple Choice)	_____
(100) MCQ (Multiple Choice)	_____

Annexure E: Online Assessment System

Demonstration on Examination System given by Symbiosis Centre for Distance Learning (SCDL) on 14th September 2012 at Mumbai University.



Agenda



System Overview

Exam Questions Management

Exam Booking

Exam Delivery

Results Management

Key Challenges

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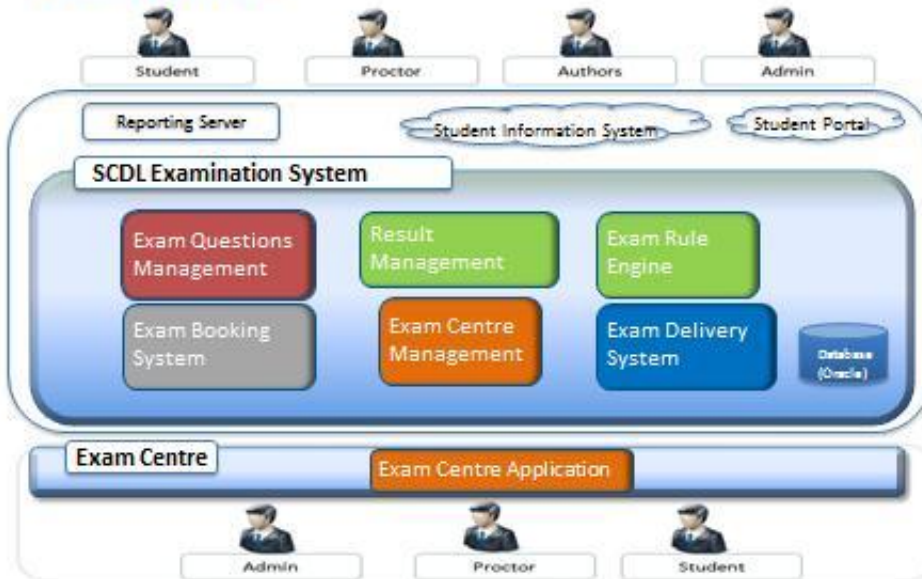
Symbiosis Centre For Distance Learning (SCDL)

- Symbiosis Centre for Distance Learning (SCDL) is India's premier distance learning institute offering distance learning programs since 1994.
- SCDL runs post graduate programs and has 200,000+ active students from all states of India and over 40 different countries.
- To effectively conduct large volumes of examinations every year, SCDL developed a Computerized Examination System (ICT based) in 2004 to conduct all examinations and pre & post examination processes.
- Today, SCDL offers complete flexibility and convenience to students through on demand computerized examination system which is tamper proof and highly accurate.
- SCDL successfully conducts over 60,000 examinations each month and approx 8 lacs examination each year.

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SYSTEM OVERVIEW

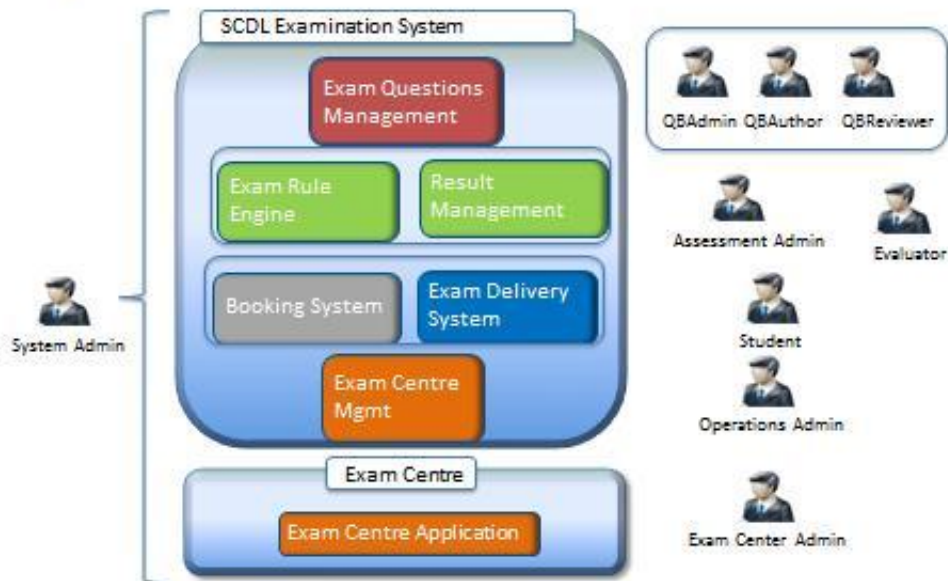
System Overview



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System Overview



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System Overview

- Examination Paper Management System
 - Question paper management and question bank generation
 - Rules and pattern setting for question papers
- Exam Delivery System
 - Unique question paper for each student
 - Online, Semi-online and offline (paper based) mode for exam
- Exam Booking and Hall Ticket
 - Exam centre booking
 - Hall ticket generation
- Result Processing and publication
 - Automatic result processing with facility for moderation
 - Mark sheet and certificate printing
- MIS and Reporting System
 - Comprehensive MIS Reporting available at click of button
 - Various Alerts for monitoring the system

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Exam Questions Management

Question Types



- ? Subjective
- ? Comprehension
- ? File Upload
- ? Fill in the blanks
- ? True or False
- ? Multiple Choice Single Select
- ? Multiple Choice Multiple Select
- ? Match the following

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Create Question Bank

SYMBIOSIS
Centre For Distance Learning

You are logged in as ashutosh.adhan Profile | Logout

Subjects | Programs | Questions | Assessments | Test Centers | Bookings | Result Processing | Users | Synchronization | Reports

Questions | Manage Question Type | Copy Question Bank | **Create Question Bank**

Year: 2012
Program: C-PDCBA
Subject: Sales and Distribution Management
Chapter: IAD

Search Add Import/Export Legacy Import

Advanced Search >>

Delete Accept Accept All Modify Modify All Ready for review All Ready for review


Create QB Version

ID	Question	Type	Level	Expiry Date	Status	
45741	One of the obje...	MCSR - Marks 2	Diffcult	18 July 2112	Reviewed	View Details Preview History
45775	Recruitment and ...	TF - Marks 2	Medium	18 July 2112	Reviewed	View Details Preview History
45774	Principles of s...	MCQR - Marks 2	Medium	18 July 2112	Reviewed	View Details Preview History

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Publish Question Bank


lib
You are logged in as Bolle | Logout

[Subjects](#) | [Programs](#) | [Questions](#) | [Assessments](#) | [Test Centers](#) | [Bookings](#) | [Result Processing](#) | [Users](#) | [Synchronization](#) | [Reports](#)

Publish Question Bank

[Manage Question Type](#) | [Questions](#) | [Copy Question Bank](#)

Year:

Program:

Subject:

Version	System name	Questions Count	Published Date	Status
1	QB_114_16-Jul-2012 (04:22 AM)	1606	16-Jul-2012	Currently Published


One item found
1

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Sample Question Paper auto-generated by System

SCDL



Program Name:	PGDIT_2012
Subject:	Web Technologies
Weightage:	50
Total Marks:	30
Duration:	120 mins

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Mobile phones and computers of any kind should not be used inside the examination hall.
4. Use of any unfair means will result in severe disciplinary action.

1) The file you are linking can be saved into the any folder. (1)

1) True
2) False

2) When aligned middle, it means (1)

1) the text is aligned vertical middle.
2) the text is aligned horizontal middle.
3) the images aligned vertical middle.
4) the images is aligned horizontal middle.

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Exam Booking

Student – Book Exam Slot

Semester:	1																									
Assessment:	PPM Exam 2012																									
Assessment Date:	12-Sep-2012 (Asia/Calcutta)																									
Test center:	NCTestcenter- Pune, Maharashtra, India																									
Address:	SCDL																									
Time Slots:	<p>Select the first time slot to start the assessment! Subsequent slots will be reserved automatically for the required duration.</p> <table border="1"><thead><tr><th></th><th>Start Date</th><th>Time</th><th>Booked seats</th><th>Available seats</th></tr></thead><tbody><tr><td><input type="radio"/></td><td>2012-09-12</td><td>10:00 Hrs To 11:00 Hrs</td><td>0</td><td>8</td></tr><tr><td><input type="radio"/></td><td>2012-09-12</td><td>11:00 Hrs To 12:00 Hrs</td><td>0</td><td>8</td></tr><tr><td><input type="radio"/></td><td>2012-09-12</td><td>12:00 Hrs To 13:00 Hrs</td><td>0</td><td>8</td></tr><tr><td><input type="radio"/></td><td>2012-09-12</td><td>13:00 Hrs To 14:00 Hrs</td><td>0</td><td>8</td></tr></tbody></table>		Start Date	Time	Booked seats	Available seats	<input type="radio"/>	2012-09-12	10:00 Hrs To 11:00 Hrs	0	8	<input type="radio"/>	2012-09-12	11:00 Hrs To 12:00 Hrs	0	8	<input type="radio"/>	2012-09-12	12:00 Hrs To 13:00 Hrs	0	8	<input type="radio"/>	2012-09-12	13:00 Hrs To 14:00 Hrs	0	8
	Start Date	Time	Booked seats	Available seats																						
<input type="radio"/>	2012-09-12	10:00 Hrs To 11:00 Hrs	0	8																						
<input type="radio"/>	2012-09-12	11:00 Hrs To 12:00 Hrs	0	8																						
<input type="radio"/>	2012-09-12	12:00 Hrs To 13:00 Hrs	0	8																						
<input type="radio"/>	2012-09-12	13:00 Hrs To 14:00 Hrs	0	8																						

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Student – Hall Ticket



2011 - PGDRA
HALL TICKET FOR BUSINESS COMMUNICATION

Candidate Id		
Candidate Name		
Subject	Business Communication	
Assessment	Exam III, 2011	
Exam Date	26-Aug-2011	
Exam Start time	9:00 AM - 11:30 AM	
Duration	02:30 Hrs.	
Exam Test Centre	SC, Pune	
Exam Centre Address	SC, SC,	
Exam Centre City	Pune	
Exam Centre State	Maharashtra	
Exam Centre Phone	9999999999	

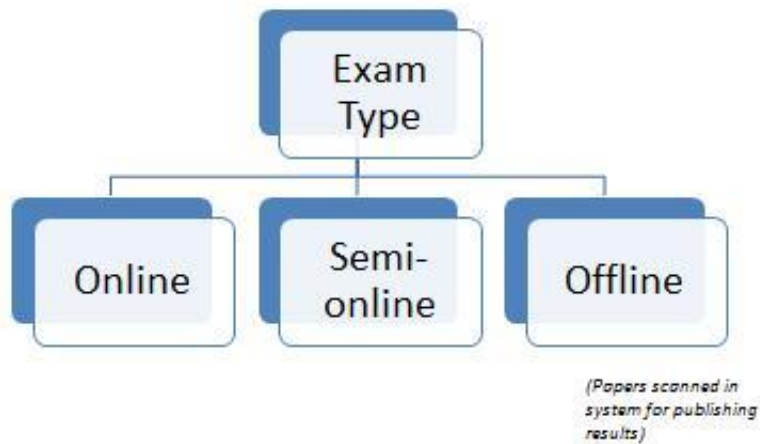
Restrictions:
*If you are requested to report the exam center 1/2 hour before the exam starts. Your Candidate will not be allowed to enter the exam. Showing College Photo ID Card and the Hall ticket.
 If College ID Card is not available, then bring your driving license. Please print your Photo ID Card for the verification purpose.
 The Exam Administrator reserves the right to disallow the candidate from taking the exam in absence of required documents.*

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Exam Delivery

Student – Exams can be given in many ways



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Exam Delivery at Exam Centre




- Question paper generation in System
- Unique question paper generation per Student
- Sync up to all Exam Centres
- Exam rendering of unique designated question paper to Student
- Score display at end of paper
- Sync up of answer papers to SCDL system

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Exam - Login Page



Proctored Exam	<input checked="" type="radio"/> Yes <input type="radio"/> No
Student Registration ID	<input type="text"/>
Activation Key	<input type="text"/>
Proctor Password	<input type="text"/>

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Exam - Info Page



You are Logged in as
Last login : 13-Sep-2012 10:27:57 AM

Symbiosis Centre for Distance Learning welcomes you.

Registration Number :	<input type="text"/>
Name :	<input type="text"/>
Program :	PGDDBA (2012)
Semester :	II
Subject :	Capital Market
Assessment :	Exam - CM - 2012
Test Center :	Online Assignment
Date (dd/mm/yyyy) :	13/9/2012


If any Discrepancy found in above information please inform the testcenter admin and exit.

Click to proceed and start Assessment

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Exam - Terms and Conditions Page



Symbiosis Center for Distance Learning

Registration No.

Instructions and Terms & Conditions
Please read the Instructions and Terms & Conditions carefully and click "I Agree" button to accept all the terms and conditions. Next, you will view and get familiar with the different question types. Thereafter, you can proceed to give your exam.

General Instructions:
The examination will consist of 40 questions of 100 marks total, to be completed in 60 minutes.
The questions will appear one at a time, with a bulleted number list of all the questions at the right hand side of the screen.
To begin the exam, you need to click "START EXAM" button, this will take you to the First Question in the Exam.
The Time allotted for the exam will be shown on the screen as TIME LEFT to complete the exam. You will be automatically stopped from answering questions when the time allotted (1 hour) is over. The timer will start as soon as you click the "START EXAM" button.


Terms & Conditions
You can be debanded/disqualified for any of the following malpractices:
Creating a disturbance
Attempting to take the exam for someone else - impersonation
Giving or receiving assistance of any kind
Attempting to tamper with the operation of the computer or meddling with system.
Using prohibited aids, items not allowed, such as:
o Cell phones
o Pieces of Paper
o Electronic diaries
o Compasses, Protractors, Rulers
o Watch alarms
o Listening devices and recording or photographic devices.

Disclaimer:
By clicking "I Agree" you agree and consent to abide by all the rules and regulations as laid down by SCDL and Atlat for the examinations.

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Exam - Instructions



SYMBIOSIS
Centre For Distance Learning

You are Logged in as
Last login : 13-Sep-2012 10:27:57 AM

Instruction (Start of Assignment):

Marks: 30

Time: 30 minutes

No Negative mark

Number of breaks unlimited

There will be no PREVIOUS button while answering the question so please double check the answer before click on NEXT button

Total Time Left 29:28

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Exam - Questions

PGOBA (2012) Capital Market - Semester III (Exam - CM - 2012)

Question 1 of 14 (Section :1)

Question flagging is only for student's reference, however these questions will be considered for evaluation. Flagging information will be lost if restarted.

Question type: Multiple choice multiple select Positive Marks: 2

CDs are freely transferable by

- non-endorsement
- endorsement
- delivery
- buy back

Total Time Left: 28:47

1	2	3	4	5	6	7
8	9	10	11	12	13	14

Save
Flag
End

Next >

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Exam – Questions Contd.

PGOBA (2012) Capital Market - Semester III (Exam - CM - 2012)

Question 4 of 14 (Section :1)

Question flagging is only for student's reference, however these questions will be considered for evaluation. Flagging information will be lost if restarted.

Question type: Fill in the blanks Positive Marks: 2

SPV may be formed as a company under the Company's Act, or a Trust formed under the

Indian Trusts Act

Total Time Left: 27:5

1	2	3	4	5	6	7
8	9	10	11	12	13	14

Save
Unflag
End

< Previous Next >

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Exam - Score Display

SYMBIOSIS
Centre For Distance Learning

You are Logged in as [redacted]
Last login : 13-Sep-2012 10:29:34 AM

PGCBA (2012) Capital Market - Semester III (Exam - CM - 2012)

Registration Number : [redacted]
Name : [redacted]
Assessment Name : Exam - CM - 2012

Results

Assessment Date (dd/mm/yyyy)	13/9/2012
Number of Correct Questions	6
Number of Partially Correct Questions	4
Number of Wrong Questions	4
Total Marks Obtained	17/30
Result	Pass
Session Breaks	1

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Offline (Paper based) Exam

- Different set of exam papers
- Subjective questions can be answered on separate paper or directly in the system
- Answers written on separate paper can be scanned and attached to the system for evaluation
- Completed exam papers with answers are forwarded to faculty for evaluation
- Model answers for each question is available in the system for faculty reference
- Faculty can put their marks, reasons and comments in the system and are tracked with the exam paper
- Result processing with moderation possible for subjective questions

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Video and Finger Print Secured Exam

- System validates the presence of Finger Print Reader and Webcam
- Authentication
 - Student authenticates himself using his username/password for the exam
 - System redirects student to scan his fingerprint
 - System sends the fingerprint image to the server
 - Server matches the fingerprint of the student with the one stored in database (captured at the time of student registration)
- On successful authentication, image capturing process is started
- Exam begins if authentication and image capturing is successful
- While student answers test, images are captured at regular (predefined) interval
- Exam will stop if internet connectivity is lost or image capturing fails

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Results Management

Summary of Results and Moderation

Year:
 Program:
 Subject:
 Reg.No: (Reg.No should be numeric)
 Status:
 Assessment Type:
 Student Name: (First Name or Middle Name or Last Name)
 Assessment Date: From Date: To Date:
 Marks Range: From: To:

<input type="checkbox"/>	Reg.No	Student Name	Subject	Assessment	Date	Marks	Max Marks	Moderated	Center Appeared	Status	Assessment Type	Action
<input type="checkbox"/>			Principles and Practices of Management	PFM Exam 2012	30-AUG-2012	19.0	70	0.0	SCDL CorpTestCenter	Published	Exam	Moderate
<input type="checkbox"/>			Capital Market	Exam - CM - 2012	30-AUG-2012	4.67	70	0.0	SCDL CorpTestCenter	Published	Exam	Moderate
<input type="checkbox"/>			Principles and Practices of Management	PFM - Exam Free	31-AUG-2012	24.0	70	0.0	Rackspace Online	Published	Exam	Moderate
<input type="checkbox"/>			Principles and Practices of Management	PFM - Exam Free	31-AUG-2012	0.0	70	0.0	Rackspace Online	Published	Exam	Moderate
<input type="checkbox"/>			Business Communication	BC Assessment		6.0	30	0.0		Evaluted	Assignment	Moderate

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Result Publishing

[Subjects](#) | [Programs](#) | [Questions](#) | [Assessments](#) | [Test Centers](#) | [Bookings](#) | [Result Processing](#) | [Users](#) | [Synchronization](#) | [Reports](#)

Publish Result | [Evaluator Assignment](#) | [Online Paper Evaluation](#) | [Paper Based Evaluation](#) | [Moderation](#)

Year:
 Program:
 Subject:
 Reg.No: (Reg.No should be numeric)
 Status:
 Assessment Type:
 Student Name: (First Name or Middle Name or Last Name)
 Assessment Date: From Date: To Date:
 Marks Range: From: To:

<input type="checkbox"/>	Reg.No	Student Name	Subject	Assessment	Date	Marks	Max Marks	Moderated	Center Appeared	Status	Assessment Type
<input type="checkbox"/>			Principles and Practices of Management	PFM Exam 2012	30-AUG-2012	19.0	70	0.0	SCDL CorpTestCenter	Published	Exam
<input type="checkbox"/>			Capital Market	Exam - CM - 2012	30-AUG-2012	4.67	70	0.0	SCDL CorpTestCenter	Published	Exam
<input type="checkbox"/>			Principles and Practices of Management	PFM - Exam Free	31-AUG-2012	24.0	70	0.0	Rackspace Online	Published	Exam

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Additional Flows and Exception Handling

- Alerts through Emails, SMSs and On-screen messages
 - Various alerts to Students
 - Email to Students and Proctors on exam booking
- Projects and Subjective papers
 - Workflow to assign Evaluators per paper
 - Screens to allow Evaluators to give marks
 - Displaying results taking into consideration subjective marks
- Operational requests from SCDL to Exam Centres and vice versa
 - System support to generate Exam Centre request like addition of machines
- Network error in sending Question papers to Exam Centres
 - CD generation of question papers to be sent to Exam Centre
- Network/Exam Centre Admin error in sending Answer papers
 - CD generation for Exam Centre Admin
 - Manual import answer papers from CD

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System Highlights

- System is deployed on Amazon Cloud (AWSEC2)
 - Latest Technology and world leaders in cloud computing
 - Reduced Infrastructure cost and managed with minimal resources
- Security
 - System is accessible on extended SSL (https:)
 - Unique question paper for student to control malpractices
 - User authentication where required
- MIS and Status Reporting
 - Comprehensive MIS Reporting available at click of button
 - Various Alerts for monitoring the system
- International Copyright with SCDL
 - Source code with SCDL helps in customization

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Key Challenges

Key Challenges

#	Key Challenges faced by SCDL	Solutions by Computerized Exam System
1	Question paper setting	<ol style="list-style-type: none">1. Question Banks for each subject2. Question paper setting by system using rules and patterns set by the evaluator3. Multiple question paper sets available
2	Control of malpractices	<ol style="list-style-type: none">1. Unique question paper for each student (Randomization)2. Automatic Hall Ticket3. Video and finger print checking
3	Evaluation of question papers	<ol style="list-style-type: none">1. Evaluation of MCQ types by system2. Recording of answers in the system including subjective type of questions3. Allotment and tracking of question papers to faculties for evaluation4. Result processing is system driven with facility for moderation

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Key Challenges

#	Key challenges faced by SCDL	Solutions by Computerized Exam System
4	Result compilation and declaration	<ol style="list-style-type: none"> 1. System generated mark sheet 2. Result is compiled by the system without human intervention 3. Mark grading and moderation possible with proper access rights 4. Timely and accurate result publication
5	Security	<ol style="list-style-type: none"> 1. User authentication and access rights 2. SSL (encryption) used for delivery 3. Various alerts and monitoring tools
6	Resource requirement	<ol style="list-style-type: none"> 1. Automation of all major processes (Registration, Question paper setting, Hall Ticket, Evaluation, Result processing etc) 2. Comprehensive MIS and reports 3. Monitoring, Tracking and Alerts

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End-to-end computerized system of Examination has helped SCDL to conduct large volume of examinations with maximum accuracy and minimum manpower. This Examination system has been developed by SCDL with 10 years experience of conducting successful examinations using ICT and hence addresses the various administrative, infrastructural, human resource allocations, security and mal-practice challenges effectively.

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Thank you