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EXAMINATION REFORMS
Guidelines & Procedures

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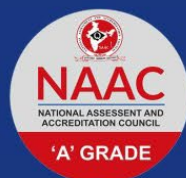
-: An Intiative of Tecnia Internal Quality Assurance Cell :-

TECNIA INSTITUTE OF ADVANCED STUDIES
NAAC ACCREDITED GRADE "A" INSTITUTE

Recognized Under Sec. 2(f) of UGC Act 1956, Approved by AICTE, Ministry of HRD, Govt. of India,
Affiliated to Guru Gobind Singh Indraprastha University.

INSTITUTIONAL AREA, MADHUBAN CHOWK, ROHINI, NEW DELHI, 110085

ISO 9001:2015, ISO 14001:2015, ISO 21001:2018 & ISO 51001: 2018 Certified Institute;
Rated as 'A' Category by JAC, Govt. of NCT of Delhi; A++ Category - Best Business School
by AIMA - Business Standard Survey & Included in Top 100 B & IT School by Dalal Street Investment Journal.

EXAMINATION REFORMS
Guidelines & Procedures

SOP FOR IMPLEMENTION OF EXAMINATION REFORMS

SL. NO.	PARTICULARS	DESCRIPTION
1	**Policy Number**	TIAS/IQAC/2019-22/
2	**Policy Structure**	The policy describes various examination reforms for introducing Bloom's Taxonomy and to achieve PLO & CO mentioned at the post graduate level in TIAS with aim to enhance the employability skills of MBA students through experiential learning by getting practical exposure of the manufacturing/production/marketing /finance/ HR/ material activities in Industry to fill the gap between academia and industry.
		The development of an outcome based Examination Reform Policy for technical education is a result of thoughtful deliberations, involving dedicated and specialized experts. This Policy has been framed to meet the expectations of an academically challenging environment, develop problem-solving skills by students, aligning with current global standards and to enrich the students learning to make them self-enablers and/or match job requirements on successful completion of their degree.
3	**Scope of the Policy**	The policy details the procedure followed by the Institute for conducting continuous evaluation of the students at PG level as per MBA course curriculum and implementing the same as per Guidelines of AICTE and monitoring/ evaluating the learning outcome of students getting experiential learning and practical training on those aspects which have been taught in the class through theory papers towards making them capable to perform on HOTs of the Bloom Taxonomy.
4	**Policy Status**	Original –Version -1.0
5	**Originated By**	Adopted from "Examination Reforms for MBA Students" November 2018, AICTE
6	**Reviewed By**	- Dr. Ajay Kumar, Professor & Director, Internal Quality Assurance Cell (IQAC), Tecnia Institute of Advanced Studies, Delhi - Coordinator, TIAS-IQAC, Tecnia Institute of Advanced Studies, Delhi
7	**Effective Date of Policy**	22.07.2021
8	**Approving Authority**	The Academic Council, TIAS and BoG of Tecnia Institute of Advanced Studies, Delhi
9	**Amendment Number**	Nil
10	**Effective Date of Amended Policy**	Nil

THE INSTITUTE

Tecnia Institute of Advanced Studies ("TIAS") is a Flagship of Tecnia Group of Institutions; one of the Premier NAAC accredited "A" Grade Institute; Approved by All India Council For Technical Education (AICTE), Ministry of Human Resource Development (MHRD), Government Of India (GoI) and Affiliated to Guru Gobind Singh Indraprastha University, Delhi; Recognized under Section 2(f) of University Grants Commission Act, 1956. The Institute conducts Master of Business Administration (MBA), Bachelor of Business Administration (BBA), Bachelors of Arts Journalism and Mass Communication BA (JMC) & Bachelor of Computer Applications (BCA) programmes in both shifts. The institute is ISO (hereinafter ISO refers to International Organization For Standardization) 9001:2015, ISO 14001:2015, ISO 21001:2018 & ISO 51001: 2018 Certified and Instituted is Top 50 Best B-School in North Zone by The Week Hansa Research Survey, Top 50 Private Institute in India by Times BBA Education Ranking Survey; The institute has established Institution Innovation Council (IIC) under the Norms of MHRD's Innovation Cell, GoI Dated 11.09.2019 to promote Innovation and Start up and also established Entrepreneurship Development Cell. Institute provides Value Added Programs & Career Counseling Session, Capabilities Enhancement Program on Technical and Soft Skill Expertise knowledge for development of young professional. The institute had setup TIAS-NPTEL Local chapter to complete MOOCs Course with e- certification for making students employable. Institute has ultra-Modern infrastructure and impart Value Based Education, conducts Training, Research & Consultancy, National and International Conferences and Seminars, Faculty Exchange Programme, Technical cum Cultural Fest etc. since 1998. The Institute is located at a prime location and has State-of-the-Art facilities, erudite faculties, dedicated staff members and an ambience to fulfill admirable academic pursuit.

VISION

Imparting holistic development by inculcating knowledge, ethics, professional acumen and socially concerned attitude to carve an edge in a dynamic environment.

MISSION

To make a thorough professional and responsible citizen through student centric teaching learning process, co-curricular, extra-curricular, enrichment, extension and outreach activities and research environment.

CORE VALUES

Being a professional institute, we subscribe to, in our dealings and hold ourselves accountable to all stakeholders by maintaining integrity, honesty, openness, personal excellence, constructive self-criticism, continual self-improvement, mutual respect, professionalism, quality service & standards, innovation, objectivity and honoring our commitments.

QUALITY POLICY

To provide quality education, training and expertise to improve the quality of life by improving the capabilities of human resources, thinking process, practices and performance in the Management, Information Technology and Media disciplines by adopting the quality management system through continual improvements.

INTERNAL QUALITY ASSURANCE CELL (IQAC)

The NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL (NAAC) conducts assessment and accreditation of (HEI) recognized institution to undertake the 'Quality Status' of the institution. NAAC evaluates the institutions for its conformance to the standards of quality in terms of its performance related to the educational processes and outcomes, curriculum coverage, teaching-learning processes, faculty, research, infrastructure, learning resources, organization, governance, financial wellbeing and student services. In pursuance of above for its performance evaluation, assessment & accreditation & quality up-gradation of higher education, NAAC proposes to establish an Internal Quality Assurance Cell (IQAC) as a post-accreditation quality sustenance measure. Since quality enhancement is a continuous process, the IQAC will become a integral part of the institution's system & work towards realization of the goals of quality enhancement & sustenance. The prime task of the IQAC is to develop a system for conscious, consistent & catalytic improvement in the overall performance of the institute for the post-accreditation period, it will channelize all efforts & measures of the institution towards promoting its holistic academic excellence. The Tecnia Institute of Advanced Studies was accredited on 11-Sept.-2017 with CGPA of 3.11 of 'A' Grade by NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL. IQAC established at Institute continued to strive for the betterment of systems, processes and policies setup. The NAAC visited the Institute Campus from 28th – 29th August 2017 (First Cycle) taking the tangible efforts to further has established a concrete Tecnia-IQAC hosting in TIAS-ERP in Institute.

IQAC VISION

To shape and certify the quality culture in the Institute with an intention of assured all round excellence.

IQAC MISSION

To channelize the efforts and establish the actions of the institute towards quantify academic and administrative talent and to be the change agent for leading and remove deficits to enrich the quality

IQAC GOALS

IQAC shall evolve mechanisms and procedures for:-
- ❖ To ensure timely, efficient and progressive performance appraisal of academic, administrative and financial tasks
- ❖ To ensure relevance and quality of academic and research programmes
- ❖ To develop equitable access to and affordability of academic programmes for various sections of society
- ❖ To optimize and integrate modern methods of teaching and learning
- ❖ To ensure credibility of evaluation procedures; adequacy, maintenance and functioning of the support structure and services
- ❖ To develop research sharing and networking with other institutions in India and abroad

IQAC DOLES

- ❖ The doles of the IQAC are:-
- ❖ To contribute meaningfully to ensure heightened level of clarity and focus on institutional functioning towards quality enhancement through internalization of the quality culture
- ❖ To act as a nodal agency in the Institute to empower, integrate and coordinate among various quality-related activities including adoption dissemination and institutionalize of best practices, for quality outcomes
- ❖ To build an organized methodology for decision-making, quality changes, documentation of the various programmes/activities to improve institutional functioning and internal communication for quality improvement

IQAC ROLES

- ❖ The roles of the IQAC are:-
- ❖ To develop, disseminate information and application of quality benchmarks for various academic and administrative activities of higher education.
- ❖ To facilitate the creation of a learner-centric environment conducive to quality education and faculty maturation to adapt the required knowledge and technology for participatory teaching and learning process
- ❖ To establish network to coordinate, facilitate and implement feedback response on quality- assurance initiatives by involving the stakeholders
- ❖ from students, parents and other stakeholders
- ❖ To organize inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles

❖ To develop and maintain institutional database through TIAS-ERP (MIS) for the purpose of maintaining, enhancing, quality culture in the institution.

❖ Periodical conduct academic and administrative audit and its follow-up to prepare the Annual Quality Assurance Report (AQAR) as per guidelines and parameters for onward submission to NAAC.

EXAMINATION REFORMS

Globalisation of the world economy and higher education are driving profound changes in technical education system. There is a continuing need to dynamically adapt to these changes, to ensure that we remain competitive and can respond effectively to the challenges of globalisation. Future technical graduates not only need to be knowledgeable in his/her discipline but also needs a new set of soft, professional skills and competencies [1]. In recent years, there have been essential changes in technical education in terms of what to teach (content) and how to teach (knowledge delivery) and how to assess (student learning).

AICTE has taken initiation to come out with model curriculum for technical programs. The digital initiatives of MHRD and AICTE have made available very large number of MOOC courses through SWAYAM that can help the colleges and teachers to adopt innovative methodologies in the delivery of course. It focuses on the recommendations for reforms in examinations (assessment of student) in the context of emerging landscape of technical education.

Examinations/student assessments play a very important role in deciding the quality of education. They must not only assess student's achievements (and grades) but also measure whether the desired learning outcomes have been achieved. The achievement of objectives and program outcomes are crucial and needs to be proven through accurate and reliable assessments.

The academic quality of examinations (question papers) in Indian technical education system has been a matter of concern from a long time. It is widely acknowledged that "assessment drives learning", what and how students learn depends to a major extent on how they think they will be assessed [2]. The question papers that require simple memory recall will not ensure deep, meaningful learning. High expectations for learning motivate the students to rise to the occasion. The assessment (examination) must embed those high expectations to ensure that the learner is motivated to attain them. Considering the above imperatives, it is clear that reforms in Examinations are critical for improvement of the quality of Indian technical education. The most important drivers for reforms in examination system of Indian technical education are:

➤ **Adaptation of Outcome-Based Education Framework**
Outcome-based education (OBE)- a performance-based approach has emerged as a major reform model in the global technical education scenario [3]. The country that wants to be a signatory member of a multinational agreement for the mutual

recognition of technical degrees, i.e. the Washington Accord (WA) must implement OBE. This will be an endorsement that the technical education system has demonstrated a strong, long-term commitment to quality assurance in producing engineers ready for industry practice in the international scene. Being signatory to the Washington Accord, Indian accreditation agency 'National Board of Accreditation (NBA)' has made it mandatory for technical institutions to adapt OBE framework for their curriculum design, delivery and assessment. In OBE framework, the educational outcomes of a program are clearly and unambiguously specified. These determine the curriculum content and its organization, the teaching methods and strategies and the assessment process.

Though Indian Universities and Colleges have started adapting OBE framework for their technical programs, the focus is limited to the curriculum design part, i.e. connecting curriculum components to the program outcomes. Very little attention is being given for connecting examination questions/assessment tools to the program outcomes. The absence of proper mapping between program outcomes and assessment tools lead to the inaccurate and unreliable measurement of attainment of outcomes by the students. This missing connect creates a big gap in the effective adaptation of OBE framework, making the whole exercise futile.

> ## Importance of Higher-order Abilities and Professional Skills

In the present examination system, memorization occupies a dominant place. The recall of factual knowledge, though essential to any examination, is only one of several major abilities to be demonstrated by the graduates. The assessment process must also test higher level skills viz. ability to apply knowledge, solve complex problems, analyse, synthesise and design. Further, professional skills like the ability to communicate, work in teams, lifelong learning have become important elements for employability of the graduates [4]. It is important that the examinations also give appropriate weightage to the assessment of these higher-level skills and professional competencies.

Keeping in view of the above challenges and looking at some of the worldwide best practices in assessment, the present report comes up with several recommendations that can be used by Universities/ Colleges to design their assessment strategies.

A: ASSESSMENT STRATEGY FOR OUTCOME-BASED EDUCATION

MBA PROGRAM OUTCOMES

The MBA curriculum focuses on the alignment with department / institute's mission. The most essential learning outcomes of MBA programs are identified through stakeholder consultation. However, department/ institute had own learning outcomes based on their mission. There may be slight variation of outcomes from one department to another of institute to the other depending upon their mission which may focus on entrepreneurship or international business or other domain's of management etc. The learning outcomes specify the knowledge, skills, values and attitudes students are expected to attain in courses or in a program. After in depth discussion, the faculty committee identified the six most popular learning outcomes of MBA as below:-

1. **Business Environment and Domain Knowledge (BEDK)**: Economic, legal and social environment of Indian business.. Graduates are able to improve their awareness sand knowledge about functioning of local and global business environment and society. This helps in recognizing the functioning of businesses, identifying potential business opportunities, evolvement of business enterprises and exploring the entrepreneurial opportunities.

2. **Critical thinking, Business Analysis, Problem Solving and Innovative Solutions (CBPI)**: Competencies in quantitative and qualitative techniques. Graduates are expected to develop skills on analyzing the business data, application of relevant analysis, and problem solving in other functional areas such as marketing, business strategy and human resources.

3. **Global Exposure and Cross-Cultural Understanding (GECCU)**: Demonstrate a global outlook with the ability to identify aspects of the global business and Cross Cultural Understanding.

4. **Social Responsiveness and Ethics (SRE)**: Developing responsiveness to contextual social issues / problems and exploring solutions, understanding business ethics and resolving ethical dilemmas. Graduates are expected to identify the contemporary social problems, exploring the opportunities for social entrepreneurship, designing business solutions and demonstrate ethical standards in organizational decision making. Demonstrate awareness of ethical issues and can distinguish ethical and unethical behaviors.

5. **Effective Communication (EC)**: Usage of various forms of business communication, supported by effective use of appropriate technology, logical reasoning, articulation of ideas. Graduates are expected to develop effective oral and written communication especially in business applications, with the use of appropriate technology (business presentations, digital communication, social network platforms and so on).

6. **Leadership and Teamwork (LT)**: Understanding leadership roles at various levels of the organization and leading teams. Graduates are expected to collaborate and lead teams across organizational boundaries and demonstrate leadership qualities, maximize the usage of diverse skills of team members in the related context.

MAPPING PROGRAM OUTCOMES TO ASSESSMENT (EXAMINATIONS)

Graduate attributes (GAs) articulate the generic abilities to be looked for in a graduate of any PG/UG degree program. They form the Program Outcomes (POs) that reflect the skills, knowledge and abilities of graduates regardless of the field of study. This does not mean that POs are necessarily independent of disciplinary knowledge – rather, these qualities may be developed in various disciplinary contexts.

In outcome-based education, a "design down" process is employed which moves from POs to Course Outcomes (COs) and outcomes for individual learning experiences. Outcomes at each successive level need to be aligned with, and contribute to, the program outcomes.

Courses are the building blocks of a program. Teaching strategies, learning activities, assessments and resources should all be designed and organized to help students achieve the learning outcomes at the course level. In the assessment activities, students demonstrate their level of achievement of the course learning outcomes. In a constructively aligned program, the courses are carefully coordinated to ensure steady development or scaffolding from the introduction to mastery of the learning outcomes, leading to achievement of the intended POs. For the effectiveness of the program, the achievement of POs is crucial which needs to be proven through accurate and reliable assessments.

TWO-STEP PROCESS FOR BRINGING CLARITY TO POs

POs give useful guidance at the program level for the curriculum design, delivery and assessment of student learning. However, they represent fairly high-level generic goals that are not directly measurable. Real observability and measurability of the POs at course level is very difficult. To connect high-level learning outcomes (POs) with course content, course outcomes and assessment, there is a necessity to bring further clarity and specificity to the program outcomes [5].

This can be achieved through the following two-step process of identifying Competencies and Performance Indicators (PI).

Identify Competencies to be attained: For each PO defines competencies – different abilities implied by program outcome statement that would generally require different assessment measures. This helps us to create a shared understanding of the competencies we want students to achieve. They serve as an intermediate step to the creation of measurable indicators.

Example:
Program Outcome (Attribute 3)

Design:
PO3: Design/Development of Solutions: Design solutions for complex managerial problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Competencies
1. Demonstrate an ability to define a complex, open-ended problem in technical terms.
2. Demonstrate an ability to generate a diverse set of alternative design solutions.
3. Demonstrate an ability to select the optimal design scheme for further development.
4. Demonstrate an ability to advance an technical design to the defined end state.

Define Performance Indicators: For each of the competencies identified, define performance Indicators (PIs) that are explicit statements of expectations of the student learning. They can act as measuring tools in assessment to understand the extent of attainment of outcomes. They can also be designed to determine the appropriate achievement level or competency of each indicator so that instructors can target and students can achieve the acceptable level of proficiency.

Example:
For the Competency -2
Demonstrate an ability to generate a diverse set of alternative design solutions

Performance Indicators:
1. Apply formal idea generation tools to develop multiple technical design solutions
2. Build models, prototypes, algorithms to develop a diverse set of design solutions
3. Identify the functional and non-functional criteria for evaluation of alternate design solutions.

It should be noted that, when we consider the program outcome, it looks like, it can be achieved only in the Capstone project. But if we consider the competencies and performance indicators, we start seeing the opportunities of addressing them

(and hence PO) in various courses of the program.

Once the above process is completed for the program, the assessment of COs for all the courses is designed by connecting assessment questions (used in various assessment tools) to the PIs. By following this process, where examination questions map with PIs, we get clarity and better resolution for the assessment of COs and POs. The pictorial representation of the process is given in Fig. 1
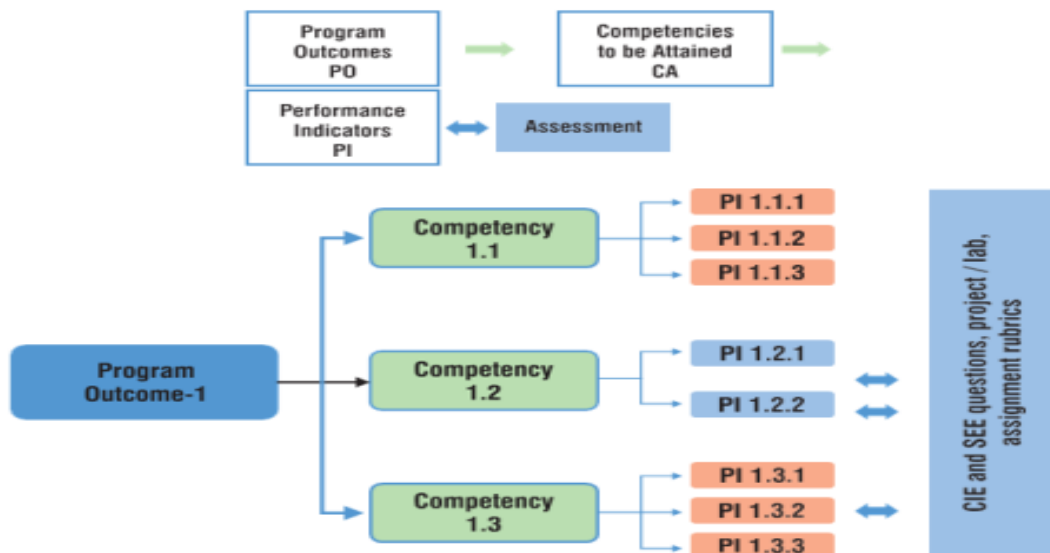

Fig. 1: Connecting POs to Assessment

PROGRAM OUTCOMES – COMPETENCIES – PERFORMANCE INDICATORS

The suggestive list of competencies and associated performance indicators for each of the PO in MBA Program refer to Appendix-A

B: IMPROVING STRUCTURE AND QUALITY OF ASSESSMENTS

For improving the structure and quality of assessment in MBA program following points need to be remembered:

1. In Indian education system, written examinations play a major role in assessing the learning and awarding of grades to the student. Universities and institute give highest weightage to the outcomes of the written examinations in overall grading. Questions raised in the examination/test papers play an important role in defining the level of learning the student is expected to achieve in the courses and hence in the program. Since assessment drives learning, the design of question papers needs to go beyond the mere test of memory recall. They also need to test higher-order abilities and skills.

2. Written examinations assess a very limited range of outcomes and cognitive levels. Particularly in the courses, where course outcomes (COs) cover a broad range of expectations, written examinations alone will not be sufficient to make valid judgements about student learning. A wide range of assessment methods (e.g., term papers, open-ended problem-solving assignments, course/lab project rubrics, portfolios etc.) need to be employed to ensure that assessment methods match with learning outcomes.

3. It is advisable to formulate assessment plans for each of the course in the program that brings clarity to the following:-

   a) Alignment of assessment with learning outcome of the course
   b) Level of learning (cognitive) student is expected to achieve
   c) Assessment method to be adapted

The method to align examination questions/assessment to COs and hence POs was discussed in the point-1. The following sections discuss the application of Bloom's taxonomy framework to create the optimal structure of examination papers to test the different cognitive skills.

BLOOM's TAXONOMY FRAMEWORK FOR ASSESSMENT DESIGN

Bloom's Taxonomy provides an important framework to not only design curriculum and teaching methodologies but also to design appropriate examination questions belonging to various cognitive levels.

Bloom's Taxonomy of Educational Objectives developed in 1956 by Benjamin Bloom [6] was widely accepted by educators for curriculum design and assessment. In 2001,

Anderson and Krathwohl modified Bloom's taxonomy [7] to make it relevant to the present-day requirements.

It attempts to divide learning into three types of domains
- Cognitive,
- Affective,
- Behavioral

and then defines the level of performance for each domain.

Conscious efforts to map the curriculum and assessment to these levels can help the programs to aim for higher-level abilities which go beyond Remembering or Understanding, and require Application, Analysis, Evaluation or Creation.

Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in higher education to structure the assessment as it characterizes complexity and higher-order abilities.

It identifies 06 Levels of competencies within the cognitive domain (Fig. 2) which are appropriate for the purposes of management HEI's educators.
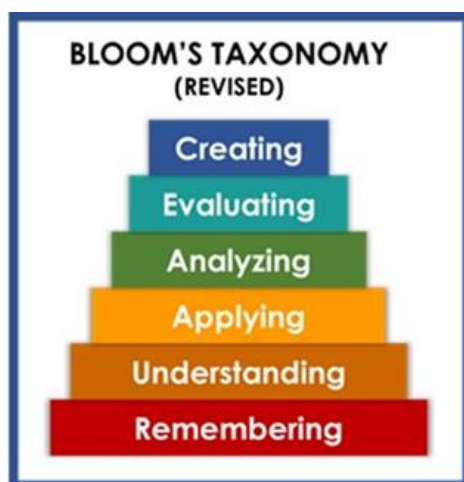
Bloom's taxonomy is hierarchical, meaning that learning at the higher level requires that skills at a lower level are attained.

Fig. 2: Revised Bloom's Taxonomy

According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:-

Level	Descriptor	Level of attainment
1.	Remembering	Recalling from the memory of the previously learned material
2.	Understanding	Explaining ideas or concepts
3.	Applying	Using the information in another familiar situation
4.	Analysing	Breaking information into the part to explore understandings and relationships
5.	Evaluating	Justifying a decision or course of action
6.	Creating	Generating new ideas, products or new ways of viewing things

ACTION VERBS FOR ASSESSMENT

Choice of action verbs in constructing assessment questions is important to consider. Quite often, the action verbs are indicators of the complexity (level) of the question. Over time, educators have come up with taxonomy of measurable verbs corresponding to each of the Bloom's cognitive levels [8]. These verbs help us not only to describe and classify observable knowledge, skills and abilities but also to frame the examination or assignment questions that are appropriate to the level we are trying to assess. Suggestive list of skills/ competencies to be demonstrated at each of the Bloom's level and corresponding cues/ verbs for the examination/ test questions is given below:

Level	Skill Demonstrated	Question cues / Verbs for tests
1. Remember	• Ability to recall of information like facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where
2. Understand	• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
3. Apply	• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show,

	or knowledge • Demonstrating correct usage of a method or procedure	examine, modify
4. Analyse	• break down a complex problem into parts • Identify the relationships and interaction between the different parts of a complex problem • identify the missing information, sometimes the redundant information and the contradictory information, if any	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select
5. Evaluate	• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
6. Create	• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

It may be noted that some of the verbs in the above table are associated with multiple Bloom's Taxonomy levels. These verbs are actions that could apply to different activities.

We need to keep in mind that it's the skill, action or activity we need students to demonstrate that will determine the contextual meaning of the verb used in the assessment question.

ASSESSMENT PLANNING

While using Bloom's taxonomy framework in planning and designing of assessment of student learning, following points need to be considered:-

1. Normally the first three learning levels; Remembering, Understanding And Applying and to some extent fourth level Analyzing are assessed in the
   - Continuous Internal Evaluation (CIE) and
   - Semester End Examinations (SEE),

   where students are given a limited amount of time. And abilities; Analysis, Evaluation and Creation can be assessed in extended course works or in a variety of student works like course projects, mini/ minor projects, internship experience and final year projects.
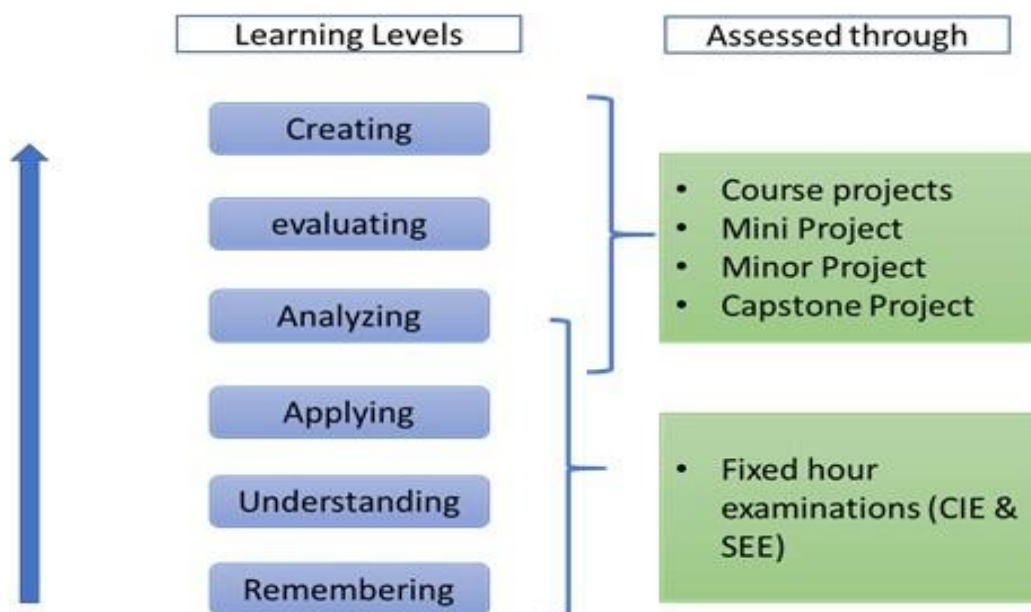

Fig. 3: Assessment methods for different Bloom's cognitive levels

2. Before adopting this framework for reforms in examination system of a MBA Program of Institute, it is worthwhile to study the present pattern of assessment in each of the course in the program to gain insight about:-

   a) Alignment of assessment questions with course learning outcomes
   b) Whether all the learning outcomes are tested;
      Sometimes some learning outcomes are over tested at the expense of others which may be not tested at all.
   c) Overall weightage in the assessment, to each of Bloom's learning levels
   d) Assessment methods used to adequately assess the content and desired learning outcomes

   Based on the study, improvement priorities for each of the above factors need to be arrived at. The reform process needs to be well planned and implemented

through institutional strategy and communicated to all stakeholders particularly to the students.

3. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Bloom's taxonomy framework helps the faculty to set examination papers that are well balanced, testing the different cognitive skills without a tilt towards a tough or easy paper perception.

   If the present examination questions are more focused towards lower cognitive skills, conscious efforts need to be made to bring in application skills or higher cognitive skills in the assessment.

   It is recommended that at institute level, upper limit need to be arrived for lower order skills (for example, no more than 40% weightage for knowledge-oriented questions). It is important to note that, as nature of every course is different, the weightage for different cognitive levels in the question papers can also vary from course to course.

   • Examples of typical questions for each of Bloom's cognitive level are given in Appendix-B

   • Model Question Papers are given in Appendix- C

C: ASSESSING HIGHER-ORDER ABILITIES & PROFESSIONAL SKILLS

In the 21st century, professional skills
also known as - Soft Skills,
       - Generic Skills
       - Transferable Skills

have emerged as important attributes of a MBA graduate. Studies had shown that Industry/ employers around the world value these abilities more than the disciplinary knowledge. This is also reflected in the NBA Graduate Attributes wherein six out of twelve attributes belong to this category, viz.

a. Communication,
b. Teamwork,
c. Understanding Ethics And Professionalism,
d. Understanding Global And Societal Contexts,
e. Lifelong Learning, and
f. Knowledge of Contemporary Issues.

Further, higher-order cognitive abilities like Critical Thinking, Problem-Solving and Making Informed Decisions are also crucial for a graduate to succeed in the emerging world.

The employers consider these professional skills and higher abilities as important, students are weak in them. The main challenge surrounding them is that they are difficult to assess through existing conventional examination system.

INNOVATIVE EDUCATIONAL EXPERIENCES TO TEACH AND ASSESS

One of the main obstacles in addressing these outcomes is the limitation of educational experience we create within our technical programs. Most of the coursework in our programs are oriented towards teaching technical knowledge and skills; hence, the assessment is limited to those abilities. However, acquiring the professional outcomes may not result simply from participation in a particular class or set of classes. Rather, these outcomes are more often acquired or influenced through sources both in and outside the classroom [4].

To address these challenges, comprehensive reforms are envisaged in the way to design curriculum pedagogy, student learning experiences and assessment of the outcomes. Worldwide several attempts are being made to address these challenges.

Following are the few educational experiences that are recommended to teach and assess professional outcomes and higher-order cognitive abilities:-

- Course Projects
- Open-Ended Experiments in laboratories
- Project-Based Learning modules
- MOOCs
- Co-Curricular experiences
- Mini / Minor projects
- Final year Projects
- Internship experiences
- E-portfolios of student works
- Outbound Experiential Learning Programmes
- Communication through Theatre Techniques
- Course of Independent Study
- NSE and other similar Certification Programs
- Social Sensitization Projects
- Community Development Projects
- Rural Innovation Projects
- Consulting Projects
- Industry or Academic Internships
- Field/Live Projects
- Global Virtual Team Project
- Study Abroad Programme
- Student Exchange Programs
- Case Based Learning
- Experiential/Live Projects
- Global Virtual Teams
- Global Classrooms
- Second Generation Core Courses
- Leadership Building
- Emphasis on Indian Business Models

In order to employ appropriate pedagogical tools in management education, it is important to understand the changing profile of learning. The paradigm shift is from Teaching to learning, Learning things to Learning how to learn, Certification to Demonstration of competence and skills, Disseminators to Guides and mentors, Time-limited to Lifelong learning and Linear to Serendipitous learning. Moderator Supported Learning Approaches (MSLA) such as Case debates, Crossword Play, Computer Simulations and Card games. May be used to engage and involve the students in learning process. Self-learning Tools (SLT) such as Poster Sessions, Break 'n Build, Free fall learning mechanisms are other innovative teaching methods like Action-Oriented Leadership, Case Study Method, Pedagogy Innovations in Business Education include Experiential Design Thinking Contemplative Practices Usage of Dance and Drama as pedagogical tools can enhance deeper learning.

PEDAGOGY - DIFFERENT METHODS AND TECHNIQUES OF TEACHING

OBJECTIVES

➢ To understand different classifications of teaching methods
➢ To comprehend various teaching methods and techniques
➢ To recognize the significance of different teaching methods and techniques in effective teaching

Teaching is a deliberate activity done in a professional manner to bring a positive change in the learner; in order to teach well. Teachers are guided by certain principles of teaching and learning which have great implication for teaching. The role of the teacher is very essential in the effective implementation of the curriculum. Teachers challenge the three domains of cognitive, affective and the psychomotor domains of learners. The classroom is a dynamic environment, bringing together students from different backgrounds with various abilities and personalities. Being an effective teacher, therefore, requires the implementation of creative and innovative teaching strategies in order to meet students' individual needs. Teaching methods denotes the strategy by which a teacher delivers his/her subject matter to the learners based on some predetermined instructional objectives in order to promote learning in the students. For a teacher to effectively adopt any teaching method, some factors must be considered. The effective implementation of any curriculum depends to a large extent on the availability of various methods of teaching. Thus to teach is to impart knowledge, an attempt to help the learner have a change of attitude and acquire skills through a series of planned activities (Buseri & Dorgu, 2011)

CLASSIFICATION OF TEACHING METHODS

Different teaching methods may elicit different types of changes in learning outcomes. There are different types of teaching methods which can be categorized into following broad types. These are teacher-centered methods, learner-centered methods, content-focused methods, and interactive/participative methods.

A. Teacher Centered Methods

In Teacher-Centered Approach to teaching, Teachers are the main authority figure. Here the teacher casts himself/herself in the role of being a master of the subject matter. The teacher is looked upon by the learners as an expert or an authority. Learners, on the other hand, are presumed to be passive and copious recipients of knowledge from the teacher. Students are viewed as "empty vessels" whose primary role is to   passively receive information via lectures and direct instruction with an end goal of testing and assessment. It is the primary role of teachers to

pass knowledge and information onto their students. In this model, teaching and assessment are viewed as two separate entities.

Examples of such methods are expository or lecture methods - which require little or no involvement of learners in the teaching process. It is also for this lack of involvement of the learners in what they are taught that such methods are called "closed-ended".

B. Learner Centered Methods

In the Student-Centered Approach to teaching, while teachers are the authority figure in this model, teachers and students play an equally active role in the learning process. In learner-centered methods, the teacher is both a teacher and a learner at the same line. In the words of Lawrence Stenhouse, the teacher plays a dual role as a learner as well "so that in his is to coach and facilitate student learning and overall comprehension of material. Student learning is measured through both formal and informal forms of assessment, including group projects, student portfolios, and class participation. Teaching and assessments are connected; student learning is continuously measured during teacher instruction. Commonly used teaching methods may include class participation, demonstration, recitation, memorization, or combinations of these. The teacher "becomes a resource rather than an authority". Examples of learner-centered methods are discussion method, discovery or inquiry-based approach, etc.

C. Content-Focused Methods

In this category of methods, both the teacher and the learners have to fit into the content that is taught. Generally, this means the information and skills to be taught are regarded as sacrosanct or very important. A lot of emphases is laid on the clarity and careful analyses of content. Both the teacher and the learners cannot alter or become critical of anything to do with the content. An example of a method which subordinates the interests of the teacher and learners to the content is the programmed learning approach.

D. Interactive/Participative Methods

This fourth category borrows a bit from the three other methods without necessarily laying emphasis unduly on the learner, content or teacher. These methods are driven by the situational analysis of what is the most appropriate thing for us to learn/do now given the situation of learners and the teacher. They require a participatory understanding of varied domains and factors.

Teaching methods are many and varied and could be used in different ways, considering among others the age of the learners, body configuration or physique of learners.

In another broad classification, teaching methods could be presented in three main categories:
• Cognitive development methods
• Affective development methods and
• Psychomotor development methods

E. Cognitive Development Methods

Here, if the focus of the instructional objectives is to develop intellectual skills in learners, then the cognitive development methods of teaching are recommended. This method helps learners to comprehend, analyze, synthesize and evaluate information. It helps learners develop good cognitive abilities. The cognitive development methods are essentially didactic. Some of the teaching methods in this category include:
• Discussion Method
• Questioning/Socratic Method
• Team Teaching Method
• Talk Chalk/Recitation Method
• Field Trip/ Excursion Method
• Team Teaching Method

F. Affective Development Method

This domain includes objectives which describe changes in interest, attitudes, and values. It further deals with the development of appreciation and adequate adjustment. Education has a lot to give the learner in order to assist him/her to develop in these areas, hence teachers are encouraged to include learning experiences that are worthwhile, teach in ways that arouse interest and develop proper attitude in learners. This mode of teaching is basically Philetic, here students feelings or opinion are aroused. Some teaching methods under this category include:
• Modeling Method
• Simulation Method
• Dramatic Method and
• Role-Playing Method

G. Psychomotor Development Methods

These are activity-based methods of teaching that aim at motor skills development in learners. This method requires that learners are able to illustrate, demonstrate,

or perform certain skills using their manual dexterity. It is a heuristic method of teaching that involves inquiry and discovery methods of teaching. It is a more student activity-based method. This method includes:

- Inquiry Method
- Discovery Method
- Process Approach Method
- Demonstration Method
- Laboratory/Experimentation Method
- Programmed Learning Method
- Dalton Plan/Assignment Method
- Project Method
- Microteaching Method
- Mastery Learning

There are a number of teaching methods have been developed, modified and even combined over centuries. Below is a list of some teaching methods that can be used to facilitate learning generally. It can be represented as the Wheel of Instructional Choice showing Various Teaching Methods
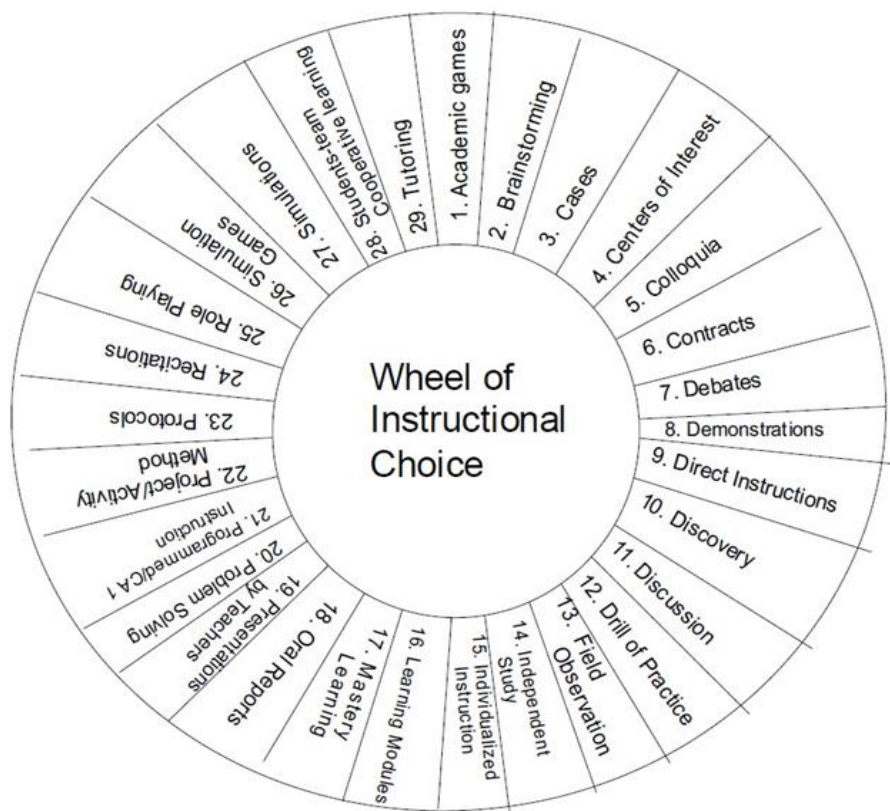
Wheel of instructional choice showing various teaching methods (Adapted from Cruickshank, D.R., Bairer, D. & Metcalf, K. "The Act of Teaching". 1995 pg.

DIFFERENT TEACHING METHODS AND TECHNIQUES

Let's see some common teaching methods and techniques, their characteristics and mode of application, which are used frequently in our daily classroom teaching.

Method, Approach and Techniques - Before proceed further it is worth enough to discriminate between the three.

Method is procedural, Approach is axiomatic and Technique is implementation.

Questioning Method

Questioning method of teaching aids learners in connecting concepts, increasing awareness, encouraging creative and imaginative thought, making inferences, etc. Questioning generally helps learners to explore deeper level of thinking, knowing and understanding. Questioning, though it is more of a technique than a method of teaching, it is used during various methods of teaching. Questioning methods may be used for the following purposes (Achuonye & Ajoku, 2003)

- To arouse interest & curiosity
- To stimulate discussion
- To channel thinking
- To determine how well the group understand the material
- To get the attention of an individual

There are five basic types of questions as shown in the figure
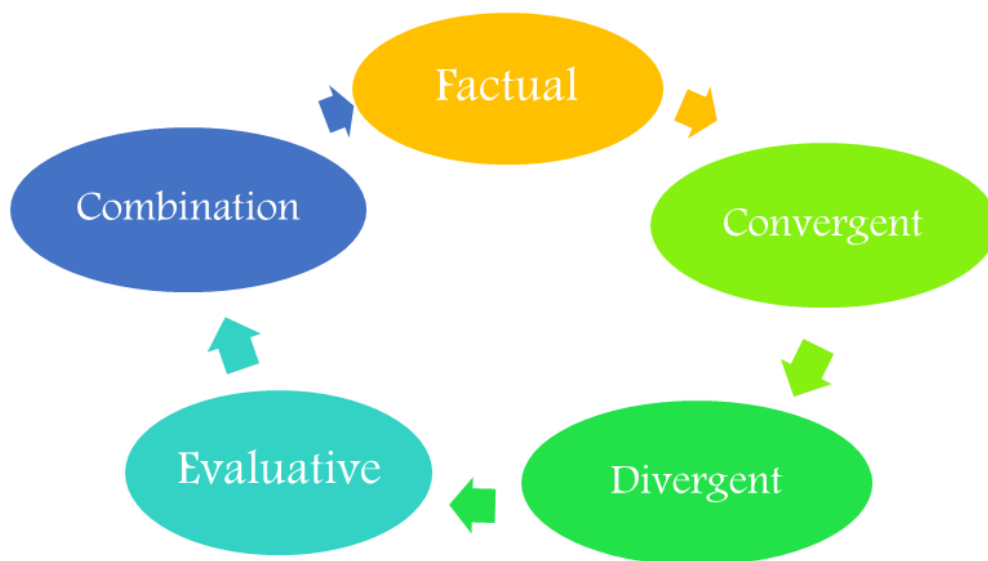
Lecture Method

A lecture is a pedagogical method where an expert in a particular field makes a carefully planned, sequentially arranged expository address on particular topic. A lecture is an oral presentation of information by the instructor. It is the method of relaying factual information which includes principles, concepts, ideas and all theoretical knowledge about a given topic. In a lecture the instructor tells, explains, describes or relates whatever information the learners are required to learn through listening and understanding. It is therefore teacher-centered. The instructor is very active, doing all the talking. Trainees, on the other hand, are very inactive, doing all the listening. Despite the popularity of lectures, the lack of active involvement of trainees limits its usefulness as a method of instruction. The lecture method of instruction is recommended for learners with very little knowledge or limited background knowledge on the topic. It is also useful for presenting an organized body of new information to the learner.

Discussion Methods

Discussion is usually at a higher cognitive level and it develops critical thinking. Student's participation is necessary for a successful classroom discussion. It is a student-centered teaching technique but requires careful planning by the teacher to guide discussion. Successful discussions are guided by specific teaching goals. In the students attempt to solve the problem or answer the question, students pair up in smaller groups discuss the issue on ground and then they are brought back for a full group discussion. This method encourages student's participation, develops critical thinking, develops student's ability to communicate, and problem-solving skills.

Buzz Groups

Another method of instruction is the buzz group. During a longer session, the plenary group can break into sub-groups to discuss one or two specific questions or issues. The room soon fills with noise as each sub-group 'buzzes' in the discussion. Buzz groups can be in pairs, trios, or more depending on the activity. People turn to their neighbors for a quick buzz or form larger groups of three or more. This allows almost everyone to express an opinion. While they are buzzing, participants are able to exchange ideas and draw on their wide collective experience. A good buzz session will generate many ideas, comments, and opinion, the most important of which will be reported back.

Brainstorming

The purpose of a brainstorming session is to discover new ideas and responses very quickly. It differs from the buzz group discussion in that the focus is on generating as many ideas as possible without judging them. In this technique, all ideas are given equal credence. Participants are encouraged to let ideas flow freely, building on and improving from previous ideas. The combination of swiftly generated ideas usually leads to a very animated and energizing session. Even the more reserved participants should feel bold enough to contribute. The purpose of listing responses is to collect existing experiences and thoughts.
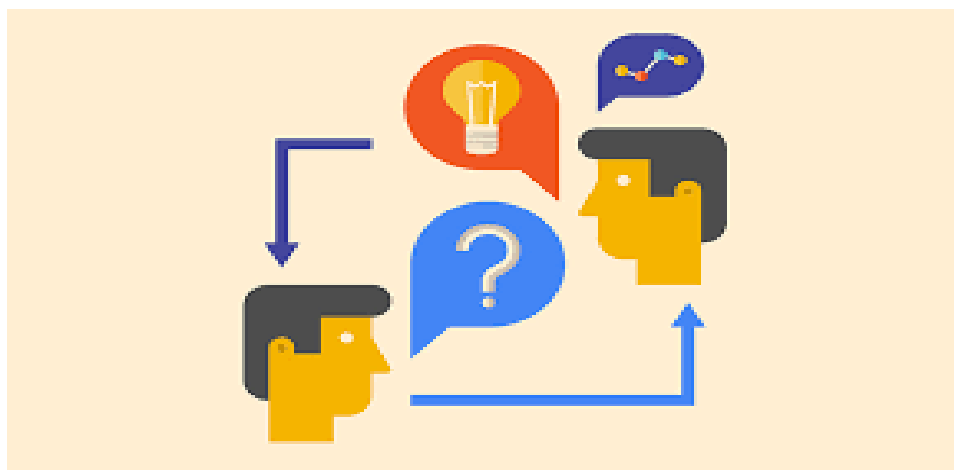
Role-Playing

This method of teaching can be used for solving real-life situational problems. The technique of role lay develops practical professional skills and functioning knowledge. It enables students in the classroom to act as stakeholders in an imagined scene. In a play role, the teacher selects an event that illuminates the

topic of study and students are assigned roles, which will be played out, the role play will be concluded, with a reflection stage that reinforces the concepts introduced by the role play. This method gives students the opportunity to explore together their feelings, attitudes, values, and problem-solving strategies.

Games/Simulation Method

This method entails a real-life activity in a simple manner that communicates the idea to the learners. The use of simulation methods in classroom situations is devised to help students learn how things operate in reality. Students are encouraged to act out the same roles and make decisions likened to real-life situations. Therefore, simulation helps students to practice and understand adult roles and also develop the skills necessary for successful adult life. Simulation and games are used at all levels of education and create both intrinsic and extrinsic motivation in the learner.

Demonstration Method

A demonstration involves showing, doing or telling the students the point of emphasis. It is mostly used as a technique within a method of teaching and a time as a method of teaching itself. Here the role of the teacher is to illustrate how to do something or illustrate a principle first by explaining the nature of the act verbally, followed by demonstrating the act in a systematic manner and later the students repeat the act. The demonstration is useful mostly in imparting psychomotor skills and lessons that require practical knowledge.

Inquiry/Discovery Method

This is a teaching-learning situation whereby students are given the opportunity to discover and find out things for themselves. This method is rooted in heuristic teaching activity and problem-solving; these are basically the major ingredients of modern science. It is a learner- centered method, whereby the learner discovers & explores some problem-solving experiences with a view to drawing conclusions from data gathered through the process of observing, predicting, measuring and formulating relevant questions. The gains of inquiry/discovery methods include.

- Demonstrates students proficiency
- Encourages curiosity
- Fosters intuitive thinking in the classroom
- Develops good communication skills and
- Students become independent thinkers.
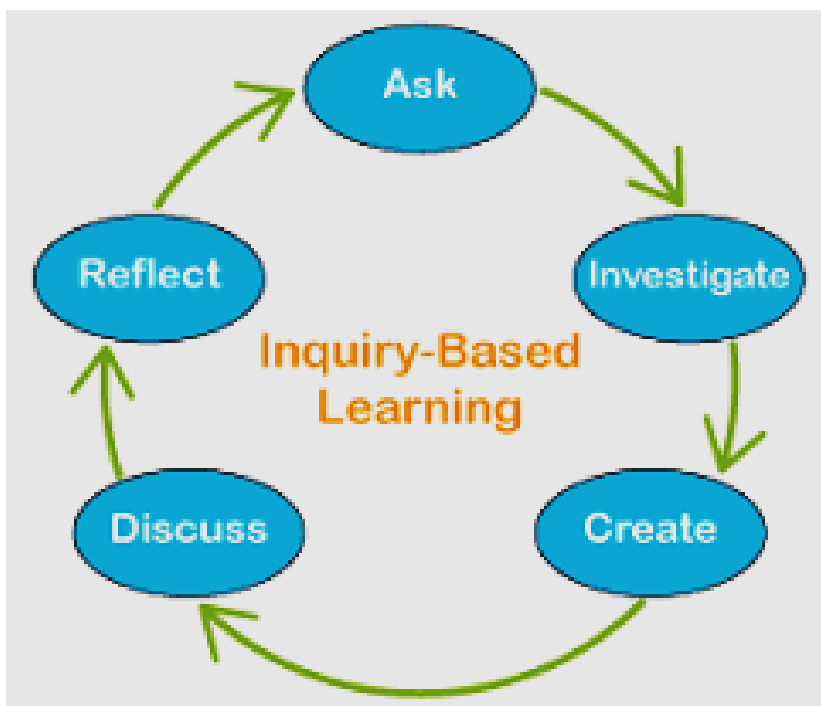
Selection of Appropriate Teaching Methods

It is important to consider the classroom environment in selecting an appropriate teaching method for a lesson. The space available in a class, ventilation, illumination and other teaching devices in a classroom, etc all these affect the choice of teaching methods to be used. A Programme Chart for Selecting Appropriate Teaching Method (Ellington& Earl,1998)

Stage 1	Are you clear as to what your instructional objectives are? If not clarify them now
Stage 2	Choose the teaching method that you think would be the best suited to helping your students achieve these particular objectives in the context of their scheme of work.
Stage 3	Will your students be comfortable with the method (s) you have chosen?
	↓ Yes
Stages 4	Will you yourself be comfortable with the method (s) you have chosen?
	↓ Yes
Stage 5	Will your chosen method (s) be practical?
	↓ Yes
Stage 6	Will you be allowed to use the method (s) you have chosen?
	↓ Yes
Stage 7	Use the chosen method (s) with your students.

In situations where teachers fail to use appropriate teaching methods, a good curriculum plan could turn out to be damaged. The main purpose of curriculum implementation is to translate the ideas into a workable blueprint, and this can be achieved basically by using appropriate teaching methods in the class. The following suggestions are made for the effective use of teaching methods in the teaching and learning process.

➢ Teachers should know the nature of the subject matter to be taught and be conversant with it to enable him/her to determine the most suitable teaching method/methods to use in a given lesson.

➢ The instructional objectives, a teacher intends to achieve by the end of the lesson determine to an extent the type of teaching methods.

➢ The teacher must be very familiar with the type of teaching methods he/she wants to use at any given time and must ensure it is most appropriate for the success of the lesson.

➢ The teacher must consider the age, interest, etc of the learner and ensures the right teaching methods and materials that will suit the learners are in place.

➢ In choosing appropriate teaching methods, the teacher is encouraged to consider the time to be used for a lesson, as this will go a long way to determine also the type of teaching methods to use.

➢ The teacher should put into consideration the population of the class, the environment and the size of the class. This will help to determine the most suitable teaching method to use for a lesson and make it worthwhile.

CONCLUSION

The teacher is a vital factor in the success of an educational system in a nation. Teaching is an attempt to bring about desirable changes in human learning, abilities, and behavior. Effective implementation of the curriculum is dependant in the effective use of appropriate teaching methods in the classroom. Teaching methods are used to facilitate students learning and satisfaction. A combination of teaching methods is encouraged for effective teaching. A variety of the use of teaching methods is a must for teachers if learning is to be effective and efficient.

To evaluate the student works for attainment of course outcomes and hence POs, it is of utmost importance to have reliable methods / proper assessment tools. Rubrics provide a powerful tool for assessment and grading of student work. They can also serve as a transparent and inspiring guide to learning. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students (and to other markers) your expectations in the assessment, and what you consider important.

There are three components within rubrics namely
(i)   Criteria / Performance Indicator: the aspects of performance that will be assessed,
(ii)   Descriptors: characteristics that are associated with each dimension, and
(iii)   Scale/Level of Performance: a rating scale that defines students' level of mastery within each criterion.

Fig. 4: Examples of Rubrics (Accessed from Rogers 2010)

OPEN-BOOK EXAMINATIONS - THROUGH ASSIGNMENTS

It was noted that the traditional written examinations have a significant weakness that they tend to encourage rote learning and more superficial application of knowledge.

This deficiency can be overcome by "open-book examination". Open-book examination is similar to time constrained written examinations but designed in a way that allows students to refer to either class notes, textbooks, or other approved material while answering questions. They are particularly useful if you want to test skills in application, analysis and evaluation, i.e. higher levels of Bloom's taxonomy.

However, in a program, the courses or the curriculum areas that are best suited to an open-book exam are to be carefully chosen.

Advantages of open-book examinations
1. Less demanding on memory and hence less stressful
2. Questions can emphasis more on problem-solving, application of knowledge and higher-order thinking rather than simple recall of facts.
3. Assessment questions can reflect real-life situations that require comprehension, information retrieval and synthesizing skills of the students to solve.

Designing a good open-book examination

- Set questions that require students to do things with the information available to them, rather than
- To merely locate the correct information and then summarize or rewrite it.
- The questions in open-book exam must take advantage of the format, and give more weightage to the application of knowledge, critical thinking and use of resources for solving real complex managerial problems.
- As the nature of questions is complex, it is to be ensured that the students get enough time. Open book test questions typically take longer time compared to traditional examinations. It is advisable either to set less number of questions that encompass 2 or 3 concepts taught or allocate longer duration of time for the examinations.

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APPENDIX

Competencies and Performance Indicators (PIs)

Appendix-A

PO 1: Domain knowledge: Apply the knowledge of Core Courses (CC) / Discipline Specific Electives (DSE) / Ability Enhancement Compulsory Course (AECC) / Skill Enhancement Course (SEC) / Open Elective Course (OEC) specialization for the solution of complex domain problems.		
Competency		**Indicators**
1.1	Demonstrate competence in Functional Area modeling : Core Courses (CC)	1.1.1 Apply the knowledge of Functional Area modeling techniques such as : Core Courses in Management, Quantitative Techniques; Managerial Economics; Accounting for Management; Financial Management; Business Research; Management of Information Systems; Management of International Business; Managing E-Business; Strategic Management specialization for the solution of complex domain problems.
1.2	Demonstrate competence in basics of Discipline Specific Electives (DSE)	1.2.1 Apply the knowledge of basic of Functional Area: Discipline Specific Electives Courses in Management: Electives of Marketing, Finance, HR, IT, IB, Operation & Analysis techniques to solve problems
1.3	Demonstrate competence in fundamental of Ability Enhancement Compulsory Course (AECC)	1.3.1 Apply the knowledge of Fundamentals of Theory & Principal of Functional Area: Ability Enhancement Compulsory Courses fundamental concepts in Management: Communication in Organizations; Minor Project, MOOC/Open Elective; Project Dissertation; Corporate Social Responsibility, Human Values & Ethics
1.4	Demonstrate competence in specialized Skill Enhancement Courses (SEC)	1.4.1 Apply the knowledge of specialized Skill Enhancement Courses: Information Technology Management; Information Technology Management Lab; Professional Skill Development (NUES); Business Analytics; Business Analytics Lab to solve problems
1.5	Demonstrate competence in Functional Area : Open Elective Courses (OEC)	1.5.1 Apply the knowledge of Functional Area: Open Elective Courses to solve problems
PO 2: Problem analysis: Identify, formulate, research literature, and analyze complex Managerial problems reaching substantiated conclusions using first principles of fundamental management		
Competency		**Indicators**
2.1	Demonstrate an ability to identify and formulate complex Managerial problem	2.5.1 Evaluate problem statements and identifies objectives 2.5.2 Identify managerial processes/modules of a parameters to solve a problem 2.5.3 Identify fundamental, basic, concepts of management domain knowledge that applies to a given problem
2.6	Demonstrate an ability to formulate a solution plan and methodology for an Managerial problem	2.6.1 Reframe the management-based system into interconnected subsystems 2.6.2 Identify functionalities and managerial resources. 2.6.3 Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions 2.6.4 Compare and contrast alternative solution/methods to select the best methods 2.6.5 Compare and contrast alternative solution processes to select the best process.

2.7	Demonstrate an ability to formulate and interpret a model	2.7.1	Able to apply principles of management domain to formulate modules of a system with required applicability and performance.
		2.7.2	Identify design constraints for required performance criteria.
2.8	Demonstrate an ability to execute a solution process and analyze results	2.8.1	Applies management fundamentals to implement the solution.
		2.8.2	Analyze and interpret the results using contemporary tools.
		2.8.3	Identify the limitations of the solution and sources/causes.
		2.8.4	Arrive at conclusions with respect to the objectives.

PO 3: Design/Development of Solutions: Design solutions for complex managerial problems and design system components or processes that meet the specified needs with appropriate consideration for managerial, processes, problems, procedures, ethical, safety , cultural, societal, and environmental considerations.

	Competency		Indicators
3.5	Demonstrate an ability to define a complex/ open-ended problem in management domain	3.5.1	Able to define a precise problem statement with objectives and scope.
		3.5.2	Able to identify and document system requirements from stake-holders.
		3.5.3	Able to review state-of-the-art literature to synthesize management requirements.
		3.5.4	Able to choose appropriate quality attributes as defined by ISO/NAAC/NBA/AICTE standard.
		3.5.5	Explore and synthesize system requirements from larger social and professional concerns.
		3.5.6	Able to develop managerial requirement specifications (MRS).
3.6	Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.1	Able to explore design alternatives.
		3.6.2	Able to produce a variety of potential design solutions suited to meet functional requirements.
		3.6.3	Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.7	Demonstrate an ability to select optimal design scheme for further development	3.7.1	Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
		3.7.2	Consult with domain experts and stakeholders to select candidate managerial design solution for further development
3.8	Demonstrate an ability to advance an managerial design to defined end state	3.8.1	Able to refine management design into a detailed design within the existing Constraints.
		3.8.2	Able to implement and integrate the modules.
		3.8.3	Able to verify the functionalities and validate the design.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

	Competency		Indicators
4.4	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.4.1	Define a problem for purposes of investigation, its scope and importance
		4.4.2	Able to choose appropriate procedure/algorithm, dataset and test cases.
		4.4.3	Able to choose appropriate hardware/software tools to conduct the experiment.
4.5	Demonstrate an ability to design	4.5.1	Design and develop appropriate procedures/ methodologies based on the study objectives

	experiments to solve open-ended problems			
4.6	Demonstrate an ability to analyze data and reach a valid conclusion	4.6.1	Use appropriate procedures, tools and techniques to collect and analyze data	
		4.6.2	Critically analyze data for trends and correlations, stating possible errors and limitations	
		4.6.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions	
		4.6.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions	

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern management and IT tools including prediction and modeling to complex managerial activities with an understanding of the limitations.

	Competency		Indicators
5.4	Demonstrate an ability to identify/ create modern management tools, techniques and resources	5.4.1	Identify modern management tools, techniques and resources for managerial activities
		5.4.2	Create/adapt/modify/extend tools and techniques to solve complex managerial problems
5.5	Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.4.3	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating managerial designs.
		5.4.4	Demonstrate proficiency in using discipline-specific tools
5.6	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an managerial problem	5.4.5	Discuss limitations and validate tools, techniques and resources
		5.4.6	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess managerial, processes, problems, procedures, ethical, safety, cultural, societal, and environmental issues and the consequent responsibilities relevant to the professional managerial practice.

	Competency		Indicators
6.3	Demonstrate an ability to describe management roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.3.1	Identify and describe various management roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.4	Demonstrate an understanding of professional management	6.4.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

	regulations, legislation and standards	

PO 7: Environment and sustainability: Understand the impact of the professional management solutions societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

	Competency	Indicators
7.3	Demonstrate an understanding of the impact of management and industrial practices on social, environmental and in economic contexts	**7.3.1** Identify risks/impacts in the life-cycle of an managerial activity **7.3.2** Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.4	Demonstrate an ability to apply principles of sustainable design and development	**7.3.3** Describe management techniques for sustainable development **7.3.4** Apply principles of preventive management and sustainable development to an managerial activity or product relevant to the discipline

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the managerial practice.

	Competency	Indicators
8.3	Demonstrate an ability to recognize ethical dilemmas	8.3.1 Identify situations of unethical professional conduct and propose ethical alternatives
8.4	Demonstrate an ability to apply the Code of Ethics	**8.4.1** Identify tenets of the ASME professional code of ethics **8.4.2** Examine and apply moral & ethical principles to known case studies

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

	Competency	Indicators
9.4	Demonstrate an ability to form a team and define a role for each member	**9.4.1** Recognize a variety of working and learning preferences; appreciate the value of diversity on a team **9.4.2** Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.5	Demonstrate effective individual and Team operations- communication, problem- solving, conflict resolution and leadership skills	**9.5.1** Demonstrate effective communication, problem-solving, conflict resolution and leadership skills **9.5.2** Treat other team members respectfully **9.5.3** Listen to other members **9.5.4** Maintain composure in difficult situations
9.6	Demonstrate success in a team-based project	9.6.1 Present results as a team, with smooth integration of contributions from all individual efforts

PO 10: Communication: Communicate effectively on complex managerial activities with the management community and with the society at large, such as being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions

	Competency	Indicators
10.4	Demonstrate an ability to comprehend technical literature and document project work	**10.6.1** Read, understand and interpret technical and non-technical information **10.6.2** Produce clear, well-constructed, and well-supported written management managerial documents **10.6.3** Create flow in a document or presentation - a logical progression of ideas so that **10.6.4** the main point is clear
10.5	Demonstrate competence in listening, speaking, and presentation	**10.6.5** Listen to and comprehend information, instructions, and viewpoints of others **10.6.6** Deliver effective oral presentations to technical and non-technical audiences
10.6	Demonstrate the ability to integrate different modes of communication	**10.6.7** Create management -standard figures, reports and drawings to complement writing and presentations **10.6.8** Use a variety of media effectively to convey a message in a document or a presentation

PO 11: Project management and finance: Demonstrate knowledge and understanding of the management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

	Competency	Indicators
11.4	Demonstrate an ability to evaluate the economic and financial performance of an managerial activity	**11.4.1** Describe various economic and financial costs/benefits of an managerial activity **11.4.2** Analyze different forms of financial statements to evaluate the financial status of an management project
11.5	Demonstrate an ability to compare and contrast the costs/ benefits of alternate proposals for an managerial activity	11.5.1 Analyze and select the most appropriate proposal based on economic and financial considerations
11.6	Demonstrate an ability to plan/manage an managerial activity within time and budget constraints	**11.6.1** Identify the tasks required to complete a managerial activity, and the resources required to complete the tasks. **12.4.1** Use project management tools to schedule a management project, so it is completed on time and on budget.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

	Competency	Indicators
12.4	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	**12.4.2** Describe the rationale for the requirement for continuing professional development **12.4.3** Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

12.5	Demonstrate an ability to identify changing trends in management knowledge and practice	12.4.4 Identify historic points of technological advance in management that required practitioners to seek education in order to stay current 12.4.5 Recognize the need and be able to clearly explain why it is vitally important to keep 12.4.6 current regarding new developments in your field
12.6	Demonstrate an ability to identify and access sources for new information	12.4.7 Source and comprehend technical literature and other credible sources of information 12.4.8 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

APPENDIX
Samples Questions for Blooms Taxonomy Levels

SAMPLES QUESTIONS FOR BLOOMS TAXONOMY LEVELS:

1. REMEMBER

Skill Demonstrated	Question Ques. / Verbs for tests
• Ability to recall of information like, facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, describe, state, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.

Sample Questions:

1. .
2.
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4.
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12.
13.
14.
15.
16.

UNDERSTAND

Skill Demonstrated	Question Ques / Verbs for tests
• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss

Sample Questions:

1.   .

2.

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16.

APPLY

Skill Demonstrated	Question Ques / Verbs for tests
• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills or knowledge • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify

Sample Questions:

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2.

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4.

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14.

15.

16.

ANALYZE

Skill Demonstrated	Question Ques / Verbs for tests
• break down a complex problem into parts. • Identify the relationships and interaction between the different parts of complex problem	classify, outline, break down, categorize, analyse, diagram, illustrate, infer, select

Sample Questions:

1. .
2.
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15.
16.

EVALUATE

Skill Demonstrated	Question Ques / Verbs for tests
• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate

Sample Problem

1. .
2.
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12.
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14.
15.
16.

CREATE

Skill Demonstrated	Question Ques / Verbs for tests
• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

Both higher order cognitive skills 'Evaluate' and 'Create' are difficult to assess in time-limited examinations. These need to be assessed in variety of student works like projects, open ended problem- solving exercises etc. Typical examples of problem statements or need statements which need higher order abilities to solve are given below:-

Sample Problem / Need statements:

1. Automatic tethering of milking machine to the udder of a cow. A milk diary wants to automate the milking process. The milking process involves attaching the milking cups to the teats. Design a system for the same.
2. An electric vehicle uses LIoN batteries. The batteries have to be charged and get discharged during use.
   The batteries require continuous monitoring during charging and discharging so that they remain healthy and yield a long life. Design a system to monitor and manage the health of the batteries.
3. A Biotech industry needs automation for filling its product into 20 ltr bottles. Design a system to meter the flow into the bottles so that each bottle has 20 ltr of the liquid. There will be more than one filling station and the system has to monitor all the filling stations as well as keep count of the total production on a daily basis.
4. Microwave Doppler radar with a range of 9m are available for motion detection. Design a surround view monitoring system for a 3 wheeler to detect human obstacles while the vehicle is in motion.
5. Design a system to assist the driver by using cameras to detect lane markers and pedestrians while the vehicle is in motion.
6. Develop a small size USB 2.0 / 3.0 CMOS camera system which can be used for industrial inspection, medical applications, microscopy, etc. The system should be able to capture the image quickly and be able to process the captured image and then store it also

APPENDIX
Sample Scoring Rubrics

RUBRICS FOR COMMUNICATION (WRITTEN & ORAL)

Component	Proficient	Acceptable	Needs Improvements
Written Communication	Report is well organized and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Diagrams or analyses enhance and clarify presentation of ideas. Sentences are grammatical and free from spelling errors.	Report is organized and clearly written for the most part. In some areas the logic or flow of ideas is difficult to follow. Words are well chosen with some minor exceptions. Diagrams are consistent with the text. Sentences are mostly grammatical and only a few spelling errors are present but they do not hinder the reader.	Report lacks an overall organization. Reader has to make considerable effort to understand the underlying logic and flow of ideas. Diagrams are absent or inconsistent with the text. Grammatical and spelling errors make it difficult for the reader to interpret the text in places.
Presentation Visual Aids	Slides are error-free and logically present the main components of the process and recommendations. Material is readable and the graphics highlight and support the main ideas.	Slides are error-free and logically present the main components of the process and recommendations. Material is mostly readable and graphics reiterate the main ideas.	Slides contain errors and lack a logical progression. Major aspects of the analysis or recommendations are absent. Diagrams or graphics are absent or confuse the audience.
Oral Presentation	Speakers are audible and fluent on their topic, and do not rely on notes to present or respond. Speakers respond accurately and appropriately to audience questions and comments.	Speakers are mostly audible and fluent on their topic, and require minimal referral to notes. Speakers respond to most questions accurately and appropriately.	Speakers are often inaudible or hesitant, often speaking in incomplete sentences. Speakers rely heavily on notes. Speakers have difficulty responding clearly and accurately to audience questions.

Body Language	Body language, as indicated by appropriate and meaningful gestures (e.g., drawing hands inward to convey contraction, moving arms up to convey lift, etc.) eye contact with audience, and movement, demonstrates a high level of comfort and connection with the audience.	Body language, as indicated by a slight tendency to repetitive and distracting gestures (e.g., tapping a pen, wringing hands, waving arms, clenching fists, etc.) and breaking eye contact with audience, demonstrates a slight discomfort with the audience.	Body language, as indicated by frequent, repetitive and distracting gestures, little or no audience eye-contact, and /or stiff posture and movement, indicate a high degree of discomfort interacting with audience.

RUBRICS FOR ASSESSMENT OF DESIGN PROJECTS

Category	Needs Improvements	Acceptable	Proficient
Purpose of the Project	Does not clearly explain the intended outcome of the project or provides little information about the problem that was being solved, the need being met, or why the project was selected	Provides a description of the intended outcome of the project which includes information about the problem that was being solved or the need being met, and why the project was selected	Provides a detailed intended outcome of the project which includes information about the problem that was being solved or the need being met, and clearly articulates the reasons and decision-making process used to select the project
Research	Lacks awareness of similar work done by others in an unacceptable literary form	Reflects awareness of similar work done by others and presents it in an acceptable literary format	•Reflects thorough understanding of similar work done by others and presents it in an acceptable literary format
Choices	Lacks justification of choices with little or no references to functional, aesthetic, social, economic, or environmental considerations	Justifies choices made with reference to functional, aesthetic, social, economic, or environmental considerations	Demonstrates sophisticated justification of choices with reference to functional, aesthetic, social, economic, or environmental consideration
Alternative Designs	Only one design presented or clearly infeasible alternative given. Serious deficiencies in exploring and identifying alternative designs.	Alternative approaches identified to some degree.	Final design achieved after review of reasonable alternatives.
Application of Technical Principles	No or erroneous application of technical principles yielding unreasonable solution. Serious deficiencies in proper selection and use of technical principles.	Effective application of technical principles resulting in reasonable solution.	Critical selection and application of technical principles ensuring reasonable results.
Final Design	Not capable of achieving desired objectives.	Design meets desired objectives.	Design meets or exceeds desired objectives.
Interpretation of Results	No or erroneous conclusions based on achieved results. Serious deficiencies in support for stated conclusions.	Sound conclusions reached based on achieved results.	Insightful, supported conclusions and recommendations.

Rubrics can also be used effectively to design the continuous assessment of the student projects. The Performance Indicators referred to in the previous sections can be used measurement criteria in the rubric. In the following example, we can see that for different phases of the students' projects, we can design the rubrics keeping in mind the deliverables of the project at that particular stage.

5- SEMESTER MINI PROJECT

RUBRICS FOR REVIEW – I

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
2.1.1	Articulate problem statements and identify objectives - GA	02	Problem statement and objectives are not identified	Problem statement and objectives are not clear	Problem statement is clear and objectives are not in line with problem statement	Problem statement is clear and objectives are not completely defined.	Problem statement is clear and objectives are completely defined
2.1.2	Identify technical systems, variables, and parameters to solve the problems - IA	02	Technical systems are not identified. Variables, and parameters to solve the problems are not defined	Technical systems are identified but not clear. Variables, and parameters to solve the problems are not defined	Technical systems are clear. Variables, and parameters to solve the problems are not defined	Technical systems are identified. Variables, and parameters to solve the problems are partially defined	Technical systems are identified. Variables, and parameters to solve the problems are completely defined
2.2.3	Identify existing processes/ solution methods for solving the problem, including forming justified approximations and assumption - GA	02	Not able to identify existing solution for solving the problem. The assumptions, approximations and justifications are also not identified.	Not able to identify existing solution for solving the problem. The assumptions, approximations and justifications are identified but not clear	Not able to identify existing solution for solving the problem. But assumptions and approximations are aligned to the objectives.	Able to identify existing solution for solving the problem. Assumptions, and approximations are clear	Able to identify existing solution for solving the problem. But assumptions, approximations and justifications are clear
2.2.4	Compare and contrast alternative solution processes to select the best process-GA	02	Not able to identify alternative solution processes	Not able to compare alternative solution processes	Able to compare alternative solution processes but could not contrast clearly	Able to compare alternative solution processes and contrast clearly but not able to select best process	Able to compare alternative solution processes, contrast it and also able to select best process
10.1.1	Read, understand and interpret technical and non-technical information - GA	02	Not able to identify technical and non-technical information	Able to identify non-technical information	Able to read technical and non-technical information, but could not understand and interpret	Able to read, understand technical and non-technical information, but could not interpret	Able to read, understand and interpret technical and non-technical information

GA – Group Assessment   IA – Individual Assessment

RUBRICS FOR REVIEW – II

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.2.1	Apply formal idea generation tools to develop multiple technical design solutions - GA	02	Not able to identify tools to develop solutions	Able to identify but not able to use it effectively	Able to use the tool but not able to generate technical designs	Able to generate technical designs but not able to justify	Able to generate technical designs with justification
3.2.3	Identify suitable criteria for evaluation of alternate design solutions - GA	02	Not able to identify criteria	Able to identify criteria but not able to use them	Able to use criteria but not able to compare alternatives	Not able to justify the comparison with criteria	Able to justify the comparison with criteria
3.3.1	Apply formal decision- making tools to select optimal technical design solutions for further development- GA	02	Not able to identify decision-making tools	Able to identify but not able to choose optimum one	Able to identify optimum one but not able to use it	Able to use optimum one but not able to justify	Able to use optimum one with justification
3.2.2	Build models/ prototypes to develop diverse set of design solutions - IA	02	Not able to identify tool to build model/ prototype	Able to choose the tool but not able to use it effectively	Able to use the tool but not able to generate alternatives	Able to generate alternatives but not able to justify the best solution	Able to generate and justify the best solution
13.1.1	Develop 2D drawings of components/ systems using modern CAD tools - IA	02	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tool but not able to generate drawings	Able to generate drawings but not able to follow drawing standards	Able to generate drawings with standards
13.1.2	Develop 3D models of components/systems using modern CAD tools - IA	03	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tool but not able to generate 3D models	Able to generate models but not able to follow standards	Able to generate models with standards
13.1.3	Apply GD&T principles as per ASME standards to manufacturing drawings, with all relevant data like material, hardness, surface finish, and tolerances - IA	02	Not able to extract GD&T principles from ASME standards	Able to extract but not able to understand them	Able to understand but not able to apply GD&T standards	Able to apply GD&T standards to drawings but not able to justify	Able to apply and justify GD&T standards to drawings

GA – Group Assessment   IA – Individual Assessment

RUBRICS FOR REVIEW – III

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.4.2	Generate information through appropriate tests to improve or revise design - GA	02	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedure	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement
4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data - GA	04	Not able to identify tools, techniques and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards
4.3.2	Analyze data for trends and correlations, stating possible errors and limitations - GA	03	Not able to understand data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations
10.2.2	Deliver effective oral presentations to technical and non- technical audiences - IA	03	Could not deliver effective presentations.	Could not deliver presentation, but presentation was prepared and attempted.	Able to deliver fair presentation but not able to answer to the audiences	Deliver effective presentations but able to answer partially to the audience queries.	Deliver effective presentation and able to answer all queries of the audience.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts – GA + IA	03	No Contribution from an individual to a team	Contributions from an individual to a team is minimal	Contributions from an individual to a team is moderate	A contribution from an individual to a team is good but not well groomed in team.	Contribution from an individual to a team is good and results in an integrated team presentation.

GA – Group Assessment   IA – Individual Assessment

TECNIA

INSTITUTE OF ADVANCED STUDIES

NAAC ACCREDITED GRADE "A" INSTITUTE

DELHI | INDIA

Tecnia Campus, Institutional Area, Madhuban Chowk, Rohini, Delhi-110085
Contact: 011-27555121-24
For Details Visit: Website: www.tiaspg.tecnia.in
E-Mail: directortias@tecnia.in