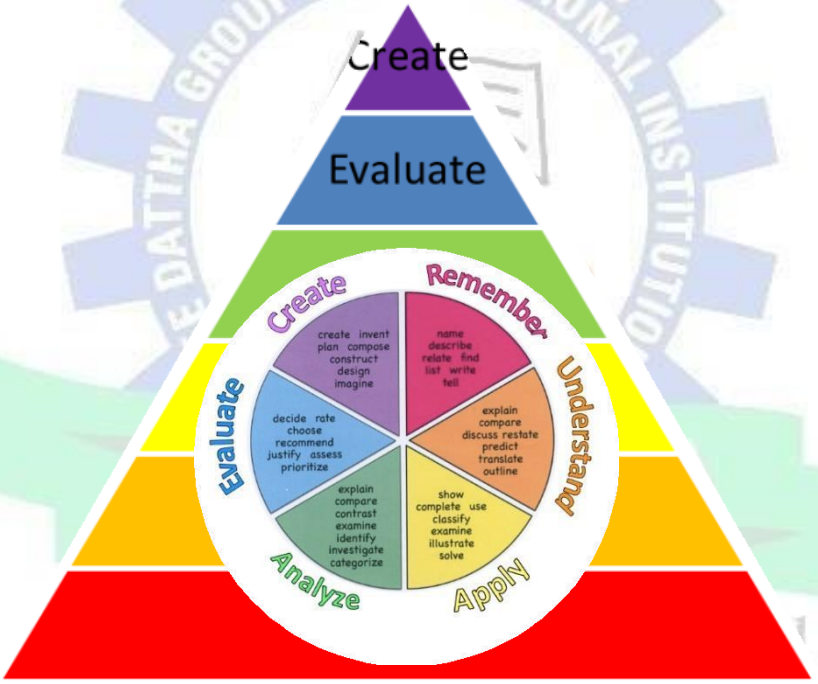
INSTITUTE ACADEMIC POLICY

Estd. 2001

SREE DATTHA
Applying Minds

ACADEMIC POLICY

2022-23



SREE DATTHA INSTITUTIONS

Sheriguda, Ibrahimpatnam, Greater Hyderabad

I N D E X

I. ATTENDANCE:

it has been observed from the university exam results that a student attending 75% of classes has passed with good grades in all their courses and labs. Students attending the classes regularly have shown better performance than those who were irregular to the classes and labs, therefore regular attendance of students in their classes and labs are directly related to their performance in the examination. Teachers need to understand that improvement in the attendance of students can be achieved only by conducting interesting lectures, activity-based outcome-based teaching-learning processes complemented with the conduction of problem-solving activities in the labs. Parents should be kept updated about the attendance of their son or daughter besides the information about grades achieved by them in tests and examinations. Students should be educated about attendance versus performance relations. the detailed attendance regulations are mentioned in **Annexure - I**

II. CLASS CONDUCTION: Faculty should be able to generate interest in students by invoking their curiosity and by engaging the students in active learning, experiential learning, and research-based learning, this will successfully attract students to their classes. Engaging the students with content is one of the important tasks of a faculty. Using modern pedagogy in the class has led to greater learning than using the conventional chalk and talk method.

Classes should be conducted as per the guidelines given in the academic policy and all the academic activities, extra-curricular and co-curricular activities should be scheduled as per the college and University almanac. The details of class conduction and guidelines are mentioned in **Annexure-II**

III. LAB CONDUCTION:

Undergraduate laboratories are losing their significance in private engineering education. The students feel it boring and not intellectually challenging. Laboratory teaching is a second-rated job for the teachers. But actually, the laboratory training provides technical competence in the usage of machines, experimental research skills, creativity and design skill, decision-making skill, teamwork, etc. The major problem with the laboratory is that they fail to attract students and staff. The laboratory courses need to be taught with personal interest by a faculty should encourage the students to make use of the laboratories by engaging them in problem-solving skills using innovative ideas technologies, this is required to meet the challenges of learning the rapidly changing business technologies and to bridge the gap between industry and academia, thus it is extremely essential to give more focus on the effective usage of laboratories.

The details of lab conduction and guidelines are mentioned in **Annexure - III**

IV. MENTORS – ROLES AND RESPONSIBILITIES: The role of a teacher is not just limited to the completion of the syllabus, rather a teacher has greater responsibilities to develop the overall persona of a student, one such responsibility is effective mentoring and counseling. The counseling can be concerning the academic affairs as well as the personal issues of a student; A mentor should be a good listener, compassionate and empathetic to understand the issues brought forth by the students and using his/ her wisdom and experience attempt to resolve those issues. If a mentor feels that he is not competent or experienced enough in dealing with particular issues then he or she should take the support of senior faculty capable of handle those issues. The proceedings of mentoring and counseling should be documented clearly in the mentor diaries.

Mentor diaries and files are subjected to an audit every week/ fortnight/ month or semester. The details of mentoring and counseling are mentioned in **Annexure – IV**

V. EXAMINATION (EXTERNAL/ INTERNAL): we have observed students practicing exam techniques rather than carrying out learning activities. Hence exams certainly need to Examinations, assignments, slip tests, quizzes are assessment mechanisms to gauge the phase-wise end semester performance of a student. These assessment types fall into two categories 1. Formative and 2. Summative. faculty should use formative assessment to continuously monitor the progress of students' performance in the entire semester.

Details of examination guidelines are mentioned in **Annexure – V**

VI. DISCIPLINE: The College can successfully run only if it maintains good discipline. A lot of importance is given to this area. The detailed rules and regulations related to it are mentioned in **Annexure - VI**

VII. ACADEMIC PUNISHMENT: A novel method of correcting acts of misconduct has been devised. Instead of monetary penalization, students will be given academic punishments for a range of undesirable acts, like, giving proxy attendance, not attending classes regularly, wandering on campus by bunking classes, not wearing an ID card, scribbling on college property, littering the classroom, and many more such acts. A list of academic punishments that can be levied on a student is mentioned in

Annexure-VII

VIII. STUDENT CLUBS: clubs should be formed by each Department to involve the students in activities like placements, seminars, symposiums, sports, cultural events, newsletters, etc. to provide a substantial amount of extracurricular activities along with quality academics. Details are mentioned in **Annexure VIII**.

IX. VALUE ADDED PROGRAMS: Value-added programs serve as parallel streams of learning and bridge the gaps in the curriculum. It is extended learning which provides beyond the syllabus exposure to the students. Faculty should be the torchbearers for this kind of program and should motivate the students to participate in it. A mechanism for regular monitoring should be devised by the heads; Assessment at regular periods should be done to monitor the progress and benefits brought by such activities. The value-added programs successfully implemented in the college are:

1. Remote Training Center of IIT Bombay & Kharagpur
2. FOSS – Spoken Tutorial Workshops – IIT Bombay
3. Research and Development Center – IIT Bombay
4. M o U with UiPath, ICT Academy, Idealabs.
5. Centre of Excellence: Dell/ EMC, Tech Mahindra's – Blockchain and Microsoft's – AI/ ML
6. Campus Recruitment Training program.
7. Mini and main projects from Industries.

Details of value-added programs are mentioned in **ANNEXURE – IX**

X. CR / STUDENTS MEETINGS: involving students in drafting the academic and disciplinary policies of the college and having better communication with them will lead to a good understanding between the students and management. CR meets is one such mechanism to bring all the representatives of respective classrooms to one place and discuss their problems and also to share their ideas, opinions, and suggestions. CR meets should be conducted every fortnight and the heads should take an interest to motivate the students to attend such meetings regularly. Head of the Departments and class teachers should make sure that the issues discussed in the meet are announced in the classrooms to all the students and acknowledgment obtained.

XI. The following administrative setup shall be put into place for the attainment of POs and PEOs.

- Program Coordinator
- Module Coordinator
- Program Assessment Committee
- Department Advisory Board

The functioning of the above administrative setup is mentioned in **ANNEXURE - X**

XII. PARENTS MEET: Effective communication with parents and their cooperation in the areas of student reforms plays a vital role in the management – parent relation-building process as well as towards the positive development of a student. Any new concept or change should be informed to the parents and their involvement should be sought for the successful implementation of that. The suggested period for the meeting can be after the declaration of university results or after the MID term exams.

XIII: INTRODUCTION OF I^3 (INDUSTRY INSTITUTE INTERFACE)

Activities:

1. Tie – up with Industries for certification programs.
2. Establishment of the various center of excellence on the campus by IT as well as the core industries.
3. mini and main projects to be done with the help of Industry
4. Faculty should motivate the students to involve and participate in the programs notified by our industry partners from time to time; the association with industries will not only provide training on cutting-edge technologies and internships but also placements to both UG and PG graduates.

5. Quality improvements of CSE – IT labs, putting the students in a habit of problem-solving.

6. Conduct talks by people from the Industry

XIV: ENTREPRENEURSHIP ACTIVITY:

The Placement and Training Officer or a senior person from a management background should be the In charge of the followingactivities to be conducted under EDC cell:

1. Promotion of boot camps, Hackathons, and talks by mentors and experts on Entrepreneurship through the Entrepreneurship Development Cell should be regularly done.

2. Identifying faculty for attending training and workshops on entrepreneurship

3. Conduction of workshop and seminars for students

4. Equipping the students with the knowledge of setting up their own business

5. Identifying the industries that support incubation activities

6. Conduct mentor and expert talks regularly

7. Identifying venture capitalist and Angel Investors

XV: RESEARCH AND DEVELOPMENT CELL:

Research is a process of systematic inquiry that involves gathering data; documentation of critical information; and analysis and understanding of that data or information, in agreement with appropriate procedures based on scientific principles.

The research assesses the validity of a hypothesis; to accumulate practical knowledge and findings for sharing them in proper manners and to generate questions for further inquiries

Today, the criticality of research is more than ever before, for the economic, intellectual, societal, environmental, and technological health and progress of a nation.

Research and innovation at education institutions in India, particularly those that are engaged in higher education, are critical. Evidence from the world's best universities throughout history shows that the best teaching and learning processes at the higher education level occur in environments where there is also a strong culture of research and knowledge creation; conversely, much of the very best research in the world has occurred in multidisciplinary university settings.

To enable research and development activity a Research and Development Cell is created the details of which are mentioned in **Annexure - XI**

ANNEXURE – 1

Class attendance facilitates learning in a variety of ways. Lectures supplement reading assignments. Classroom presentations present information differently than the text. Discussion and elaboration of topics provide current information that may not be found in the textbook. Hearing the comments and questions of others can answer your questions. Instructors can use class discussion to enhance critical thinking skills. They can pose questions that require students to make connections between concepts and relate what they are learning to real life. The more students analyze and examine material, the better their retention will be. As you can see, attending class regularly gives you much more than just credit for attendance.

Most people who fail in a course(s) were found to be irregular in their classes and labs. Regular class attendance requires discipline and time management skills. These skills are beneficial no matter what career path you choose. Attending class also increases a student's interaction with a variety of faculty members. This raises the likelihood of finding mentors and role models who can help guide their academic, career, and personal development.

Students seem to be aware that class attendance is important. Some of the students think that getting class notes from a missed class is as useful as attending class. These few students who thought borrowed notes were as good as going to class had significantly lower grades in their tests and exams than those who valued class attendance more than borrowed notes. Also, there is a strong relationship between the number of absences and the final course grade. The majority of students understand that attending class is important, though there are students who think that they would miss more classes if they could get missed notes directly from their faculty.

Students miss class for a variety of reasons. Some of the most frequent reasons are because they need to complete other course work related to higher studies or career, find the class boring, are ill, or have social obligations.

Some faculty are very textbook-oriented. You will run into some who read the text rather than provide extraneous information in their lecture. students may think this is a waste of their time to attend class. It is not. While their instructor is reciting the text, they are hopefully absorbing the information and in turn, decreasing their study time later on. If students pay attention in class, they may be surprised by how much they can cut their study time later on. No textbook can explain something to a student as another person can.

Some faculty are not textbook-oriented at all. They lecture their material and the textbook is used for clarification of concepts. In a class like this, test questions will more than likely be based on lecture notes, not the text. Good notes are what will save students. students won't have good notes if they don't attend class.

Regardless of what kind of faculty we have, students should keep in mind that lectures are a continuation. One follows the other – if they miss one and don't get the notes, they will be missing chunks of information. Since most information is cumulative, this can lead to them not grasping entire concepts.

Students who attend class regularly do better in class. Engaged students do not just fill a seat. They participate in class discussions and ask appropriate questions. Missing an occasional class is not the end of the world. Faculty understands that they may become sick or have other legitimate reasons to not be in class. If students come to class regularly and participate, The faculty will know that missing class is not the norm for you.

Some college faculty believe that students should be allowed to decide whether to attend class. Others believe that attendance should be mandatory. **Regardless of your opinion, expectations regarding attendance should be clearly explained for each class**. **Attendance objectives should also be attainable. Students are often more willing to comply with policies when they understand why the policies exist**. **Communicating attendance expectations conveys a level of adult-to-adult respect between students and faculty. Remember, there may be consequences for missing class. These consequences should be conveyed along with attendance policies.**

Skipping classes can be a fast track to poor performance, increased stress and anxiety, lower GPAs, dropping classes, and even dropping out of school. Realize that going to class is not a decision that needs to be made.

GOOD ATTENDANCE LEADS TO:

a. Better assimilation or understanding of the course
b. Continuous interaction between students and teacher towards improvement in the quality of a student academic life
c. Better assimilation of the courses leads to greater confidence in a student, and better performance in laboratories also leads to creative & innovative thinking and good grades in the examination
d. students scoring 75% of aggregate in all courses of all the semesters will qualify for recruitment opportunities in top Industries.
e. Increasing their participation and involvement in extracurricular and co-curricular activities
f. Better availability and reachability to the students

STEPS TO IMPROVE ATTENDANCE:

i. It should be announced in the class of students that 75% of class attendance will be mandatory for all students.

ii. De-Centralized attendance register system

a. Each faculty will maintain a digital or manual attendance register related to his or her course(s) in each semester

b. Fortnightly attendance should be calculated and displayed on the department notice boards, percentage of student's class attendance should be informed to students and obtain their acknowledgment, it should also be informed to parents/ guardian through an SMS/ email and should maintain proof of it.

iii. Information about students having less than 75% of class attendance should be sent to their parents through registered posts.

Regularity and punctuality:

iv. To discourage students from deliberately missing any of their classes in a day they should be marked absent throughout the day.

v. Students who report after the commencement of the first period should not be permitted in the class, and they should be discouraged from reporting late to the college through regular counseling.

vi. Students who bunk their classes regularly should be identified and counseled by the teachers/ mentors and they should be imposed with academic punishment, in case no reforms are seen in the student.

vii. If a student is consecutively absent for multiple days then he/ she should be informed to meet the Head of the department along with his/ her parent with valid reasons to continue his / her studies in the college. Outstation students should produce valid reasons with proof or else they will be marked absent for double the period of their absence.

viii. Motivational sessions should be conducted by faculty to encourage the students in attending their classes regularly, they should be made aware of how good class attendance is related to good

assimilation of the courses, good grades in examinations, and importance of higher percentage and what are the consequences of lower-class attendance leading to detention and backlogs.

ix. Students putting good attendance in their classes should be encouraged by bestowing awards and appreciation. They should be felicitated on occasions like Annual Day/fresher's day or any other gatherings

x. Attendance to be recorded at the beginning of the class

xi. Attendance registers/ records should be checked every week by the head of the department.

xii. A student with less than 75% should not be allowed to attend any of the examinations.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – II

A faculty should be a role model for their students. The primary responsibilities of a faculty are

1. Preparing themselves thoroughly in the subject allotted to them by referring to the prescribed textbooks, reference books, research papers, and any other curated material of high standards and quality followed by preparation of a meticulous lesson plan using the revised Bloom's taxonomy.
2. Faculty should prepare the formative assessments and summative assessment question papers aligning them with the learning objectives set using Bloom's taxonomy, the lesson plan and the question papers of assessment tests should be synchronized. At the end of the course, a faculty should be successful in meeting the Course objectives and Course Outcomes which in turn will complete the larger picture of achieving the Program Outcome.
3. Faculty should practice and preach compassion, sincerity, perseverance, honesty, consistency, empathy like values, and ethics. A simple example of inculcating ethics in a student is to advise him not to copy his assignments or thesis contents from his fellow mates or through a textbook or web. This will make a student not only a sound technocrat but also an ethical, morally sound, cultured, and civilized human being. For this, the teacher should live the values and principles along with the student, A teacher should lead by example
4. A faculty should not just deliver and adhere to the curriculum of the university rather he or she should make the students learn beyond their syllabus. Every faculty should develop a research mindset and that mindset should be reflected in his or her teaching. Faculty should include the study of research papers in their lectures and should keep the students abreast with the latest development and

advancements in the course they learn. Project-based, experiential, and research-based learning should be implemented leading to the generation of IPRs and patents as a byproduct of research-based learning. Labs should be utilized to the fullest for this learning to happen.

5. Tutorials should be prioritized to make the students' problem solver, and remedial classes should be taken up by the faculty for questions that a student failed to answer in the formative assessment tests. Remedial classes can be conducted in an offline or online mode based upon time constraints.

6. The fight between technology and a teacher is an unfair one. But, if used judiciously technology can not only facilitate effective delivery of lessons, it can also work as an efficient aid for a teacher to assess the individual learning curves of students.

   All teachers should be made comfortable in handling ed-tech tools. Project-based learning should be promoted in classrooms in a big way since it is the best form of active learning. With increased learner engagement and the opportunity to witness real-world situations while executing a task, such activities enhance the learning outcomes for all age groups.
   Every teacher in today's world requires help in tracking their student's growth, and ed-tech tools certainly will help in making teaching more effective. A Robotics or IoT lab can cultivate a culture of innovation, problem-solving, and teamwork among students.

7. Faculty should make use of blended learning i.e. make use of LMS and MOOCS based online platforms as it enables a student towards self-learning, self-assessment, and self-paced. Students should be

motivated to learn more on their own at their own pace. Forums like Coursera, Edx, Udemy, etc. are fascinating ways through which students can enhance their skills and learning objectives.

8. Final year UG and PG students should be encouraged to publish research papers in peer-reviewed journals of high standards, faculty should involve in guiding them or can be co-authors of those research papers.
9. Faculty should maintain a course file related to their course that should consist of :
    a. Almanac of university
    b. Academic policy and academic schedule of the college/ department.
    c. A Lesson Plan based on revised Blooms taxonomy and the OBE model
    d. Lecture notes should be prepared using prescribed textbooks, reference books, research papers, and curated information from the internet.
    e. Set of Teaching aides (PPTs, FLIP classes, animations, videos, etc.)
    f. Question bank based on revised blooms taxonomy(comprising of a minimum of 20 questions from each unit)
    g. Set of assignments based on active learning, research-based learning, experiential learning, and STEM.
    h. Previous university examination question papers for analysis

1. Faculty should have equal emphasis on all units. If a faculty is lagging in his or her syllabus as per the university or college almanac then makeup classes should be conducted in a blended mode keeping in mind the time constraints, online makeup classes can be conducted on holidays or after college hours to avoid students or teacher's late stay in the campus.

2. A faculty who was on leave should compensate for the classes not conducted by him or her by conducting makeup classes.

3. The regular academic audit will be conducted by the academic committee to assess the effectiveness of the teaching-learning process adopted by the faculty.

4. Use of course guides like **All – in - One**, or any other guides should be discouraged among the faculty and students. faculty should motivate the students to use textbooks and reference books prescribed by the university. Teachers should regularly observe the reading habits of the students.

5. Course notes should be continuously updated, every semester and as and when there is up-gradation in subject content or as per the latest editions of the books prescribed by the university. Course content created should reflect the richness of quality.

6. Faculty should not disclose in advance the question papers devised by them for their assessment tests or examination.

7. Faculty and students should be in a mode of continuous learning.

8. Faculties found weak in courses as per the students' feedback and the head of the department's observation should undergo self-improvement through faculty development programs and training.

9. Faculty should teach the subjects with an application-oriented approach. Guest lecture/ seminars from experts in a subject or technology should be conducted at least once a semester

10. If the learning objectives set by a faculty achieve only 70% or less than 70% mark as per the slip test and assignment marks scored by the students then the faculty has to conduct remedial classes till he orshe attains 100% of the learning objectives set. Similarly, remedial classes should be scheduled by the faculty if the semester – university exam results are very low in his or her subject(s) and it should be conducted as per the norms mentioned in academic policy.

11. Remedial Classes on Technical subjects & English improvement skills should be conducted for those students who are weak in English language communication. The remedial classes on semester courses should be handled by the Students of final year/faculty or both. The students that have topped in a subject(s) are most suitable for conducting remedial classes for their peers or juniors.

12. Lab. faculty and teaching faculty should have good coordination among themselves for effective and conduction of lab. Experiments.

13. Faculties should make prior adjustments of their classes for the day on which they are availing casual leaves; otherwise, no leave will be sanctioned unless there is an emergency. A faculty should compensate his or her classes lost due to leaves availed by him or her in the same week he or she had availed a leave(s). Leaves without prior information will be marked as Loss of pay that in turn can lead to a break in service and may be treated as a negative remark in the faculty performance appraisal. No leave will be granted through SMS or any other indirect approach.

14. Incentives and increment will be directly connected to the

a. Overall performance of a teacher
b. based on their result analysis
c. innovations
d. Mentoring,
e. Proactivity
f. R & D activity
g. Patent generation
h. Contributing to increasing the NIRF, ATAL, NBA, or NAAC core and ranks
i. Paper publishing
j. Participation in administrative work etc.
k. Promoting our college through their positive work and attract good enrollments of bright students every year.

15. Denial to accept the work assigned by the superiors or non - cooperation with higher authorities or reporting authority can lead to organizational loss and this will be treated as insubordination & may lead to termination of faculty that had indulged in such activities.

16. Course files and documents related to academic and mentorship activities will be audited fortnightly by the designated auditors; heads will be accountable for discrepancies if any found. Signature of Heads in the course files and mentor diaries will be mandatory at the time of academic audits.

17. Teachers are accountable for the academic results and failures in their subject and this may lead to their disqualification for yearly increments or termination from services or both.

18. Faculties should award the marks judiciously and with utmost careful evaluation and this will be monitored and audited by the higher authorities, discrepancies may lead to disciplinary action.
19. Use of e-classrooms, computer system, LCD projector, in conduction of classes/tutorials are mandatory are highly recommended.

20. Students of second-year should be associated with 3rd Year students in their mini projects – viva should be conducted for 2nd year students - credits should be assigned to the 3rd year students based on the performance of 2nd year students.

21. **MBA:** experienced/ eminent People from HR, Finance, and Marketing fields should be invited fortnightly, possibly on Saturday, for a lecture or workshop for students of MBA. Standard Case studies related to national/international organizations should be presented to students and assignments or assessments should be conducted on it. The assessment/assignments should be conducted to assess the critical thinking, logical reasoning, and analytical capabilities of students. Final year students should be encouraged to prepare a fictitious real-time business plan(an inter-college competition can be held for assessing the best business plan). An eminent personality from the industry maybe invited to assess the best idea/ plan

Improvement of existing teaching-learning methods: the current situation is that we are running after marks and it is ruining the way curriculum is transacted in the class, perhaps, it also changes the nature of the relationship between a student and a teacher. Education when converted into a marks-sheet is a recipe for disaster because then it guides the teachers' quality of engagement in the class. It also guides the nature of assessments and finally, it narrows down the definition of a successful student and a good teacher. To implement teaching-learning we should

emphasize creating an environment where a relationship is a form of socio-economical bonding between students and teacher.

Excellence should be further incentivized through appropriate rewards, promotions, recognitions, and movement into institutional leadership. Meanwhile, faculty not delivering on basic norms will be held accountable.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – III

1. **Encourage Active Participation in Labs**

   a. Use methods from a variety of fields or interdisciplinary approaches to problem-solving

   b. Expand the kinds of observations beyond those traditionally carried out in scientific research

   c. Incorporate and validate personal experiences of all groups, and are likely to have had as part of the class discussion or laboratory exercise.

   d. Emphasize lab/classroom connection

   e. Show connection to current research topics

   f. Have the students design experiments.

   g. Arrange industrial visits for the students to observe the use of various machines used for different applications related to their domains.

2. Engineering and Diploma Institutions shall have Idea Implementation Centre/ Tinkering Laboratory/ Innovation Centre. Labs should be converted into tinkering centers and innovation hubs and should be used not only for conducting experiments within the curriculum but also to prepare the students for conducting experiments that are beyond the syllabus. in case students cannot afford the cost of components for bigger experiments/ models or projects in the field of **Civil Engineering** and **Mechanical Engineering** and **Electrical and Electronics Engineering**, then faculty can encourage them to take up simulation-based projects using MATLAB, SCILAB, FUSION 360,

STAD PRO or AUTODESK kind of software. Students of **Electronics and Communication Engineering** should be encouraged to bring their circuit designs to be implemented and executed in the labs(for example, they can refer to Electronics For You kind of magazines for getting novel ideas). **Computer Science and Engineering** students should be motivated and encouraged to take up the design and development of smaller applications beyond the lab syllabus in the technologies within or outside the syllabus.

3. Conduct experiments parallelly for all batches attending the lab on a particular day, once a batch completes their experiment, they should be assigned the next experiment in a round-robin fashion(subjected to availability of time)

4. A project expo should be conducted out of all the projects designed and developed by the students and prizes should be given for the best ones.

5. **Utilization of FOSS – Spoken Tutorial – Resource Center of IIT Bombay to enrich the laboratory assignments:**

   a. Many of the commercial software which is used in academia is now available free of cost in the FOSS(Free Open Source Category) category, Spoken Tutorials provide video tutorials of much such software along with an installable version of the software that is ready for use by both faculty and students. The tutorials are very illustrative and comprehensive, these tutorials can be used by

students for better assimilation of the technologies which are in their curriculum as well as the ones which are used in industries.

b. Encourage and motivate the students and faculty to participate in the spoken tutorial activities by conducting workshops each semester. Students and faculty who attend the spoken tutorial sessions are eligible for a participation certificate and those who undergo all the assignments/ assessment tests suggested by IIT Bombay and scores minimum marks are eligible for a learner's certificate. Faculty should identify the courses/ labs that can be mapped with Spoken Tutorials as an additional aid/ mechanism for better learning and assimilation of such courses

6. **Exemplary work in mini and main projects** by the students (UG/ PG) shall be considered as the source/ material for publication in national and international Journals, students and faculty should be rewarded for such activities.
7. The activities included in the student's **Campus Recruitment Training(CRT)** program should be synchronized with the lab activities in the regular lab work schedule, students should be made to practice the assignments recommended in the CRT program along with their curriculum prescribed work.
8. Lab activity: Viva should be conducted every week by the lab faculty, marks for the viva, record, observation & output should be maintained for the entire semester and the average of these marks can be the internal lab exam marks and also basis for awarding good marks in the external lab examination.

Reg. No.	1st week					2nd week					nth week				
	Viva	Record	Observation	O/P	Total	Viva	Record	Observation	O/P	Total	Viva	Record	Observation	O/P	Total

9. The faculty teaching theory should be allotted the associated lab and this faculty can be assisted by another teaching or lab faculty in effective conduction of that lab. A lab faculty will be responsible for the security & protection of the lab assigned to him or her during college hours. Any theft/damage will be compensated from the concerned lab faculty's salary.
10. All the students attending a lab session should wear an apron, rubber rubber-soled shoes, and identity cards, entry into the lab will be prohibited if they fail to do so, and disciplinary action will be initiated on the lab faculty if any students are found violating the Dressing code.
11. Students should be provided with lab schedules for the entire semester.
12. Laboratory journals should be updated by the students after performing each experiment each week and the lab faculty and the teaching faculty should evaluate the journal each week and put their remarks and signatures.
13. The Head of the departments should audit the students' Lab. Journals twice in a semester i.e. first audit should be performed immediately before 1st mid examination and the second audit should be performed before the second mid exams external lab exams.
14. Faculty development programs should be conducted for the lab faculty during zero class work periods by senior teaching faculties.

9. The first internal lab exams should be scheduled after the 1st spell of the semester and the second internal lab exams should be conducted after the second spell of a semester. A lab should be equipped with the following information

   a. Lab schedules with the name of the lab, branch, year, semester, section, academic year along with the name of the faculty handling the lab should be displayed on the notice board in the labs

b. Lab manuals (for faculty reference & not for students)

c. Issue - registers to record what components were issued to the students and the acknowledgment of students after receiving the components and equipment.

d. Complain registers are to be maintained by each lab faculty. The use of a complaint register should be for recording the grievances of students related to that lab. The Head has to devise a mechanism to solve those complaints on a day-to-day basis and in case the head is unable to resolve an issue related to the lab then he/ she should escalate the complaint to the higher authorities, if he/ she fails to do so then the delay in resolving the issue will be considered as negligence and will attract an appropriate disciplinary action. a continuous monitoring and feedback mechanism will be devised to collect the inputs from students concerning the functioning of labs

e. Heads should devise a mechanism to raise an indent for the lab requirements well before the commencement of the academic Year/ academic semester i.e. before the beginning of odd semesters. Faculty concerned with the labs should forward an application to the Head of the department mentioning the requirement of additional equipment that has arisen due to new regulations of the university or for conducting experiments beyond the syllabus, or due to any kind of deficiencies, repair works, calibration of equipment, and scope for up-gradation if any. The head of the department should ascertain and validate the indent submitted by the Lab Faculty and forward it to the Principal / Director along with his detailed remarks. In the case of purchasing equipment, the Head of the department should invite quotations from various competent vendors, compile them and submit a comparative price statement to the Director/

Principal along with their recommendations of a vendor and the reasons for the recommendations.

f. A Lab audit will be performed during the summer vacation of every academic year as per the invoices and stock registers and data uploaded on the University/ AICTE portal. HODs will be accountable for any discrepancies, losses, damage, and theft in the labs.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE - IV

1. Student counseling sessions should be conducted as per the scheduled dates in the college academic schedule provided by the college
2. Identifying students, who disturb the class, bunk the college, and chronic absentees to be counseled by senior faculty. Serious problems should be reported to the higher authorities for remedial action.
3. Motivate the students to take up the training sessions (Technical and soft skills) conducted by the college.
4. Inculcate the sense of discipline in the students
5. Conduct sessions on human values; enlighten them about the social evils related to the teenage community and their consequences
6. Inculcate in students respect for parents, teachers, elders, and people younger to them; teach them classroom mannerism, etc.
7. Motivate the students to participate in national level and state level technical, sports, and cultural activities; involve the students in organizing events in the college, these activities will develop healthy minds, healthy bodies and will inculcate team spirit – coordination-harmony and leadership qualities in the students.
8. Keep a continuous track on students lagging in attendance and take measures to reach their parents and keep them informed about their wards attendance and overall progress in academics
9. A mentor should maintain the mentor diary up to date.
10. There should be a Mentor meet every month to discuss the common problems and exchange their views about how they were able to handle or resolve the students' problems
11. Mentors should insist on an audience with the student's parent to share information related to their ward and obtain acknowledgments from the parents about the information received and also invite suggestions and opinions from the parents
12. In case of any grievance, students should first approach their assigned mentor, if the problems remain unresolved by the mentor; students

can then meet the head and then the higher authorities if the problem continues.

13. Incentives for effective mentorship:
    a. Mentors can be given an incentive/ bonus for bringing good reforms and academic improvements among the students allotted to them.
    b. Mentors can be promoted to 'A' grade based upon their performance and they can be identified by giving a **Star- Mentor** identity card.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – V

I. Examinations, assignments, slip tests, quizzes are used for the assessment of student's performance and therefore faculty should not be restricted to conduct only summative assignments as summative assignments can be used to give a grade to the student. , they should make use of the formative assignments which are true indicators of the actual learning that happened in students.

1. Formative assessment, formative evaluation, formative feedback, or assessment for learning, including diagnostic testing, is a range of formal and informal assessment procedures conducted by teachers during the learning process to modify teaching and learning activities to improve student attainment. The goal of a formative assessment is to monitor student learning to provide ongoing feedback that can help students identify their strengths and weaknesses and target areas that need work. It also helps faculty recognize where students are struggling and address problems immediately. It typically involves qualitative feedback (rather than scores) for both student and teacher that focuses on the details of content and performance. It is commonly contrasted with summative assessment, which seeks to monitor educational outcomes, often for purposes of external accountability.

2. Summative assessments are used to evaluate student learning, skill acquisition, and academic achievement after a defined instructional period—typically at the end of a project, unit, course, semester, program, or school year. Generally speaking, summative assessments are defined by three major criteria:

3. The tests, assignments, or projects are used to determine whether students have learned what they were expected to learn. In other words, what makes an assessment "summative" is not the design of

the test, assignment, or self-evaluation, per se, but the way it is used—i.e., to determine whether and to what degree students have learned the material they have been taught.

4. Summative assessments are given after a specific instructional period, and therefore they are generally evaluative, rather than diagnostic—i.e., they are more appropriately used to determine learning progress and achievement, evaluate the effectiveness of educational programs, measure progress toward improvement goals, or make course-placement decisions, among other possible applications.
5. Summative-assessment results are often recorded as scores or grades that are then factored into a student's permanent academic record, whether they end up as letter grades on a report card or test scores used in the college admissions process.
6. Assessment test should be conducted using rubrics
7. All the assessment and summative assessments should be based on Bloom's taxonomy, details of which are given on Page No.

Regulations to be followed for conduction of all the semester examinations:

1. Attendance in the University examination should be mandatory
2. Students should be allowed to attend internal and external (theory and lab) exams only if he/ she has attended all the assessment tests in that semester.
3. Faculty should meticulously and judiciously evaluate answer sheets and display the awarded marks in a compartmentalized manner with appropriate remarks and suggestions as per the need and this information should be made transparent to all the students. Based on the score of students in the assessment/ examinations, a strategy should be devised to conduct remedial and makeup classes.

4. Every student should have access to his or her answer sheets to verify the correctness of marks awarded to him or her, and if the marks are awarded transparently then the faculty should collect the acknowledgment of the student, in case of any discrepancies, the faculty should immediately rectify them.
5. Mid-semester exams (i.e. Mid-1 and Mid-2) and end-semester University lab exams should not be re-conducted or rescheduled for any student under any circumstances as it's against the University rules.

6. Students should be encouraged by the Head of the departments and faculty to take up all the exams conducted by the college and university and they should be kept updated about their progress or no-progress from time to time.
7. Mentors and counselors should keep the parents updated about their son or daughter's attendance and performance in all the examinations and should seek their support in reforming the student.

8. All the question papers and answer sheets evaluated by faculty will undergo a strict academic audit mechanism, discrepancies found will attract severe disciplinary action and may lead to termination of service.
9. Each Head should submit a report of all the assignments, slip tests, internal and external exams (of theory and practical) marks with an aggregate percentage of all the assessments of each student. This report will reflect the performance of the student in the end semester university exams.

10. Conduction of three internal exams in addition to University exams, one after 50 % of the syllabus is completed and another after remaining 50% of the syllabus is completed(questions should be

question bank and from the 50% syllabus only-on the JNTU-H question

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

paper model). A grand test should be conducted after 100% completion of the syllabus.

11. Question papers should be set on the lines of learning objectives that are derived using Bloom's Taxonomy.

Note :

The academic burden on the students should be taken into consideration, and measures should be taken to reduce the burden or not to overburden them. Students should not be overburdened by conducting all the slip tests at once or by giving the same deadlines by faculty to complete their syllabus. The principals/ Heads or Academic coordinators should be more meticulous in scheduling the academic activity to meet this requirement

Estd. 2001
SREE DATTHA
Applying Minds

ANNEXURE - VI

1. Faculty will be primarily responsible to control the discipline in the class, as they are the one who is authorized to assess and award marks to students in labs and theory - they can have better control over the students

2. Information about absentees and bunkers should be sent through SMS. Parents and students should be instructed to fill the above application with valid phone numbers and email address so that the important SMS/ messages can reach those particular numbers/mailboxes, failing to provide information by parents will lead to loss of communication between the parents and college for which the college will not be responsible.
3. Use of tobacco, gutkha, chewing and any other toxic material is strictly prohibited within the campus.
4. Students are not allowed to use cell phones within academic boundaries/ or to keep cell phones in their bags inside the college.
5. Students using two-wheelers are asked to limit the speed up to20km/hr and should not have more than one pillion rider on permissible roads of the campus.
6. All students are advised to maintain the environment clean and not to litter campus.
7. Vehicles should be parked in the parking space only.
8. Students should come to the classroom with formals. On Saturdays, students can wear decent casuals and presentable attire. Students should wear shoes on all days and should have a neat haircut and should be clean shaved.
9. Writing on walls of the toilets, roads, and pasting of posters on the walls are strictly banned.

10. College tuition fee, exam fee, dues, and other charges should be paid on the starting day of the academic year to avoid any embarrassment otherwise a penalty will be imposed if the cut -off dates are missed
11. Do not indulge in any act of eve-teasing and outraging the modesty of a girl student or lady faculty.
12. Avoid taking the support of any outsider other than parents/ guardians for any matter related to academics/ college affairs.
13. Discipline and decorum should be maintained in all College events.
14. Protest in any form within the college campus will be seriously dealt with.
15. The use of the internet for the purpose other than academic-related activities is banned and punishable under the cyber act.
16. Strict punctuality should be observed. Students coming late will not be permitted into the lecture Hall.
17. Students are forbidden to loiter in the college building during working hours.
18. No notice or intimation shall be put up by students in the college on the notice board or the college premises.
19. Students who willfully or otherwise damage college property will be severely dealt with and heavy penalties will be imposed.
20. Admission fee, tuition fee, transport fee, and other fees once paid will be not be refunded.
21. No student shall be gainfully employed during the Course until the completion of the Final Examination.
22. Any student who is persistently insubordinate and undisciplined, found to be involved in ragging or willfully, violates the rules of the College is guilty and is punishably leading to suspension or disciplinary action will be taken.

23. Students are not permitted to enter and leave the campus within the stipulated time as announced. Visitors are strictly not allowed during class hours.
24. Identity Card: Each student will be issued an Identity Card with name, photo, and signature. One should possess it all the time while in college otherwise penalty will be imposed.
25. The management reserves the right of admission concerning matters of admission, academic programmers, extracurricular, co-curricular activities, and student discipline. The decisions of the management shall be final and binding on all parties concerned.
26. Students can take part in inter-college competitions like sports, cultural events, technical events, etc. only after getting prior permission from the Principal/ Director.
27. Students are instructed to read the notices kept on the notice board of the admin office/ principal office and the department regularly otherwise the college or the management is not responsible for the damage caused to the student by ignoring or not reading the notices.
28. Ragging is strictly prohibited and any student involved in such activity will lead to initiation of suitable legal action apart from prohibition of ragging Act 1997.
29. The punishment prescribed under the act are as follows:

a. .Imprisonment up to a term of 2 years.

b. .A Fine up to Rs. 10,000/-

c. .Students convicted for Ragging will be dismissed from the Institution and shall not be admitted to any other Educational Institutions '

30. The entry of the Students to the college will be strictly through the Identity cards.
31. Nobody can enter the campus with a covered face or with his/her helmet on.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – VII

1. Students can be asked to make a PowerPoint presentation on a specified topic.
2. Students can be asked to give a seminar to junior students on a relevant topic.
3. Students may be asked to come to college on holidays or during a vacation to take an examination based on previous question papers.
4. Students may be asked to prepare notes for all the subjects.
5. If found guilty of littering the campus, the students may have to conduct sanitation week in the college premises.
6. If a student loses a library book, he/she has to replace the book with a new copy and write a brief on library management.
7. Present a seminar on environmental science.
8. Present a seminar on the topic covered in the class and clarify the doubts asked by other students.
9. Make him/her take notes of the hour and answer student's queries on that topic in the next class.
10. Make him/her gather information on a topic that is not discussed
11. in the prescribed textbook.
12. Explain a flow chart for a problem.

    Example: Reverse of a given number, Finding Factorial of a given number, etc.

13. Write an appropriate program and submit it along with an updated observation book.
14. The student must give an apology letter stating that he/she will lose 2 days of attendance if the action is repeated.
15. Must answer a previous exam paper

16. Prepare 20 objectives – type questions from one unit and submit them in two days. Otherwise, she /he will lose attendance for that particular class or lab.
17. In the event of harassing a junior, the student offers a detailed apology in the junior's class.
18. Give a seminar on the subject that is a prerequisite for the course under study.
19. Give a detailed list of the subjects studied so far.
20. A student is asked to do not less than 3 lab exercises.
21. Making the student type a chapter's notes. This will:
22. Increase notes making speed
23. The student will learn something about what is being typed
24. Spellings of some keywords will be known.
25. Notes can be verified by the teacher and circulated to others in the class.
26. Download at least 1 MB of tutorials from the Internet on a specified subject.
27. Record his/her reading voice on a cassette for a chapter or part, and submit it to the teacher.
28. Do a "role play" in English on the topic given by the teacher for at least 7 minutes.
29. Give an extempore for at least 5 minutes on the topic being dealt with in the next class.
30. Solve a problem in the presence of the teacher from the syllabus covered.
31. Write proof for two important theorems, five times each.
32. Solve five problems related to the topic of the day.
33. Present the topic under discussion to the class in the next period itself.

34. Learn ten words given by the teacher. Students should write the synonyms and the different forms of those words.
35. Write a composition (250 – 300 words) on a theme suggested by the teacher.
36. Answering essay-type questions about the unit under discussion.
37. Derive all the equations present in the entire syllabus
38. Present a seminar on any topic in the presence of the Principal and the HOD
39. Prepare a brief on a mathematician who has made a significant contribution to the field.
40. Write five or more derivations about any subject and circulate copies in the class.
41. Repeat the same topic the next day and engage the class for the full hour.
42. Prepare charts of difficult circuits, computer programs, etc., for display in class.
43. Suggest two books that are not available in the library. The title, author, publisher, cost, and the name of the book shop where they are available should also be mentioned.
44. Download the literature on current trends about the subject under discussion.
45. An IEEE paper to be copied once.
46. Write an assignment three times on the topic of the day.
47. Give a seminar on discipline and respect.
48. If a student is found scribbling on college property, he/she has to clean the scribbled space.
49. All circuit diagrams in the lab must be drawn once.
50. The student has to collect the profile of the faculty who is holding the session.

51. Submit wall posters for the lab.
52. Collect the history of the college and submit a write – up
53. The student has to collect information on advancements related to his/her field.
54. Collect electrical engineering-related news from various journals.

a. Anti-ragging activities to be taken up by the Disciplinary committee that includes spreading awareness by making students watch movies related to ragging consequences. Apprising students of the latest stand taken by government/ Supreme Court/ state high court. Consequences of Ragging as per the Indian penal code

b. Maintaining a visitor's register at the entrance along with issuing identity cards to them will restrict unwanted and trouble creators on the campus.

ANNEXURE – VIII

A college should focus on skillset and attitude development activities in addition to imparting quality academics in students, these activities should focus on inculcating leadership qualities, coexisting in harmony with peers, good communication skills, ability to handle failures and success, compassion, courage, persistence, responsibility, arts, and sportsmanship, these can be made possible through establishing various clubs like

1. Literary Club

Activities:

a. Book Reading and reviewing Sessions
b. Make students watch English movies with subtitles and then without subtitles and ask them to comprehend and submit their understanding of the movie.
c. e-Newsletter (the editorial board will be comprised of students under the supervision of a senior faculty), This newsletter will be posted on the college website on a bi-monthly basis.
d. Academics and current events oriented debates and discussions
e. Essay writing, jam sessions, group discussions extempore, etc.
f. lectures by seniors on the English perspective of juniors
g. workshops on the following areas for Students and Faculty (in collaboration with EFLU like organizations):
h. spoken English
i. written English
j. FDP: Faculty meets should be held every 4th Saturday. Faculty from any of the branches from any of the colleges on the campus may deliver seminars/lectures/power presentations and the other faculty from all the 3 colleges (SDES, SDIP, and SDGI) should be

the audience. The 4th Saturday of every month will also conduct activities related to FDP by external agencies, the purpose or objective of this Saturdays will be to develop healthy learning among the faculty

2. Sports Club:

Activities:

Objectives

a. To make aware of the importance or benefits of physical activities in day-to-day life.
b. To develop moral values through sports and games.
c. To motivate the students for mass participation in sports/games.
d. To enable the students, change their attitudes towards life (positive thinking, healthy criticism, etc.)
e. To promote co-operation between other colleges with similar objectives.
f. To conduct intra-college and inter-college sports events
g. To encourage students to participate in state level and national level sports events
h. Relaxation in attendance should be extended for students participating in sports activities

Means

a. Department provides safety and quality equipment for the practice and competition.
b. To create interest among students and yoga classes may be conducted.

c. Department informs the dates of the different tournaments well in advance for preparations to participate.

d. Department recognizes and encourages the outstanding sportsperson by presenting some incentives.

e. To motivate the students' workshops and seminars on sports may be organized.

3. Innovation club (Innovation, Ideation and Incubation Club)

Mission

To provide students a platform for transforming their dream ideas into reality.

Purpose of the Club: SDI should have its own "Innovation Club "and its main purpose should be to create the spark of innovation in the students' mind sothat he or she can see the existing problems in the society that need to be solved with the knowledge of engineering/ pharmacy and management.

a. To propagate the value of entrepreneurship.

b. To encourage students to come up with ideas that have commercial value and connect them to experts for mentoring.

c. Project making, poster presentation, quiz competition, inspirational lectures, and should be part of the yearly event schedule.

d. Aims to continuously review our mission on searching creativity, creating awareness, tapping the potential for entrepreneurial development among the student population.

e. Innovation Club will invite thinkers, researchers, entrepreneurs from varied fields to contribute methods and designs for problem-

solving and success scenarios that may benefit any stakeholder of the club.

Objective:

Create an interdisciplinary community of student's and facilitate understanding of all aspects of innovation and entrepreneurship.

Foster the networking between students from various fields.

Contribute to a culture of innovation and entrepreneurship in society.

Goals:

Providing a platform for students to:

- Understand the basic concepts around innovation.
- Build interdisciplinary networks and teams.
- Interact with people from innovative companies and the entrepreneurial eco-system at large.
- Exchange ideas.
- Incubate a new business venture by technical infrastructural support and troubleshooting.
- Assist in preparation of Feasibility Report and approval of loans from government/ non-government agencies.
- Collaborate with Micro Small and Medium Enterprises.
- Minimize Carbon Footprints.

Why join the Innovation Club?

While reading this you may be asking yourself: why should I bother about all this? Don't I already have too much on my plate, with my classes, labs, exams, sports activities, and the coaching classes related to GATE/ GRE and TOEFL, etc.? But, there are other success factors (besides professional skills) that are decisive to get the best and most interesting careers

- Professional network: Through the innovation club you can start building your professional network that goes beyond your family, friends, and fellow students.
- Inter-disciplinary competences: At the club, you can meet people from different departments, with different background and skills that are eager to learn working as teams and collectively complex engineering problems can be solved using integrated technologies.
- Best innovations can be patented and the patentee becomes the most sought after person in the realm of industries
- Innovation can be incubated if they have commercial value
- Innovation can lead to enterprises, which in turn can generate employment and increase exports of the country thereby contributing to both employment generation and economy
- Students can be employers rather than seeking to be an employee.
- Good innovations leading to startups invite the attention of industries that can be followed by industry patronage, thereby the startup gets bigger funding and a bigger platform.

what we can do together…

-Regular monthly meetings

-Developing innovative projects

-Innovation related global news

-Innovation showcase

-Demonstration of the innovation process, methodologies, case studies

-Experience sharing and innovation workshops

-Information on innovation events

-Research activities

-Events & workshops

-Discussion forums

-Blogging

-Industrial Visits

-Competitions

4. Cultural and Arts club

Purpose:

Participation in cultural activities results in enhancement of the personal skills and experiences like confidence; self-presentation; teamwork and collaboration; time management and organizational skills; self-awareness; self-discipline; open-mindedness to move beyond boundaries and experiment with different ideas; communication skills; the ability to cope with criticism and learn from them resulting in a whole new developed, changed and an improved person.

To promote a vibrant campus experience through organizing innumerable activities about the performing arts and cultural activities bringing people from all walks, interests, and ethnicity come together in ways that stimulate lifelong learning, and community interaction.

List of activities:

- Song Competition
- Classical Dance Competition
- Fusion Dance Competition
- Rang Manch "Skit"
- Battle Of Ideas (Debate)
- Just A Minute
- Color-O-Mate(Face Painting)

- Business Plan
- Rangoli Competition
- Collage
- Business Quiz
- Fashion show
- Mr. and Miss. Sree Dattha

Important Events:

- Teacher's Day
- Freshers Welcome
- Inter College Cultural Festival
- Placement Party
- Farewell Event
- Convocation Ceremony
- Regular Competitions

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – IX

Colleges should be aware of the growing demands of the industry in terms of graduate recruitments and the business technologies used in the industries; in this regard, mere dependence on the curriculum of the university will not suffice to make a student industry-ready. Therefore many parallel programs are to be conducted without disturbing the university curriculum, to make the students industry-ready. teachers should involve along with students to participate in such programs as mentioned below:

1. Programs conducted by Industry partners:
   a. Technical training, certification, internships, and placements
   b. Mini projects/ main projects followed by certification in emerging technologies like AI/ML, Data Science, Cybersecurity, IoT, 3D printing, Augmented Reality/ Virtual Reality, Robotics Process Automation, Cloud Computing, Data Analytics, mobile testing, and other cutting edge technologies.
   c. Workshops and certification (participant or learner or both) from Free Open Source Software (FOSS) – Training And Resource Center, IIT Bombay
   d. Participation in research and development activities conducted by the R&D cell
   e. Spoken English and written English workshops by premium institutions like EFLU – English & Foreign Language University(Central University) and others

2. Soft Skills Training: A student requires much more than the University Grades to get qualified for a job in any industry. Industry emphasizes more on the problem-solving skills, aptitude, and reasoning capabilities of a student, and most importantly his

/ her English communication skills play an important part. The above capabilities should be inculcated in the student's right from 1st year onwards. Each student has to be subjected to identifying the problems, defining the problems, devising various solutions to a problem, selecting the best of the solutions, and converting the solutions into a computer programming language.

3. Technical Symposiums / Workshops: Each Department should conduct workshops on cutting-edge technologies regularly, at least 2 in a semester are advisable. These workshops should be conducted with collaboration from Governmental organizations, companies, and Industries. as.

4. International Conferences: Conferences should be conducted to assemble students and faculty from various colleges across the state or nation on a single platform to share their knowledge about addressing the solutions to the problems through research and by using the newer and advanced technologies; this will enhance the knowledge of students and faculty in the field of research and development.
5. College should start a journal publishing capacity of its own.

6. Conduct cultural festivals to bring awareness to students and faculty about the rich cultures and traditions of India

7. NPTEL/ SWAYAM (National Program on Technically Enhanced Learning) sessions: electives on emerging technologies require faculty well versed with disruptive technologies to teach those electives which is a big challenge to the colleges. This learning gap in the faculty can be filled by the use of online MOOCS courses

provided by portals like NPTEL, SWAYAM, COURSERA, etc. Universities are permitting to take up online courses that are attached with credits from some of the above portals, therefore students should be motivated by the faculty to participate in such online courses.

Estd. 2001
SREE DATTHA GROUP OF EDUCATIONAL INSTITUTIONS
SREE DATTHA
Applying Minds

ANNEXURE – X

Program Coordinator:

- Interacts and maintains liaison with key stakeholders i.e. students, faculty, Department Head, and employers.
- Monitor and reviews the activities of each year in the program (II/IV, III/IV& IV/IV) either independently or with course coordinators
- Schedules program work plan following specifications of program objectives and outcomes
- Oversees daily operations and coordinates activities of the program with interrelated activities of other programs, departments, or staff to ensure optimum efficiency and
- Compliance with appropriate policies, procedures, and specifications given by HOD.
- Conducts and interprets various surveys required to assess POs and PEOs

Module Coordinator:

- Coordinates and supervise the faculty teaching the particular course in the module
- Responsible for assessment of the course objectives and outcomes
- Recommend and facilitate workshops, faculty development programs, meetings, or conferences to meet the course outcomes.
- Analyzes results of particular course and recommends the Program coordinator and/or Head of the Department to take appropriate action.

- Liaise with students, faculty, program coordinator, and Head of the Department to determine priorities and policies.

Program Assessment Committee:

- Program Assessment Committee consists of Program Coordinator, Module Coordinator, and faculty representatives
- Chaired by the Program Coordinator, the committee monitors the attainment of PO and PEO's.
- Evaluates program effectiveness and proposes necessary changes
- Prepares periodic reports records on program activities, progress, status, or other special reports for management key stakeholders.
- Motivates the faculty and students towards attending workshops, developing projects, working models, paper publications, and research.
- Interact with students, faculty, Program Coordinators, Module Coordinator, and outside/community agencies (through their representation) in facilitating program educational objectives.
- PAC meets at least once in 6 months to review the program and submits a report to Department Advisory Board.

Department Advisory Board (DAB):

- DAB consists of the head of the department, program coordinators, and the representatives of key stakeholders
- DAB chaired by the head of the department, receives the report of the Program Assessment Committee and monitors the progress of the program
- DAB on current and future issues related to programs
- Develops and recommends new or revised program goals and objectives

ANNEXURE – XI

Research and Development Policy

Vision & Mission

Vision

To create an ecosystem for researchers, broadly enabling the faculty and students to take up research activities within the institute and in collaboration with Governmental, non-Governmental research agencies, and Industries.

To inculcate research-based learning in the institution that will enable students to provide solutions to socio-economical problems through research and to generate startups that will contribute to the economy of the nation.

Mission

- Appointment of senior faculty from premium institutions and industries with a sound background in Research and Development.
- with the professional bodies like IEEE, ISTE, IETE, ACM, CSI, etc.
- Subscription to online journals of repute
- Faculty to publish papers in SCOPUS/ SCI and peer-reviewed journals
- Organizing international conferences
- Promote Research-based learning
- Enhance researchers' abilities to obtain and manage grants
- Strategically invest in promising research and researchers
- Enhance the ability to perform research in a global community
- Support strong infrastructure for interdisciplinary research

KEY FEATURES OF THE R&D CELL

Exploring /feasibility study on the announcement of proposals for collaborative research from various organizations like DST, ISRO .and other govt organizations

Encouraging and involving the students and faculty in the research activity

Identification and classification of the existing infrastructure and lab facilities for collaborative research activity

Identification of proposals and preparation of project proposals for submission.

Tracking of submitted proposals

In-depth study of requirements/ proposals from industry (on the requirement from industry)

Preparation of proposals for collaborative research with industries

Formulating and planning the activities for research projects undertaken

Guidance and interactive supervision of research/ industry projects

The domain of the projects may be for all departments of the college

Empowering the faculty to conduct innovative teaching, research, and service as they see best will be a key motivator and enabler for them to do truly outstanding, creative work

Faculty who have never published a research paper should be given the task of reading 50 research papers in a semester and publishing a paper on literature review at the end of that semester. After two-semester of the period, a faculty will be able to publish two literature review papers and can be capable of publishing one research paper based on the problem he has identified for research through the review of research papers done by him.

FUNCTIONS OF THE CELL:

The Research and Development cell majorly focuses on the following criteria

1. **Strengthening the internal quality of research for faculty and students.**

To improve the research at every stage of an Undergraduate program, it is a must to ensure developing the research culture in various ways as to integrate it into the curriculum. The various ways that research might be integrated into classroom-based teaching include and the Research and Development cell work on:

- To create, maintain and monitor the research conducive environment
- Creating exercises that help students as well as to develop research skills (i.e., literature reviews, critically reading articles, publishing to a publicly accessible site) from the basic level.
  - The collaboration of assignments with the labs for practical evaluation.
  - One research paper per unit faculty will discuss with the students (from standard journals IEEE, SCI, etc.), to search the papers,

articles, research and development cell cooperate and provide the guidance to faculty in solving the papers at initial levels by conducting the workshops and sessions every week. Research and Development cell also gives guidance in choosing the topic of the research paper to explain among the students.

- Encouraging students and faculty to use research tools such as software, research equipment, etc.
  - For example, the R&D cell identifies the equipment in the concerned labs which are feasible and useful for the research like Logic Analysers, FPGA kits, Spectrum analyzers, higher-end computer systems, broadband internet connections, software relevant to research areas, computer peripherals, access to journals of repute, etc.. and guidance to faculty and students on which type of research can be conducted with that available lab equipment.
  - Apart from the hardware tools, a lot of research can be done with simulation software which is open source, which is also not required much coding knowledge. Initially, the R&D cell will give guidance on these tools which are easy to understand handle (ex: Esim, Dsch, Microwind (not required coding, only on analog and digital circuits can concentrate and connect the devices).
  - After establishing the research environment and all the faculty and students are feasible in the knowledge of tools, R&D cell will concentrate coding of particular languages also, so that faculty and students can develop products on their own.
  - R&D cell also gives guidance to the faculty for publishing in standard journals by conducting the sessions weekly (how to write papers, how to check plagiarism, how to use article rewriters, how to use Grammarly check, tools like Latex, MS office, MS Excel to generate the graphs from results).
  - Later R&D cell Encourage the staff and students to attend/publish papers in various National/International conferences of their specialized areas and make publications in

standard journals. Coordinates, provide any kind of assistance, and monitors till the time the faculty habituates for the research and publishes the research journals.

- Apart from internal guidance from the R&D cell members, also concentrates on involving undergraduate students in research seminars, visits of guest speakers, and symposia.
- The faculty and students should identify the problems existing in the rural areas and together with the help of technology solve those problems. This activity should be started from the first year onwards. A separate division under the R&D cell should be created to handle these assignments.
- Providing hands-on laboratory training to students and encouraging them to do original research (internships, projects, etc.). Independent laboratory exercises or special projects will help promote research creativity if students are encouraged to explore the problem from multiple angles
- Educating students and faculty on evidence-based research and on how to draw inferences and make empirical observations.
- While designing course files, lectures, and activities, R&D cell monitors whether faculty highlighted recent research that is relevant to course material.
- Team also encourages the faculty to register for Ph.D. in reputed organizations and assists in conducting their research.

The above approaches will lead to an increase in critical thinking ability, experimental design ability, and self-rated abilities such as navigating the literature, thinking like a scientist, and understanding research in context. Thus, incorporating research into classroom-based teaching ultimately leads to a) stimulation of student interest, b) creating a classroom environment of lifelong learning for both student and teacher, and, finally, c) striving to achieve optimum outcomes for the society.

2. Collaborating with external agencies.

To improve the internal standards of research, R&D cell also coordinates and works

- To interact with various external agencies and organizations to enhance the quality of R&D activity in the institute.
- To promote the institute through various innovative projects and highlight them on the national and international stage.
- To establish centers of excellence and innovation labs for various research focus groups.
- To work closely with the industrial needs that eventually will result in new or improved products, processes, systems, or services that can increase the company's productivity. To foster collaborations for mutual benefits and to maximize Industrial connectivity.
- To establish collaboration with other universities, public and private sectors and identify R&D projects including consultancy services that could be undertaken at the institution.

3. Consultancy Projects Collaboration

- Research and Development cell will put efforts in getting the consultancy projects from various organizations and to complete the projects within time. Initially, the R&D cell focuses on small projects and step by step will increase for the consultancy projects.

- Will continuously work to get the projects from outside agencies to support them in making the products. Also will focus on if any student having the idea, to make a product will tie-up with the external agency and provide assistance to the student in developing the product and to market the product in coordination with the Entrepreneurship and Development cell.

4. DST, MHRD, AICTE, etc. Proposals.

- Research and Development cell also responsible for writing the proposals and getting the funding for the research from the Department of Science and Technology, MHRD, AICTE, and from other reputed organizations.
- Research and Development cell Continuously monitors the websites and newspapers for the ads of grants and funds from research organizations.
- Will be responsible for submitting the research proposals on time and monitoring and finding suitable Faculty members in the team with the principal investigator, finally to form a team.
- If the proposal is accepted, assistance and responsible to complete the project within time and within the budget allocated.
- Also, will concentrate on tin getting the funds to organize conferences, FDPs, STTPs from various organizations.

5. Monitoring and Organizing the Events under the MOUs

- Research and Development cell will allot one Convenor/Coordinator under each MOU with external agencies and the convenor/coordinator will track, monitor, and organizes the events/training according to the

6. Events /activities Planner

- Initially, the R&D cell conducts a Weekly one-session/Faculty Development Program to give guidance to faculty for two months. Dates will be fixed according to the time and schedule of academics. Internal R&D cell members will be resource persons.
- After two months, monthly twice research programs will be conducted. Resource persons will be from reputed research organizations.

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

Nelson Mandela Marg, Vasant Kunj

New Delhi – 110 070

Recommendations for

Examination Reforms

Preface

The globalisation of the world economy and higher education are driving profound changes in the engineering education system. Worldwide adaptation of Outcome-Based Education framework and enhanced focus on higher-order learning and professional skills necessitates a paradigm shift in traditional practices of curriculum design, education delivery and assessment. In recent years, worldwide sweeping reforms are being undertaken to bring about essential changes in engineering education in terms of what to teach (content) and how to teach (knowledge delivery) and how to assess (student learning).

Examinations or student assessment of students play a very important role in deciding the quality of education. The academic quality of examinations (question papers) in Indian Engineering education system has been a matter of concern for a long time. This report attempts to bring out recommendations for reforms in examination system to meet challenges on emerging engineering education landscape.

The recommendations are presented in four sections. In Section-1, the most important drivers for examination reforms in Indian engineering education system are discussed. Section-2 brings out strategies to be adopted to align assessment with the desired student learning outcomes. A two-step method is proposed for mapping the examination questions course outcomes. Section-3 highlights the necessity of designing question papers to test higher order abilities and skills. Application of Blooms taxonomy framework to create the optimal structure of examination papers to test the different cognitive skills is discussed in detail. Challenge of assessing higher order abilities and professional skills through traditional examination system is brought out in Section-4. Several educational experiences and assessment opportunities are identified to overcome the challenges. Appendices contain the supplement material that is helpful for Universities/ Colleges to implement recommendations.

At this juncture, reforms in examinations are critical for improvement of the quality and relevance of Indian engineering education. It is hoped that the Report will be of use to Universities and Colleges to bring out the much-needed change. The cooperation received from AICTE officials in bringing out the Report is gratefully acknowledged.

Prof Ashok S. Shettar
Prof Rama Krishna Challa
Prof Sanjay Agarwal
Prof Upendra Pandel

Table of Contents

1. Introduction

The Globalisation of the world economy and higher education are driving profound changes in the engineering 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 engineering graduate 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 engineering education in terms of what to teach (content) and how to teach (knowledge delivery) and how to assess (student learning).

AICTE has already taken initiation to come out with model curriculum for engineering programs. The digital initiatives of MHRD and AICTE have made available a very large number of Massive MOOCs through SWAYAM, that can help the colleges and teachers adopt innovative methodologies in the delivery of course.

This present report makes recommendations for reforms in examinations (assessment of student) against the emerging landscape of engineering education.

Examinations or assessments student of 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 awardable assessments.

The academic quality of examinations (question papers) in the Indian engineering 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 ebbed 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 engineering education. The most important drivers for reforms in examination system of Indian engineering education are:

1. Adaptation of Outcome Based Education Framework

Outcome based education- a performance-based approach has emerged as a major reform model in the global engineering education scenario [3]. The country that wants to be a signatory member of a multinational agreement for the mutual recognition of engineering degrees, i.e. the Washington Accord (WA) must implement Outcome Based Education. This will be an endorsement that the engineering 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 engineering institutions to adapt an OBE framework for their curriculum design, delivery and assessment. In OBE framework the educational outcomes of a program is 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 engineering 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 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.

2. 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 the 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 and colleges to design their assessment strategies.

2. Assessment Strategy for Outcome Based Education

2.1 Mapping Program Outcomes to Assessment (Examinations)

Graduate attributes (GAs) articulate the generic abilities to be looked for in a graduate of any undergraduate degree program. They form the Program Outcomes (POs) that reflect 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 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.

2.2 Two-step Process for bringing clarity to POs

Program Outcomes give useful guidance at 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. A 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).*

(1) Identify *Competencies to be attained*: For each PO define *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 our students to achieve. They serve as an intermediate step to the creation of measurable indicators. Example:

Program Outcome (Attribute 3)

***Design**:*

***PO 3: Design/Development of Solutions**: Design solutions for complex engineering 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 engineering 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 engineering design to defined end state*

(2) 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 engineering 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 alternative 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 are designed by connecting assessment questions (used in various assessment tools) to the Performance Indicators. By following this process, where examination questions map with Performance Indicators, we get clarity and better resolution for the assessment of COs and POs. The pictorial representation of the process is given in Fig.

1

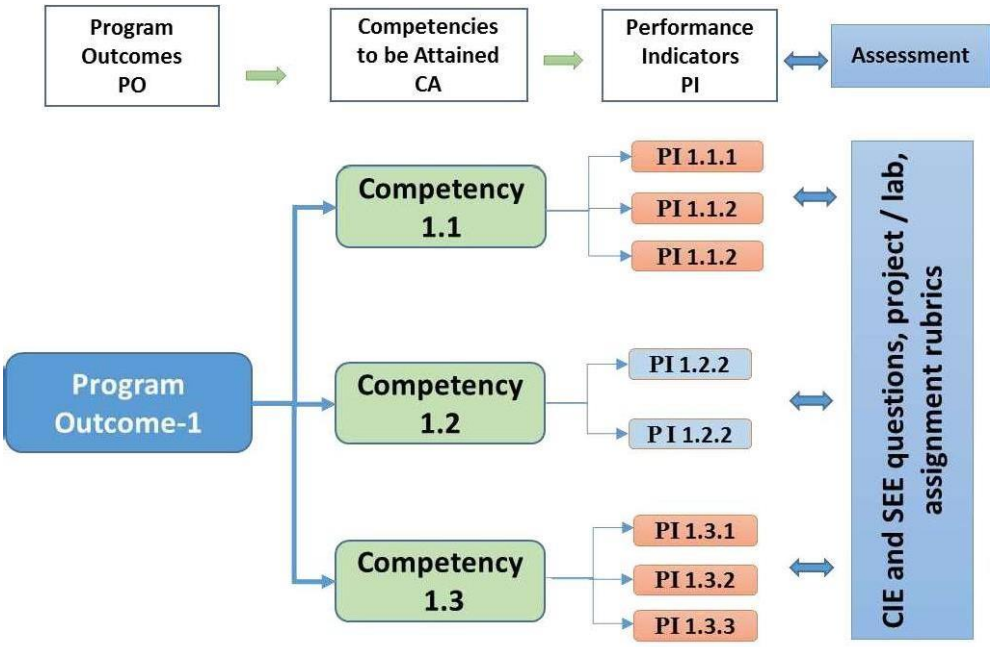


Fig.1 Connecting POs to Assessment

2.3 Program Outcomes -Competencies – Performance Indicators

The following table gives a suggestive list of competencies and associated performance indicators for each of the PO in Mechanical Engineering Program.

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.	
Competency	**Indicators**
1.1 Demonstrate competence in mathematical modelling	1.1.1 Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems 1.1.2 Apply advanced mathematical techniques to model and solve mechanical engineering problems
1.2 Demonstrate competence in basic sciences	1.2.1 Apply laws of natural science to an engineering problem
1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply fundamental engineering concepts to solve engineering problems
1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply Mechanical engineering concepts to solve engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	
Competency	**Indicators**
2.1 Demonstrate an ability to identify and formulate complex engineering problem	2.1.1 Articulate problem statements and identify objectives 2.1.2 Identify engineering systems, variables, and parameters to solve the problems 2.1.3 Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe complex problems into interconnected sub- 2.2.2 problems Identify, assemble and evaluate information 2.2.3 and resources. Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions 2.2.4 Compare and contrast alternative solution processes to select the best process.
2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy. 2.3.2 Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Apply engineering mathematics and computations to solve mathematical models 2.4.2 Produce and validate results through skilful use of contemporary engineering tools and models 2.4.3 Identify sources of error in the solution process, and limitations of the solution. 2.4.4 Extract desired understanding and conclusions consistent with objectives and limitations of the analysis
PO 3: Design/Development of Solutions: Design solutions for complex engineering 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	
Competency	**Indicators**
3.1 Demonstrate an ability to define a complex / open-ended problem in engineering terms	3.1.1 Recognize that need analysis is key to good problem definition 3.1.2 Elicit and document, engineering requirements from stakeholders 3.1.3 Synthesize engineering requirements from a review of the state-of-the-art 3.1.4 Extract engineering requirements from relevant engineering Codes and Standards such as ASME, ASTM, BIS, ISO and ASHRAE.

	3.1.5	Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues
	3.1.6	Determine design objectives, functional requirements and arrive at specifications
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Apply formal idea generation tools to develop multiple engineering design solutions
	3.2.2	Build models/prototypes to develop diverse set of design solutions
	3.2.3	Identify suitable criteria for evaluation of alternate design solutions
3.3 Demonstrate an ability to select optimal design scheme for further development	3.3.1	Apply formal decision making tools to select optimal engineering design solutions for further development
	3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Refine a conceptual design into a detailed design within the existing constraints (of the resources)
	3.4.2	Generate information through appropriate tests to improve or revise 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	
4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem, its scope and importance for purposes of investigation
	4.1.2	Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation
	4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physical quantities
	4.1.4	Establish a relationship between measured data and underlying physical principles.
4.2 Demonstrate an ability to design experiments to solve open ended problems	4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures
	4.2.2	Understand the importance of statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data
	4.3.2	Analyze data for trends and correlations, stating possible errors and limitations

	4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions 4.3.4 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 engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Competency	Indicators
5.1 Demonstrate an ability to identify / create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools such as computer aided drafting, modeling and analysis; techniques and resources for 5.1.2 engineering activities Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2 Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
	5.2.2 Demonstrate proficiency in using discipline specific tools
5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1 Discuss limitations and validate tools, techniques and 5.3.2 resources 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 societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Competency	Indicators
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

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

Competency	Indicators

7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1 Identify risks/impacts in the life-cycle of an engineering product 7.1.2 or activity Understand the relationship between the technical, socio economic and environmental dimensions of sustainability
7.2 Demonstrate an ability to apply principles of sustainable design and development	7.2.1 Describe management techniques for sustainable development 7.2.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	
Competency	**Indicators**
8.1 Demonstrate an ability to recognize ethical dilemmas	8.1.1 Identify situations of unethical professional conduct and propose ethical alternatives
8.2 Demonstrate an ability to apply the Code of Ethics	8.2.1 Identify tenets of the ASME professional code of ethics 8.2.2 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**
9.1 Demonstrate an ability to form a team and define a role for each member	9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team 9.1.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2 Demonstrate effective individual operations-- communication, problem solving, conflict resolution and leadership skills	9.2.1 Demonstrate effective communication, problem solving, conflict resolution and leadership skills 9.2.2 Treat other team members respectfully 9.2.3 Listen to other members Maintain composure in difficult situations
9.3 Demonstrate success in a teambased project	9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts
PO 10: Communication: Communicate effectively on complex engineering activities with the engineering 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**

10.1 Demonstrate an ability to comprehend technical literature and document project work	10.1.1 Read, understand and interpret technical and non-technical information 10.1.2 Produce clear, well-constructed, and well-supported written engineering documents 10.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2 Demonstrate competence in listening, speaking, and presentation	10.2.1 Listen to and comprehend information, instructions, and viewpoints of others 10.2.2 Deliver effective oral presentations to technical and non-technical audiences
10.3 Demonstrate the ability to integrate different modes of communication	10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations 10.3.2 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 engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Competency	Indicators
11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1 Describe various economic and financial costs/benefits of an engineering activity 11.1.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1 Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks. 11.3.2 Use project management tools to schedule an engineering project so it is completed on time and on budget.

PO 12: Life-long learning: Recognise 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
12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1 Describe the rationale for requirement for continuing professional development 12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay 12.2.2 current Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3 Demonstrate an ability to identify and access sources for new information	12.3.1 Source and comprehend technical literature and other credible sources of information 12.3.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

The above table can be used for most of the engineering programs. However, for Computer Science / Information Science programs it requires some modifications.

Suggestive list of competencies and associated performance indicators for Computer Science / Information Science Programs are given in Appendix- A

3. Improving Structure and Quality of Assessments

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

1. In Indian engineering education system written examinations play major role in assessing the learning and awarding of grades to the student. Universities and colleges 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 need to go beyond 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 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 (example; 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 course outcomes and hence POs was discussed in the section-1. The following sections discuss application of blooms taxonomy framework to create optimal structure of examination papers to test the different cognitive skills.

3.1 Bloom's Taxonomy 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, and behavioural) 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 engineering education to structure the assessment as it characterizes complexity and higher-order abilities. It identifies six levels of competencies within the cognitive domain (Fig. 2) which are appropriate for the purposes of engineering educators.

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

Level	Descriptor	Level of attainment
1	**Remembering**	Recalling from memory of previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using information in another familiar situation
4	Analysing	Breaking information into 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

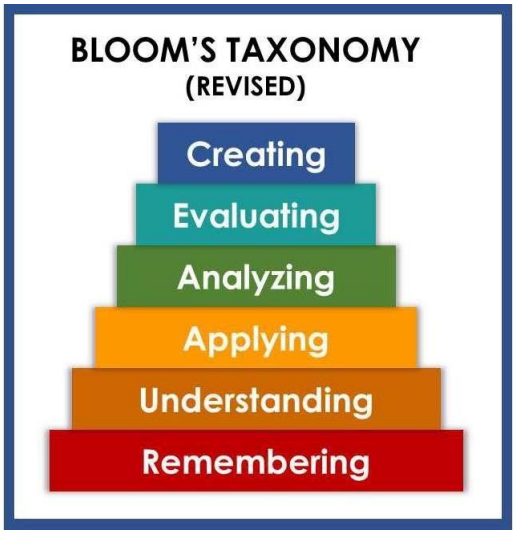


Fig. 2, Revised Bloom's Taxonomy

Bloom's Taxonomy is hierarchical, meaning that learning at the higher level requires that skills at lower level are attained.

3.2 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 the 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.

A suggestive list of skills/ competencies to be demonstrated at each of the Bloom's level and corresponding cues/ verbs for the examination/ test questions are given below

Level	Skill Demonstrated	Question Ques / 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, etc.
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 • Ills or •	calculate, predict, apply, demonstrate,
4. Analyse	• break down a complex problem into parts. Identify the relationships and interaction between the different parts of 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 level. 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 out students to demonstrate that will determine the contextual meaning of the verb used in the assessment question.

3.3 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 analysing are assessed in the Continuous Internal Evaluation (CIE) and semester End Examinations (SEE), where students are given limited amount of time. And abilities; analysis, evaluation and creation can be assessed in extended course works or in variety of student works like course projects, mini / minor projects, internship experience and final year projects.

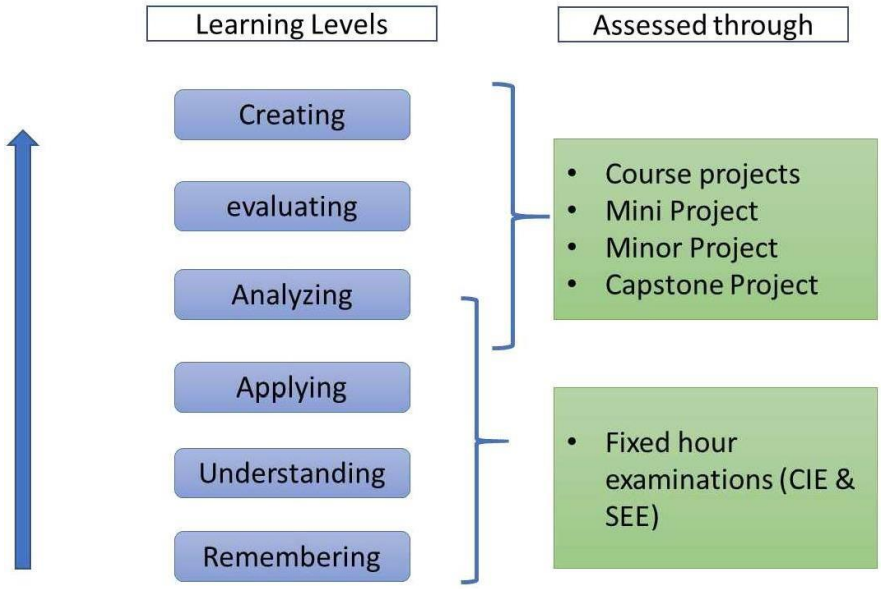


Fig. 3 Assessment methods for different Bloom's cognitive levels

2. Before adopting this framework for reforms in examination system of a University/Institution, 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 the 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 need to be well planned and implemented through institutional strategy and communicated to the 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 focussed towards lower cognitive skills, conscious efforts need to be done to bring in application skills or higher cognitive skills in the assessment. It is recommended that at institution/ University 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 the Bloom's cognitive level are given in Appendix-B Model question Papers are given in Appendix- C

4. Assessing higher-order abilities & Professional Skills

In the 21st century, professional skills (also known as soft skills, generic skills or transferable skills) have emerged as important attributes of a graduate engineer. Studies show 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 twelve attributes belong to this category, Viz. (1) communication, (2) teamwork, (3) understanding ethics and professionalism, (4) understanding global and societal contexts, (5) lifelong learning, and (6) 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. Though the employers consider these professional skills and higher abilities as important, our students are weak in them. The main challenge surrounding them is that they are difficult to assess through our conventional examination system.

4.1 Innovative Educational experiences to teach and assess

One of the main obstacle in addressing these outcomes is the limitation of educational experience we create within our engineering 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 (Shuman, Besterfield-Sacre, & McGourty, 2005).

To address these challenges, comprehensive reforms are needed in the way we design our curriculum, 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

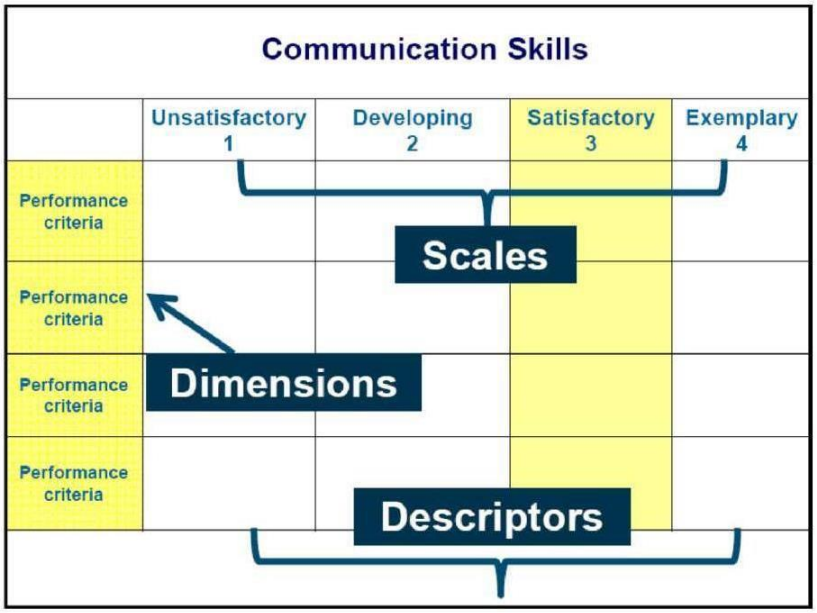
4.2 Using Scoring Rubrics as Assessment tool

To evaluate above student works for attainment of course outcomes and hence POs, it is of utmost important 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.

Examples of Rubrics (Accessed from Rogers (2010)



4.3 Open-Book Examinations (OBE)

In the earlier sections 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 emphasise 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 requires comprehension, information retrieval and synthesising 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 application of knowledge, critical thinking and use of resources for solving real complex engineering 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.

References:

1. Lueny Morell, *Engineering Education in the 21st Century: Roles, Opportunities and Challenges* Int. J. Technol. Eng. Educ. 2010, Vol.7, No.2
2. Miller, A.H., Imrie, B.W. & Cox, K. 1998. *Student Assessment in Higher Education*. London, UK: Kogan Page
3. Felder, R.M. & Brent, R. 2003. *Designing and teaching courses to address the ABET engineering criteria*. J. Engr. Education 92(1), 7–25 (2003).
4. Shuman, L. J., Besterfield-Sacre, M., and McGourty, J. (2005, January). *The ABET "Professional Skills" - Can They Be Taught? Can They Be Assessed?* Journal of Engineering Education, p. 41-55.
5. University of Toronto. *Report on the Outcomes and Indicators for the CEAB Graduate Attributes Process, Faculty of Applied Science and Engineering University of Toronto*. Available as on April 12, 2018 http://www.engineering.utoronto.ca/wp-content/blogs.dir/28/files/2015/02/Revised-UCCGrad-Att-Cover2c-Rpt-26-Table_Apr-11-2012.pdf
6. Bloom, B.S., Engelhart, M.D., Furst, E.J., Hill, W.H. and Krathwohl, D.R. (1956) *Taxonomy of educational objectives Handbook 1: cognitive domain*. London, Longman Group Ltd.
7. Anderson, L.W., Krathwohl, D.R., Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J. and Wittrock, M.C. (eds.) (2001). *A taxonomy for learning and teaching and assessing: A revision of Bloom's taxonomy of educational objectives*. Addison Wesley Longman.
8. Illinois online network, *Assessing Learning Objectives Bloom's Taxonomy, available as on April 12,2018,* http://www.ion.uillinois.edu/resources/tutorials/assessment/bloomtaxonomy.asp
9. Chan, CKY (2015). *"Rubrics for Engineering Education"*, Engineering Education Enhancement and Research Asia (E3R Asia)
10. Rogers, G. (2010). *Developing rubrics*. Retrieved from http://www.abet.org/uploadedFiles/Events/Webinars/Developing_Rubrics.pdf

APPENDIX-A

Competencies and PI's

Computer Science/ Information Science Programs

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

Competency	Indicators
1.2 Demonstrate competence in mathematical modelling	1.2.1 Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems 1.2.2 Apply the concepts of probability, statistics and queuing theory in modeling of computer based system, data and network protocols.
1.5 Demonstrate competence in basic sciences	1.5.1 Apply laws of natural science to an engineering problem
1.6 Demonstrate competence in engineering fundamentals	1.6.1 Apply engineering fundamentals
1.7 Demonstrate competence in specialized engineering knowledge to the program	1.7.1 Apply theory and principles of computer science engineering to solve an engineering problem

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Competency	Indicators
2.5 Demonstrate an ability to identify and formulate complex engineering problem	2.5.1 Evaluate problem statements and identifies objectives 2.5.2 Identifies processes/modules/algorithms of a computer based system and parameters to solve a problem
	2.5.3 Identifies mathematical algorithmic knowledge that applies to a given problem
2.6 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.6.1 Reframe the computer based system into interconnected subsystems 2.6.2 Identifies functionalities and computing 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 computer engineering principles 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 engineering mathematics 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 engineering 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.

Competency	**Indicators**	
3.5 Demonstrate an ability to define a complex / open-ended problem in engineering terms	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	Ability to review state of the art literature to synthesize system requirements.
	3.5.4	Ability to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard.
	3.5.5	Explore and synthesize system requirements from larger social and professional concerns.
	3.5.6	Ability to develop software requirement specifications (SRS).

3.6 Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.1 3.6.2 3.6.3	Ability to explore design alternatives. Ability to produce a variety of potential design solutions suited to meet functional requirements. 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 3.7.2	Ability to perform systematic evaluation of the degree to which several design concepts meet the criteria. Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.8 Demonstrate an ability to advance an engineering design to defined end state	3.8.1	Ability to refine architecture design into a detailed design within the existing constraints.
	3.8.2 3.8.3	Ability to implement and integrate the modules. Ability 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 4.4.2 4.4.3	Define a problem for purposes of investigation, its scope and importance Ability to choose appropriate procedure/algorithm, data set and test cases. Ability to choose appropriate hardware/software tools to conduct the experiment.
4.5 Demonstrate an ability to design experiments to solve open ended problems	4.5.1	Design and develop appropriate procedures/methodologies based on the study objectives
4.6 Demonstrate an ability to analyze data and reach a valid conclusion	4.6.1 4.6.2 4.6.3	Use appropriate procedures, tools and techniques to collect and analyze data Critically analyze data for trends and correlations, stating possible errors and limitations 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 engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.		
Competency	**Indicators**	
5.4 Demonstrate an ability to identify / create modern engineering tools, techniques and resources	5.4.1	Identify modern engineering tools, techniques and resources for engineering activities
	5.4.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.5 Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.5.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
	5.5.2	Demonstrate proficiency in using discipline specific tools
5.6 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.6.1	Discuss limitations and validate tools, techniques and resources
	5.6.2	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 societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.		
Competency	**Indicators**	
6.3 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.3.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level
6.4 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.4.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.		
Competency	**Indicators**	

7.3 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.3.1	Identify risks/impacts in the life-cycle of an engineering product or 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	7.4.1	Describe management techniques for sustainable development
	7.4.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering 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 ure in difficult ituations
	Maintain compos	
9.6 Demonstrate success in a teambased 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 engineering activities with the engineering 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	10.4.1 Read, understand and interpret technical and non-technical information 10.4.2 Produce clear, well-constructed, and well-supported written engineering documents 10.4.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.5 Demonstrate competence in listening, speaking, and presentation	10.5.1 Listen to and comprehend information, instructions, and viewpoints of others 10.5.2 Deliver effective oral presentations to technical and non-technical audiences
10.6 Demonstrate the ability to integrate different modes of communication	10.6.1 Create engineering-standard figures, reports and drawings to complement writing and presentations 10.6.2 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 engineering and management principles and apply these to one's own 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 engineering activity	11.4.1 Describe various economic and financial costs/benefits of an engineering activity 11.4.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.5 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering 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 engineering activity within time and budget constraints	11.6.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks. 11.6.2 Use project management tools to schedule an engineering project so it is completed on time and on budget.

PO 12: Life-long learning: Recognise 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	12.4.1 Describe the rationale for requirement for continuing professional development 12.4.2 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 engineering knowledge and practice	12.5.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current 12.5.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.6 Demonstrate an ability to identify and access sources for new information	12.6.1 Source and comprehend technical literature and other credible sources of information 12.6.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

APPENDIX-B

Sample questions for Bloom's Taxonomy levels

Samples questions for Blooms Taxonomylevels:

1. Remember

Skill Demonstrated	Question Ques / Verbs for tests
• Ability to recall of information 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. State Ohm's law
2. List the physical and chemical properties of silicon
3. List the components of A/D converter
4. List the arithmetic operators in increasing order of precedence.
5. Define the purpose of a constructor.
6. Define the terms: Sensible heat, Latent heat andTotal heat of evaporation
7. List the assembler directives.
8. Describe the process of galvanisation and tinning
9. Write truth table and symbol of AND, OR, NOT, XNOR gates
10. Define the terms; Stress, Working stress and Factor of safety.
11. What is the difference between declaration and definition of a variable/function?
12. List the different storage class specifiers in C.
13. What is the use of local variables?
14. What is a pointer on pointer?
15. What are the valid places for the keyword break to appear?
16. What is a self-referential structure?

2. 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. Explain the importance of sustainability in Engineering design
2. Explain the behaviour of PN junction diode under different bias conditions
3. Describe the characteristics of SCR and transistor equivalent for a SCR
4. Explain the terms; Particle, Rigid body and Deformable body giving two examples for each.
5. How many values of the variable num must be used to completely test all branches of the following code fragment ?

```
                if (value<25)
if (num>0)
        {
                value=10*num;
        if(num<12)
        value=value/10;
        }
        else
                Value=20*num;
else
                Value=30*num
```

6. Discuss the effect of Make in India initiative on the Indian manufacturing Industry.
7. Summarise the importance of ethical code of conduct for engineering professionals
8. Explain the syntax for 'for loop'.
9. What is the difference between including the header file with-in angular braces < > and double quotes " "?
10. What is the meaning of base address of the array?
11. What is the difference between actual and formal parameters?
12. Explain the different ways of passing parameters to the functions.
13. Explain the use of comma operator (,).
14. Differentiate between entry and exit controlled loops.
15. How is an Array different from Linked List?

3. 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:

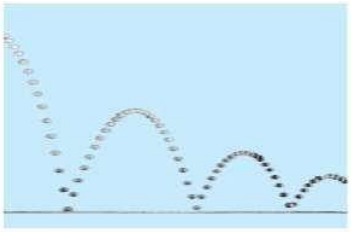
1. Model and realize the following behaviors using diodes with minimum number of digital inputs. (i) Turning on of a burglar alarm only during night time when the locker door is opened.
   (ii) Providing access to an account if either date of birth or registered mobile number or both are correct.
   (iii) Updating the parking slot empty light in the basement of a shopping mall.

2. One of the resource persons needs to address a huge crowd (nearly 400 members) in the auditorium. A system is to be designed in such a way that everybody attending the session should be able to hear properly and clearly without any disturbance. Identify the suitable circuit to boost the voice signal and explain its functionality in brief.

3. A ladder 5.0 m long rests on a horizontal ground & leans against a smooth vertical wall at an angle 20□ with the vertical. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder & the floor.

4. A ball is dropped from 6 meters above a flat surface. Each time the ball hits the surface after falling a distance h, it rebounds a distance rh. What will be the total distance the ball travels in each of the following cases.

   (a) $r > 1$ (b) $0 < r < 1$ (c) $r = 1$



5. The region bounded by the curves $y = e^{-1/x}, y = 0, x = 1$, and $x = 5$ is rotated about the x-axis. Use Simpson's Rule with $n = 8$ to estimate the volume of the resulting solid.

6. An electric train is powered by machine which takes the supply from 220 V DC rail running above the train throughout. Machine draws current of 100 A from the DC rail to account for high torque during starting and runs at 700 r.p.m initially. Calculate the new speed of the train once it picks up the speed where the torque output required is only 70% of starting torque. Assume the motor has a resistance of 0.1Ω across its terminals.
7. Write an algorithm to implement a stack using queue.
8. A single array A[1..MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables *top1* and *top2* (*topl*< *top2*) point to the location of the topmost element in each of the stacks. What is the condition for "stack full", if the space is to be used efficiently.
9. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.

Process	Arrival time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

   The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?
10. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation lookaside buffer (TLB) which can hold a total of 128-page table entries and is 4-way set associative. What is the minimum size of the TLB tag?

4. 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. A class of 10 students consists of 5 males and 5 females. We intend to train a model based on their past scores to predict the future score. The average score of females is 60 whereas that of male is 80. The overall average of the class is 70. Give two ways of predicting the score and analyse them for fitting model.

2. Suppose that we want to select between two prediction models, M1 and M2. We have performed 10 rounds of 10-fold cross-validation on each model, whereas the same data partitioning in round one is used for both M1 and M2. The error rates obtained for M1 are 30.5, 32.2, 20.7, 20.6, 31.0, 41.0, 27.7, 26.0, 21.5, 26.0. The error rates for M2 are 22.4, 14.5, 22.4, 19.6, 20.7, 20.4, 22.1, 19.4, 16.2, 35.0. Comment on whether one model is significantly better than the other considering a significance level of 1%.

3. Return statement can only be used to return a single value. Can multiple values be returned from a function? Justify your answer.
4. Bob wrote a program using functions to find sum of two numbers whereas Alex wrote the statements to find the sum of two numbers in the main() function only. Which of the two methods is efficient in execution and why?
5. Carly wants to store the details of students studying in 1st year and later on wishes to retrieve the information about the students who score the highest marks in each subject. Specify the scenario where the data can be organized as a single 2-D array or as multiple 1-D arrays.
6. Dave is working on a Campus Management Software but is unable to identify the maximum number of students per course. He decided to implement the same using arrays but discovered that there is memory wastage due to over provisioning. Which method of memory storage should be used by Dave and how it can be implemented using C?
7. Albert is working on a 32-bit machine whereas Julie is working on a 64-bit machine. Both wrote the same code to find factorial of a number but Albert is unable to find factorial of a number till 9 whereas Julie is able to find the factorial of higher number. Identify the possible reason why Albert is unable to find the factorial. Suggest some changes in the code so that Albert can handle bigger inputs.
8. While writing a C code, the problem faced by the programmers is to find if the parenthesis is balanced or not. Write an algorithm to check if the parenthesis in C code are balanced. Initially your code should work for balanced { and } braces.
9. Swapping of the data in a linked list can be performed by swapping the contents in the linked list. Can the contents of a linked list be swapped without actually swapping the data?

5. 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

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

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-C

Model Question Papers

Model Question Paper

Course: Programming for Problem solving (ESC 103)

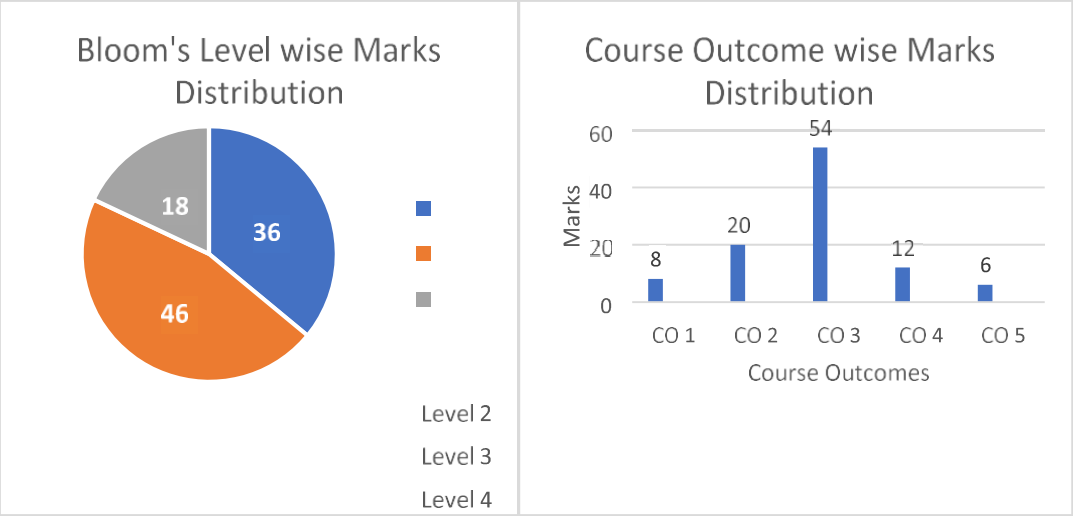
Maximum Marks :100; Duration: 03 hours

Q.No	Questions	Marks	CO	BL	PI
1(a)	Explain the steps involved in solving a problem using computer.	08	CO1	L2	1.4.1
1(b)	Write an algorithm to find roots of a quadratic equation ax2 + bx +c = 0 reading the values of a, b and c.	12	CO2	L3	1.4.1
2(a)	Compare if-else-if and switch statement giving examples for their relevant use.	08	CO2	L2	1.4.1
2b	Write a C program that reads a given integer number and checks whether it a palindrome. A palindrome is a number that has same value even when it is reversed. Eg: 12321 is a palindrome.	12	CO3	L3	1.4.1
3a	Compare the working of three looping constructs of C language giving their syntax.	08	CO3	L2	1.4.1

3b	What does the following program do?
	#include <stdio.h>
	
	int main()
	{
	char ch;
	int vcnt = 0, ccnt=0; for (ch = getchar(); ch != '\n'; ch=getchar()){ if(ch=='a' || ch=='e' || ch=='i' || ch=='o' || ch=='u' || ch=='A' || ch=='E' || ch=='I' || ch=='O' || ch=='U') vcnt++;
	else if((ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z')) ccnt++;
	}
	printf(" %d %d\n", vcnt, ccnt);
	}
	Rewrite the above program using while and switch constructs.
		12	CO4	L4	1.4.1

4a	Compare call by value and call by reference with relevant examples.	8	CO3	L2	1.4.1
4b	Write a C function to find the largest and smallest in a given list of inegers of size n using call by reference: void minmax(int list[ ], int n, int *min, int *max);	12	CO3	L3	1.4.1

5a	Explain at least four file handling operations available in C language giving their syntax.	4	CO3	L2	1.4.1
5b	Identify the bug in the following function written to return the swapped values of two integer variables given:	6	CO5	L4	1.4.1
Q.No	**Questions**	**Marks**	**CO**	**BL**	**PI**
	int swap(int *x, int *y) { int *temp; temp = x, x=y, y = temp; }				
5c	Define a structure to store time with three components hours, mins and seconds. Write a modular C program to compute the time taken by an athlete to complete a marathon reading the start and end time of his run.	10	CO3	L3	1.4.1



BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes
PO – Program Outcomes; PI Code – Performance Indicator Code

Model Question Paper for End Semester Examination Course Name: Programming for Problem Solving

Duration: 3 hrs. ; Max. Marks: 100

Instructions:

a. **Attempt five questions selecting ONE from each section. Question 9 (Section E) is compulsory.**
b. **All the questions carry equal marks.**
c. **Draw neat diagrams wherever applicable.**

Q. No	Question	Marks	BL	CO	PO	PI Code
	Section-A					
1	a. What is an algorithm? Explain the characteristics of an algorithm.	**2+6**	**1,2**	**2**	**1**	**1.4.1**
	b. Write an algorithm to find angle between hour and minute hands of a clock at a given time.	**7**	**3**	**3**	**1**	**1.4.1**
	c. Is it mandatory to declare main() function with return type as void or int. What will be the effect if there is no return type declared for main() function?	**3+2**	**4**	**3**	**1**	**1.4.1**
	OR					
2	a. What is the difference between definition and declaration in C? When a user writes "*int x;*" is it treated as declaration or definition in C.	**3+2**	**2,4**	**3**	**1**	**1.4.1**
	b. Write a program in C to find largest of 3 positive integer numbers using conditional operators.	**7**	**3**	**3**	**1,2**	**1.4.1, 2.2.4**
	c. What is meant by iterative statements? What are the different types of iterative statements in C?	**8**	**1,2**	**3**	**1**	**1.4.1**
	Section-B					
3	a. Shyam has placed *N* objects in a row which are marked with a number equal to their weight in Kg. He wants to check whether the objects are in increasing order of their weights or not. Write a C program to help Shyam.	**12**	**3**	**3,6,7**	**1,2**	**1.4.1, 2.2.4**
	b. Differentiate between Big-O and Big-Omega notation.	**4**	**2**	**3**	**1**	**1.4.1**
	c. What is the role of index in an array? How are the elements of a 2D array accessed in C?	**2+2**	**2**	**3**	**1**	**1.4.1**

OR

4	a. Ram is conducting a study which is based on counting the number of cars crossing the highway. Every hour he generates a random string containing sequence of characters <*rbwbwr*…>, where *r* represents red color, *w* denotes white color and *b* denotes blue color cars. The string is forwarded to Shyam for analysis who computes the number of red, blue and white color cars crossing Ram every hour. Assume that Ram works for 5 hours in a day, help Shyam generate a daily report containing the following: i. Total number of different colour cars crossing Ram in an hour. ii. Total number of different colour cars crossing Ram in a day. iii. Total number of cars crossing Ram in a day.	**4+4+4**	**3**	**3,6,7**	**1,2**	**1.4.1, 2.2.4**
	b. What is a variable? Explain the ways to declare scope of a variable.	**2+6**	**1,2**	**3**	**1**	**1.4.1**
	Section-C					
5	a. Write a program which will read positive integer numbers from the users and compute the sum if the number can be expressed as power of 2. The test whether a number can be expressed as power of 2 will be done using a function power_of_two(int a).	**12**	**3**	**3,6,7**	**1,2**	**1.4.1**
	b. What is recursion? Differentiate between homogeneous and heterogeneous recursion with the help of an example.	**2+3+3**	**2**	**3**	**1**	**1.4.1**
	OR					
6	a. What are the different ways to pass parameters to a function? Explain with the help of a suitable example.	**4+4**	**2**	**3,5**	**1**	**1.4.1**
	b. Is it possible to return multiple values from a function? Justify the statement with the help of an example.	**4+8**	**3**	**3,6,7**	**1,2**	**1.4.1**
	Section-D					

7	a. What is a structure? What is the benefit offered by using a structure over multiple arrays?	**2+6**	**2**	**5**	**1**	**1.4.1**
	b. Ram is working on a project which requires returning multiple values from a function. He observed that a return statement can only be used to return a single value from a function. How the function should be implemented so that multiple values can be returned by Ram?	**12**	**4**	**5**	**1**	**1.4.1**
	OR					
8	a. Write a program that reads a number as input from the user. The entered number is written to a file "even.txt" if the input is even else it is written to "odd.txt". Write a C code to perform the desired task.	**12**	**3**	**5**	**1**	**1.4.1**
	b. What are the different methods to open a file? Explain each with the help of a C program.	**3+5**	**2**	**5**	**1**	**1.4.1**
	Section-E (Compulsory Question)					
9	a. What is a compiler? List names of any 2 compilers.	**2 ½**	**1**	**1**	**1**	**1.4.1**
	b. What are the benefits of designing a flowchart for solving a problem?	**2 ½**	**4**	**2**	**1**	**1.4.1**

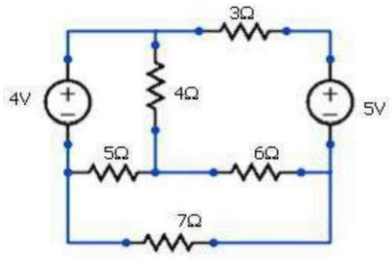
	c. What is the output of the following code?
	int main(){ int
	x=10; int
	y=sizeof(x/2);
	printf("%d",y);
	}
		2 ½	**3**	**4**	**1**	**1.4.1**

	d. What is the difference between creating constant using *#define* macro and *const* keyword?	**2 ½**	**3**	**3**	**1**	**1.4.1**
	e. What is the role of function prototype? When is it required in C?	**2 ½**	**2**	**3**	**1**	**1.4.1**
	f. Which of the following are unary operators in C? State reason for your answer. a. ! b. sizeof c. ~ d. &&	**2 ½**	**2**	**3**	**1**	**1.4.1**

	g. Which of the following special symbol allowed in a variable name? State reason for your answer. a. * (asterisk) b. | (pipeline) c. - (hyphen) d. _ (underscore)	**2 ½**	**2**	**3**	**1**	**1.4.1**
	h. In which header file is the NULL macro defined? State reason for your answer. a. stdio.h b. stddef.h c. stdio.h and stddef.h d. math.h	**2 ½**	**2**	**3**	**1**	**1.4.1**

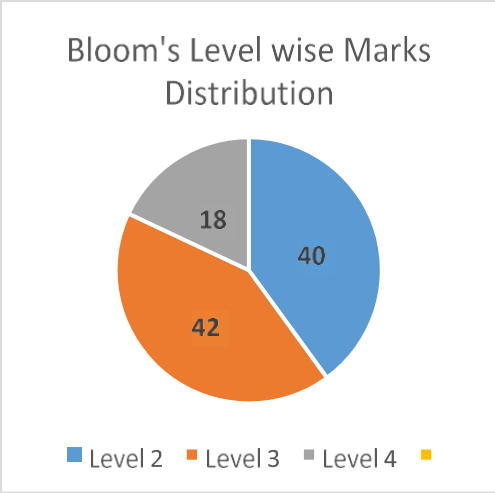
BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 -Applying, 4 -Analysing, 5 – Evaluating, 6 - Creating)
CO -Course Outcomes
PO –Program Outcomes; PI Code -Performance Indicator Code

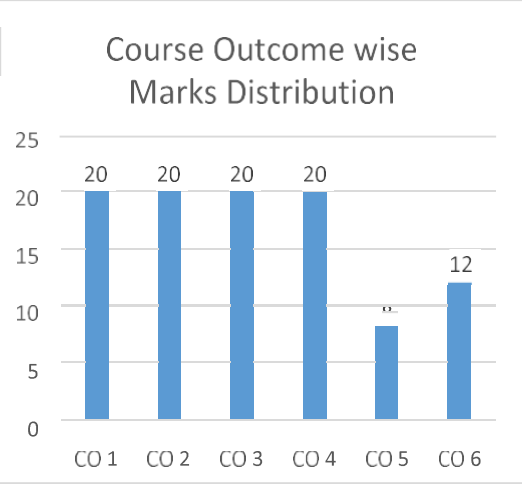
Model Question Paper Total Duration (H:M): 3:00
Course : Basic Electrical Engineering (ESC101) Maximum Marks :100

Q.No	Questions	Marks	CO	BL	PI
1(a)	Calculate current through 4 Ω resistor using Kirchoff's Laws? Verify the same using Superposition Theorem. 	12	CO1	L3	1.3.1
1(b)	Derive the expression for the transient current in a series 'R-L' circuit when a 'dc' voltage of V volts is applied. Sketch time variation of current in the circuit.	8	CO1	L2	1.3.1

2(a)	Two impedances Z_1=15+j12Ω and Z_2=8-j5 Ω are connected in parallel. If the potential difference across one of the impedance is 250 V, calculate i) total current and branch currents ii) total power and power consumed in each branch iii) overall p.f. IV) draw the phasor diagram	12	CO2	L3	1.3.1
2b	It is desired to operate a 100 W, 120 V, electric bulb at its rated current on a 240 V, 50 Hz supply. The simplest arrangement is to use either (a) a resistor, or (b) a capacitor or (c) an inductor having 10 Ω resistance in series with the electric bulb so as to drop the excess voltage. Determine the value of the component used, the total power consumed and the power factor in each case. Giving reasons, state which alternative is the best.	8	CO2	L4	1.3.1
3a	A single phase 25 kVA 1000/2000 V, 50 Hz transformer has maximum efficiency of 98% at full load upf. Determine its efficiency at, (a) 3/4th full load, unity power factor (b) 3/4th full load 0.8 power factor	12	CO3	L3	1.3.1
3b	Explain the working of a practical transformer with relevant phasor diagram. and define voltage regulation.	8	CO3	L2	1.3.1
4a	A two pole 3 phase 50 Hz induction motor is running on load with a slip of 4%. Calculate the actual speed and the synchronous speed of the machine. Sketch the speed/ load characteristic of the machine.	8	CO4	L2	1.3.1
4b	A wireless battery powered drilling machine operates on 24 V DC with constant speed and negligible field current. Initially when the machine is powered it runs at 1200 rpm and draws 0.5 A from the battery. Further when the drill bit starts drilling the hole, the speed reduces to 1120 rpm.	12	CO4	L4	1.3.1
Q.No	**Questions**	**Marks**	**CO**	**BL**	**PI**
	Determine power requirement from the battery for drilling if the resistance of the armature is 0.2Ω. What is the power drawn initially?				
5a	Explain the working principle of a single phase pulse width modulated voltage source inverter with relevant circuit diagram and draw the output voltage wave form.	8	CO5	L2	1.3.1
5b	To protect an expensive circuit component from being delivered too much power, you decide to incorporate a fast blowing fuse into the design. Knowing that the circuit component is connected to 12 V, its minimum power consumption is 12 watts and the maximum power it can safely dissipate is 100 watts, which of the three available fuse ratings should you select: 1A , 4A or 10 A? Give reasons.	6	CO6	L4	1.3.1

5c	Calculate the i) ampere-hour and ii) watt-hour efficiency of a secondary cell which is discharged at a uniform rate of 30 A for 6 hours at an average terminal voltage of 2 V. It is then charged at a uniform rate of 40 A for 5 hours to restore it to its original condition. The terminal voltage during charging is 2.5 V.	6	CO6	L3	1.3.1





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes
PO – Program Outcomes; PI Code – Performance Indicator Code

APPENDIX-D

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 decisionmaking 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 a 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 Engineering Principles	No or erroneous application of engineering principles yielding unreasonable solution. Serious deficiencies in proper selection and use of engineering principles.	Effective application of engineering principles resulting in reasonable solution.	Critical selection and application of engineering 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 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 engineering systems, variables, and parameters to solve the problems - **IA**	02	Engineering systems are not identified. Variables, and parameters to solve the problems are not defined	Engineering systems are identified but not clear. Variables, and parameters to solve the problems are not defined	Engineering systems are clear. Variables, and parameters to solve the problems are not defined	Engineering systems are identified. Variables, and parameters to solve the problems are partially defined	Engineering 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 assumptions - **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 nontechnical 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 engineering 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 engineering designs	Able to generate engineering designs but not able to justify	Able to generate engineering 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 engineering 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**

AICTE Committee on Examination Reforms

Members of the Committee

1. **Prof Ashok S. Shettar, Chairman**
   Vice Chancellor, KLE Technological University, Hubballi, Karnataka

2. **Prof Rama Krishna Challa,**
   Prof and Head, Dept. of Computer Science and Engineering NITTTR, Chandigarh

3. **Prof Sanjay Agrawal**
   Professor, Dept. of Computer Engineering and Applications, NITTR, Bhopal (M.P)

4. **Prof Upendra Pandel**
   Professor, Dept. of Metallurgical & Material Engineering, MNIT Jaipur.