**CRITERION 4. CONTINUOUSIMPROVEMENT**

**A. Student Outcomes**

The objective of the Computer Science and Engineering (CSE) programme is to provide graduates with the core knowledge necessary for future leadership positions in the several disciplines that rely on computers and its essentials as a foundational science. We seek to provide each graduate with a solid grounding in both the theory and practice of computers in order to train them for possibilities to generate new knowledge beyond graduation. We seek to give the required information and skills to encourage lifelong learning and ethical behaviour. The faculty believes that the mission can only be accomplished through a dedication to assisting student learning through analysis and continuous improvement of the programme through assessment and evaluation of student needs, as well as responsiveness to changes in the discipline within a global, social, and ethical context.

Our programme uses different tools and processes to assess and evaluate the extent to which its SOs are being attained. These processes are used to gather the data which is necessary for the assessments. Evaluation, in the form of interpreting the data, is then carried out in order to determine how well the outcomes are being attained. The results of both the assessment and evaluation processes are finally utilized for the continuous improvement of the programme. The steps used for the assessment, evaluation and feedback to the continuous improvement of the program follow the following three steps.

**Step-1:** Assessment tools of the SOs (i.e., collecting appropriate data) can be direct or indirect. Direct assessment of SOs usually relies on the course work, whereas indirect assessments of SOs are usually obtained by using surveys.

**Step-2:**Analyse and compare the student’s assessment data to a pre-set performance indicator of SOs, which constitutes the evaluation processes.

**Step-3:**Checking the degree to which the data evaluation results meet the pre-set targets will be the driving force for the continuous improvement processes.

The following administrative setup ensures the attainment of SOs

* Course coordinator
* Year coordinator
* Program Monitoring and Assessment Committee (PMAC)
* Head of the Department of CSE

Course Coordinator:

The course coordinator coordinates and supervise the faculty teaching the particular course and responsible for assessment of the course outcomes and student outcomes. The course coordinator analyses results of the particular course and recommends the Head of the Department to take appropriate action.

Year Coordinator:

The year coordinator has to monitor the particular batch student’s activities like course registration, selection of electives and feedback collections. The year coordinator is also responsible for collecting various surveys like graduate exit survey, parents survey, alumni survey, employer survey, and faculty survey.

Program Monitoring and Assessment Committee:

The program monitoring advisory committee (consist of Head of the Department, senior faculty and course coordinator) analyses the collected data by the course coordinators and recommends content delivery methods, curriculum improvements, set the attainment targets and also discuss about the attainment process of course outcomes and student outcomes, as needed. The advisory committee meets yearly once specifically during the month of June /July of the academic year after the announcement of results. The improvements suggested by advisory committee as a result of assessment are implemented for next batch of students.

Head of the Department:

The Head of the Department of the programme act as programme coordinator as well as chair-person for the department advisory committee and monitors the whole process of outcome attainments and continuous improvements.

The process of SO assessment and continuous improvement is shown in figure 4.1.



Figure 4 1: Process of SO assessment and continuous improvement

Assessment process is divided in to two types: Direct assessment and Indirect assessment.

In direct assessment, the data is collected during the semester the course is taught. The procedure for assessment of student performance varies by outcome and by course and can include performance measurements from various assessment tools that can be categorized as two types

* Cumulative Internal Examinations (CIE)
* Semester End Examinations (SEE)

The nature of the courses for internal examination and semester end examination details are given in the table 4.1.

Table 4 1: Nature of the courses for assessment

|  |  |  |
| --- | --- | --- |
| **Course type** | **External** | **Internal** |
| Theory course | Semester end examination –Theory | Weekly test examination,  Mid examination |
| Lab course | Semester end examination – Practical | Continuous lab assessment (Day to day work and record),  Internal practical examination |
| Theory course integrated with laboratory | Semester end examination - Theory and Practical | Weekly test examination,  Mid examination,  Continuous lab assessment,  Internal practical examination |
| Theory course integrated with minor project | Semester end examination - Theory and minor project | Weekly test examination,  Mid examination,  Internal minor project review |
| Theory course integrated with laboratory and minor project | Semester end examination -Theory, practical and minor project | Weekly test examination,  Mid examination,  Continuous lab assessment,  Internal practical examination,  Internal minor project review |
| Project/Internship | Semester end examination - Viva-Voce and demonstration | Internal reviews |

In Indirect assessment, the data is collected from various programme constituencies and the procedure for calculation is as follows

* **Step-1**: Consolidate the response of the questions for all the surveys.
* **Step-2**: The responses of the questions are mapped to appropriate SOs.
* **Step-3**: Average of each SOs attainment for the surveys are calculated.

For final SO attainment, the weight age of the SO direct attainment is 80% and the SO indirect attainment is 20%.

The approach of SO attainment process is shown in figure 4.2.



Figure 4 2: Process of SO Attainment

The assessment process used to gather the data for evaluation of each student outcome as well as the frequency of the assessment along with the weight age is shown in the Table 4.2.

Table 4 2: Assessment process, data collection, weight age and frequency of assessment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Assessment processes used for data collection** | | **Description** | **Weight age of marks** | **Frequency of assessment (**per semester) |
| 1 | Direct attainment | Weekly test | Five to seven-week test will be conducted on every Monday.  The maximum marks will be 10. Each question is a single question carrying ten marks (or) 2 sub questions with a total of ten marks. It is expected that a student should score at least 6 marks (60%) out of 10 marks for the attainment of that course outcome. | 10 | 5-7 |
| 2 | Mid exam | Three Mid Examinations are conducted in a semester. Mid-1 is conducted from first unit and half of second unit of the course syllabus, Mid-2 is conducted for half of second unit and full third unit of the course syllabus and MID-3 is conducted from fourth and fifth units of the course syllabus. The question paper has thirty marks (10 one marks, two five marks and one ten marks). It is expected that a student should score at least 18 marks (60%) out of 30 marks for the attainment of that course outcome. | 30 | 3 |
| 3 | Continuous lab assessment | Ten to thirteen continuous lab assessment will be conducted on every week during laboratory session. The maximum marks will be 10. Each experiment carrying ten marks. It is expected that a student should score at least 6 marks (60%) out of 10 marks for the attainment of that course outcome. | 10 | 10-13 |
| 4 | Internal lab exam | One exam will be conducted when 5 to 6 experiments have been completed. The maximum marks will be of fifty. It is expected that a student should score at least 30 marks (60%) out of 50 marks for the attainment of that course outcome. | 50 | 1 |
| 5 | Internal minor project | The minor project is carried out during every semester by conducting two reviews with fifty marks. It is expected that a student should score at least 30 marks (60%) out of 50 marks for the attainment of that course outcome. | 50 | 2 |
| 6 | End semester theory exam | The end-semester theory examination is of 3-hour duration and cover the entire syllabus of the course. It would generally satisfy all course outcomes for a particular course. The question will have a total of 24 questions. The question paper has ten one mark, four either (or) choice of five marks and three either(or) choice of ten marks. The marks scored by the students in the end semester examination are used to assess the attainment level of the whole course and the same is transferred to each course outcome attainment level, while calculating the overall attainment level. It is expected that a student should score at least 24 marks (40%) out of 60 marks for the attainment of that course outcome. | 60 | 1 |
| 7 | End semester lab exam | The end semester lab examination shall be conducted with an external examiner and the lab handling faculty. The external examiner will be appointed from university exam cell. These end-semester examinations are of 3-hours duration and cover all the experiments of the course. The end exam is evaluated for a maximum mark of fifty. It is expected that a student should score at least 20 marks (40%) for the attainment of that course outcome. | 50 | 1 |
| 8 | End semester minor project exam | The end semester minor project examination shall be conducted with an external examiner and the internal faculty. The external examiner will be appointed from university exam cell. These end-semester examinations are of 3-hours duration and batch wise. The end exam is evaluated for a maximum mark of fifty including presentation, report and demonstration of their works. It is expected that a student should score at least 20 marks (40%) for the attainment of that course outcome | 50 | 1 |
| 9 | Internal Project / Internship reviews | The project is carried out during final year (seventh or eighth semester) by conducting three reviews. First review is conducted for 10 marks and other two reviews are conducted for 20 marks. It is expected that a student should score at least 30 marks(60%) out of fifty marks for the attainment of that course outcome.  The internship is carried out during final year (seventh or eighth semester) by conducting two reviews. Each review is conducted for twenty-five marks. It is expected that a student should score at least 30 marks(60%) out of fifty marks for the attainment of that course outcome. | 25 | 2 |
| 10 | End semester Project / Internships reviews | Project/internship is conducted during final year (seventh or eighth semester). The committee consists of an external examiner and a senior faculty member of the department shall conduct the exam. The end exam is evaluated for fifty marks. It is expected that a student should score at least 20 marks(40%) out of fifty marks for the attainment of that course outcome. | 50 | 1 |
| 11 | Indirect attainment | Graduate Exit Survey | Indirect Assessment involves the qualitative method of obtaining the reflections of the stakeholders on the achievement of the program outcomes, through feedback mechanism. | Grade scale of 3 to 1 | 1 - End of the program |
| 12 | Parents Survey | 1 - End of the program |
| 13 | Alumni Survey | 1 - After one year of graduation |
| 14 | Employer Survey | 1 - After one year of graduation |
| 15 | Faculty Survey | 1 - End of the program |

**A .1 EALUATION OF STUDENT OUTCOMES (AS PER EAC)**

**A.1Course Outcomes**

Each course has a set of outcomes called “Course Outcomes” or COs. The COs of a course are the abilities targeted to be attained by the students through the various topics taught to them in the course. For CSE programme the COs are part of the syllabus and are included in the curriculum book. The syllabus for each course with the COs is also provided in Appendix A - Course Syllabi. An example of the set of COs for the course 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS is shown below. COs are important because they are the basis of all direct assessments of SOs.

**Course Outcomes**:

Upon successful completion of this course, students should be able to:

CO1: Understand different algorithmic design strategies like divide and conquer, greedy, dynamic programming, backtracking etc.

CO2:Apply various design algorithms to solve a given problem.

CO3:Analyze the efficiency of a given algorithm using time and space complexity theory.

CO4: Investigate which design strategy is efficient to solve a given problem scenario.

CO5: Synthesize new algorithms for solving given problems based on dynamic programming and backtracking techniques and analyze them.

**A.2 CO-SO Mapping**

The ability attained by students in a CO may be linked to an ability represented by one or more SOs. Therefore, CO-SO map is required to show this linking using the 1-3 logic. A typical CO-SO map for the course 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS is shown below. A value of 3 indicates the CO is significantly contributing towards the relevant SO. Since SOs are linked to the COs of various core courses through the CO-SO mapping, if the COs of particular test are attained to the required level of satisfaction, the relevant SOs are also assumed to be attained to the required level of satisfaction. Based on this proposition, the most important part of our SO assessment process is to track the attainment and satisfaction of COs in various courses. The data obtained for CO satisfaction are then mapped to SO satisfaction data by using CO-SO mapping.

Table 4 3: 16CS206 - Design and Analysis of Algorithm CO-SO Mapping

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SOs==> | SO1.1 | SO1.2 | SO2 | SO3 | SO4.1 | SO4.2 | SO4.3 | SO5.1 | SO5.2 | SO6.1 | SO6.2 | SO7 |
| CO 1 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| CO 2 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO 3 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO 4 | 3 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO 5 | 2 | - | 3 | 2 | 3 | - | - | - | 2 | 2 |  | - |
| **Avg.** | **2.67** | **2.50** | **3.00** | **2.00** | **3.00** | **-** | **-** | **-** | **2.00** | **2.00** | **3.00** | **-** |

**A.3 Relationship of highly correlated courses in the curriculum to the student outcomes**

The courses were carefully chosen to create linkage across the entire CSE curriculum for assessment, evaluation and continuous improvement. Among these courses, three highly correlated courses are selected for direct attainment of each SOs. The Articulation Matrix (also referred to as Analysis of Course Content Matrix) helps to choose the particular course for SO assessment.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Mapping to student outcomes** | | | | | | | | | | | |
| **Course Code with Name** | SO1.1 | SO1.2 | SO2.1 | SO3.1 | SO4.1 | SO4.2 | SO4.3 | SO5.1 | SO5.2 | SO6.1 | SO6.2 | SO7.1 |
| 16HS103 - Engineering Mathematics-I | 2.95 | 2.95 |  |  |  |  |  |  |  | 2.95 |  | 2.95 |
| 16HS102 - Engineering Physics | 2.47 | 3.00 | 3.00 |  |  |  | 2.80 |  |  |  |  |  |
| 16HS105 - - Technical English Communication |  |  |  | 2.93 | 2.87 |  | 2.73 | 2.93 |  |  |  | 2.95 |
| 16CS101 - Basics of Computers and Internet | 2.00 | 2.26 |  |  |  |  |  |  |  |  |  |  |
| 16CS102 - Computer Programming | 2.72 | 2.72 | 2.64 |  |  |  |  |  |  |  |  |  |
| 16EE101 - Basics Of Engineering Products | 2.72 | 2.72 | 2.74 |  |  |  |  |  |  |  |  |  |
| 16HS104 - English Proficiency and Communication Skills |  |  |  | 2.87 |  |  |  | 2.87 |  |  |  |  |
| 16HS110 - Engineering Physics Laboratory | 2.92 |  | 2.95 |  |  |  |  |  |  | 2.95 |  |  |
| 16HS108 - Engineering Mathematics-II | 2.96 | 2.96 |  |  |  |  |  |  |  | 2.96 |  | 2.96 |
| 16HS107 - Engineering Chemistry | 3.00 | 2.87 |  |  |  |  | 2.87 |  |  | 2.87 |  |  |
| 16ME101 - Engineering Graphics | 2.50 | 3.00 |  |  |  |  |  |  |  | 2.00 |  |  |
| 16EE102-Basics of Electrical and Electronics Engineering | 2.77 | 2.77 | 2.19 |  |  |  |  |  |  |  |  |  |
| 16HS111 - Engineering Chemistry Laboratory | 3.00 | 3.00 |  |  |  |  |  | 3.00 |  |  |  | 3.00 |
| 16HS109 - Environmental Science and Technology |  |  |  |  | 2.84 | 2.84 | 2.87 |  |  |  |  | 2.87 |
| 16EC202 - Electronic Devices and Circuits | 2.63 | 2.63 | 1.20 |  |  |  |  | 2.63 |  |  |  | 2.63 |
| 16ME103 - Workshop Practice | 3.00 | 2.31 | 2.47 |  |  |  | 2.00 | 2.50 |  | 2.47 |  |  |
| 16HS202 - Probability and Statistics | 2.51 | 2.51 | 2.51 |  |  |  |  |  |  |  |  |  |
| 16MS201 - Management Science | 2.18 | 2.49 | 2.00 |  |  |  |  |  |  |  | 2.18 |  |
| 16CS201 - Database Management System | 2.12 | 1.93 | 2.00 | 2.00 | 2.38 |  |  |  |  | 2.13 |  |  |
| 16CS202 - Data Structures | 2.01 | 2.25 | 1.93 |  |  |  |  |  |  |  |  |  |
| 16CS203 - Digitl Logic Design | 2.84 | 2.67 | 2.60 |  |  |  |  |  |  |  |  |  |
| 16CS204 - Discrete Mathematical Structures | 2.84 | 2.64 | 2.50 |  |  |  |  |  |  |  | 2.13 |  |
| 16EL102 - Softskill Laboratory | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |  |  |  | 3.00 |
| 16CS205 - Computer Organization and Architecture | 2.25 |  | 2.58 |  |  |  |  |  |  |  | 2.50 |  |
| 16CS206-Design and Analysis of Algorithms | 2.90 | 2.14 | 2.93 | 2.93 | 2.93 |  |  |  | 2.93 | 2.93 | 2.90 |  |
| 16CS208 - OOP | 2.78 | 2.92 | 2.82 | 2.82 |  |  |  | 2.82 | 2.82 | 2.80 |  | 2.82 |
| 16CS207 - FLAT | 2.27 | 2.54 | 2.20 |  |  |  |  |  |  | 2.20 | 2.24 |  |
| 16EL103 - Professional Communications Laboratory |  |  |  | 3.00 |  | 3.00 | 3.00 | 3.00 |  | 3.00 |  | 3.00 |
| 16CS241 - Computer Graphics | 2.92 | 2.92 | 2.92 |  |  |  |  |  |  |  | 2.92 |  |
| 16CS242 - Scripting Languages | 2.45 | 2.49 | 2.48 |  |  |  |  |  | 2.66 | 2.66 | 2.57 | 2.66 |
| 16CS245 - Advanced databases | 2.50 | 2.80 | 2.48 |  |  |  |  |  |  | 2.58 |  |  |
| 16CS246 - Linux/Unix & Shell Programming | 2.46 | 2.32 | 2.58 |  |  |  |  |  |  |  |  |  |
| 16HS219 - Indian History and Culture |  |  |  |  |  | 2.57 |  | 2.57 |  |  |  |  |
| 16MS202 - Principles and Practice of Management | 2.76 | 2.80 | 2.80 | 2.20 |  | 2.60 |  | 2.80 |  |  |  | 2.00 |
| 16EC270 - Embedded Linux | 2.14 | 2.14 |  |  |  |  |  |  |  |  | 2.04 |  |
| 16HS301 - Professional Ethics |  |  | 2.00 |  |  | 2.65 |  | 2.00 |  | 2.10 |  |  |
| 16CS301 - Software Engineering | 2.58 | 2.49 | 2.62 |  |  |  |  |  |  | 2.63 | 2.41 |  |
| 16CS302 - Web Technologies | 2.98 | 2.66 | 2.64 | 2.64 |  |  |  | 2.64 |  | 2.64 | 2.07 |  |
| 16CS303 - Compiler Design | 2.51 | 2.51 | 2.40 |  |  | 2.40 | 2.40 |  |  | 2.51 | 2.51 |  |
| 16CS304 - Operating Systems | 2.52 | 2.59 | 2.53 |  |  |  |  |  |  | 3.00 | 2.72 |  |
| 16CS341 - Fundamentals of  Image Processing | 2.26 | 2.27 |  |  |  |  |  |  |  |  |  | 2.22 |
| 16CS342 - Open System for  Web Technologies | 2.35 | 2.19 | 2.22 |  |  |  |  |  |  |  |  |  |
| 16CS345 - Distributed System | 2.10 | 2.47 | 2.53 | 2.20 |  |  |  | 2.53 |  | 2.54 | 2.20 | 2.41 |
| 16CS351 - R Programming | 2.38 | 2.38 | 2.33 | 2.34 |  | 2.40 |  | 2.34 | 2.34 | 2.34 | 2.38 | 2.34 |
| 16CS448 - Python Programming | 2.14 | 2.29 | 2.17 |  |  |  |  |  |  |  |  |  |
| 16EC271 - Embeded Systems  for RTOS | 2.18 | 2.17 | 2.17 |  |  |  |  |  |  |  | 1.70 | 2.11 |
| 16HS224 - Polity and  Governance of India |  |  |  |  |  | 1.94 |  | 1.94 |  |  |  |  |
| 16ME369 - Advances in Robotics | 2.70 | 2.65 | 2.71 |  |  | 2.65 |  | 2.65 | 2.65 |  | 2.70 | 2.65 |
| 16MS301 - Managerial Economics |  | 2.28 | 2.14 |  |  |  | 2.36 |  |  |  | 2.28 | 2.12 |
| 16CS305 - Data Mining Techniques | 2.40 | 2.74 | 2.40 |  |  | 2.73 |  |  |  | 2.73 | 2.70 | 2.73 |
| 16CS306 - Computer Networks | 1.99 | 2.52 | 2.69 | 2.67 |  |  |  |  |  |  | 2.79 |  |
| 16CS307 - Micro Procesors and Interfacing | 2.39 | 2.40 | 2.39 | 2.13 |  | 2.13 |  | 2.13 | 2.13 | 2.13 |  | 2.40 |
| 16CS308 - Operations Research for Computer Science and Engineering | 2.68 | 2.69 | 2.86 |  |  | 2.86 |  |  |  |  | 2.81 | 2.86 |
| 16CS344 - Aritificial Intelligence | 1.97 |  | 2.82 | 2.69 |  |  |  |  |  | 2.69 | 3.00 |  |
| 16CS347 - Middleware Technologies | 2.60 | 2.54 | 2.51 |  |  |  |  |  |  | 2.47 | 2.54 |  |
| 16CS350 - Cloud Computing | 2.02 | 2.04 |  |  |  | 2.42 |  |  |  | 1.88 | 2.02 |  |
| 16EC370 - Micro Controllers for Embedded Systems | 1.88 | 1.79 | 2.27 |  |  |  |  |  |  | 2.43 | 2.21 | 2.02 |
| 16HS307-ECONOMIC & SOCIAL DEVELOPMENT OF INDIA |  |  |  |  |  | 1.84 |  |  |  |  |  |  |
| 16CS401 - Search Engine | 2.18 | 2.21 | 2.30 |  |  |  |  |  | 2.21 | 2.21 | 2.21 | 2.21 |
| 16CS402 - Embedded Systems | 2.56 | 2.49 | 2.46 |  |  |  |  |  |  | 3.00 | 2.64 | 2.42 |
| 16CS403 - Information Security | 2.47 | 2.47 | 2.52 |  |  | 3.00 |  |  |  | 3.00 |  |  |
| 16CS404 - Mobile communications | 2.46 | 2.46 | 2.74 | 2.68 |  | 2.78 | 2.53 | 2.53 | 2.74 | 2.73 | 2.73 | 2.73 |
| 16CS440 - Mobile Adhoc Networks | 2.70 | 2.69 | 2.70 |  |  | 2.60 |  |  |  | 2.70 |  |  |
| 16CS441 - Pattern Recognition | 2.33 | 2.39 | 2.79 |  |  |  |  |  |  |  | 2.68 |  |
| 16CS442 - Emerging Technologies | 2.29 | 2.25 |  |  |  |  |  |  |  |  | 2.04 |  |
| 16CS445 - Big Data Analytics | 2.68 | 2.68 | 2.69 | 2.68 |  | 2.68 | 2.56 |  | 2.64 | 2.76 | 2.63 | 2.68 |
| 16CS446 - Data science Using Python | 2.55 | 2.01 | 2.55 |  |  |  |  |  |  |  |  |  |
| 16HS308 - Geography & Environmental for Concerns of India |  |  |  |  |  | 2.21 | 2.20 |  |  |  |  | 2.51 |
| 16ME458 - Artificial Intelligence  for Robotics | 2.36 | 2.52 |  |  |  |  |  | 2.36 |  |  |  | 2.52 |
| 16MS401 - Engineering Enterpreneurship | 2.85 |  |  | 2.27 |  | 2.60 | 2.27 |  |  |  | 3.00 |  |
| 17ES004 - Design of IOT  Systems | 2.28 | 2.28 | 2.28 | 2.26 |  | 2.28 | 2.28 | 2.28 | 2.26 | 2.28 | 2.28 | 2.26 |
| 16CS411 - Project | 1.20 | 1.20 | 1.20 | 1.20 |  | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 16CS412 - Internship | 1.20 | 1.20 | 1.20 | 1.20 |  | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| EL & LS1 | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| El & LS2 | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| EL & LS3 | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| EL & LS4 | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| EL & LS5 | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Modular Course | 3.00 | 3.00 | 3.00 |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |

Table 4 4: Relationship of highly correlated courses in the curriculum to SO's

**A.4 Attainment level for student outcomes**

The CSE programme selected two types of evaluation approaches with three levels of achievement to ensure there was a clear distinction between work that met the department’s standards. The approaches are

1. Best attainment values among all assessment tools are considered with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level.
2. The attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is1. Further the attainment is obtained by the weighted level of questions mapped with COs.

After assessment, each student outcomes follows one of the three rubric levels:

Table 4 5: Rubric Levels

|  |  |  |
| --- | --- | --- |
| **3: Exemplary** | **2: Satisfactory** | **1: Developing** |
| Exceeds expectations about understanding and application. | Understands the concept and applies it properly thereby meeting minimum expectations or requirements. | Partially understands the concept, but does not apply it properly, and thus fails to meet expectations. |

**A.5ASSESSMENT CYCLE: 2017-2021 BATCH**

**A.5.1 Assessment of SO1**

Table 4 6: Mapping of SO1 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO1** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. | SO1.1- Ability to identify and formulate problems in the area of computing. | 16HS103 -  16HS102 -  16CS101 -  16CS102 -  16EE101 -  16HS108 -  16HS107 -  16ME101 -  16EE102 -  16HS111 -  16EC202 -  16ME103 -  16HS202 -  16MS201 -  16CS201 -  16CS202 -  16CS203 -  16CS204 -  16CS206 -  16CS208 -  16CS207 -  16CS241 -  16CS242 -  16CS245 -  16CS246 -  16MS202 -  16EC270 -  16CS301 -  16CS302 -  16CS303 -  16CS304 -  16CS341 -  16CS342 -  16CS345 -  16CS351 -  16CS448 -  16EC271 -  16MS301 -  16CS305 -  16CS306 -  16CS307 -  16CS308 -  16CS347 -  16CS350 -  16EC370 -  16CS401 -  16CS402 -  16CS403 -  16CS404 -  16CS441 -  16CS442 -  16CS445 -  16CS446 -  16ME458 -  16MS401 -  16CS411 -  16CS412 - |
| SO1.2- Apply engineering, science, and mathematics skills to solve engineering issues using analytical, numerical, and statistical methods. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 7: SO1 against the Rubrics Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (1):**An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO1.1**:Apply engineering, science, and mathematics skills to solve engineering issues using analytical, numerical, and statistical methods. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |
| **SO1.2**:Ability to identify and formulate problems in the area of computing. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |

The first approach for SO1 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.8 and table 4.9 shows the SO1 attainment of three highly correlated courses.

Table 4 8: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS208 OOP | Internal Minor | 50 | 444 | 403 | 41 | 0 | 91% |
| Mid exam 1 | 30 | 435 | 434 | 0 | 1 | 100% |
| 2 | 16CS241 COMPUTER GRAPHICS | Weekly test 2 | 10 | 147 | 135 | 5 | 6 | 93% |
| Mid exam 1 | 30 | 151 | 151 | 0 | 0 | 100% |
| 3 | 16CS204 - Discrete Mathematical Structures | WT 3 | 10 | 421 | 349 | 33 | 39 | 83% |
| Mid I | 30 | 401 | 394 | 5 | 2 | 98% |

Chart, bar chart, box and whisker chart

Description automatically generated

Figure 4 3: Best Attainment values among assessment tools

Table 4 9: SO attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS208 OOP | Internal Minor | CO1 CO2 CO3 CO4 CO5 | SO1, SO2,SO2,SO3,SO5,SO6,SO7 | 91% | Attained |
| Mid exam1 | CO1 | SO1 | 100% | Attained |
| 2 | 16CS241 COMPUTER GRAPHICS | Weekly test 2 | CO2 | SO1, SO2, SO6 | 93% | Attained |
| Mid exam 1 | CO1 CO2 | SO1, SO2, SO6 | 100% | Attained |
| 3 | 16CS204 - Discrete Mathematical Structures | WT 3 | CO2 CO3 | SO1, SO2 | 83% | Attained |
| Mid I | CO1 CO2 | SO1 | 98% | Attained |

1. The second approach for SO1 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.9 shows the SO1 attainment of three highly correlated courses.

Table 4 9:Student Outcome 1 (SO1) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS208 OOP | 1.94 | 2.92 | 3.00 | 3.00 | 3.00 | 3.00 | 2.85 | Attained |
| 2 | 16CS241 COMPUTER GRAPHICS | 2.58 | 3.00 |  | 3.00 | 3.00 |  | 2.92 | Attained |
| 3 | 16CS204 - Discrete Mathematical Structures | 2.35 |  |  | 3.00 |  |  | 2.74 | Attained |

Chart, bar chart

Description automatically generated

Figure 4 4: Levels of attainment in each process

Table 4 10: Attainment values from indirect assessment

|  |  |  |
| --- | --- | --- |
| **Types of survey** | **SO1.1** | **SO1.2** |
| Graduate Exit Survey | 2.5 | 1.73 |
| Alumni Survey | 3.00 | 3.00 |
| Employer Survey | 2.67 | 2.67 |
| Faculty Survey | 3.00 | 3.00 |
| Average | **2.7925** | **2.60** |
| 20 % of indirect attainment | **0.558** | **0.52** |

#### Attainment of SO1 from direct and indirect assessment:

Table 4 11: : Student Outcome 1 (SO1) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS208 OOP | 2.83 |
| 2 | 16CS241 COMPUTER GRAPHICS | 2.92 |
| 3 | 16CS204 - Discrete Mathematical Structures | 2.53 |
| 80% of direct attainment value | | **2.208** |
| 20% of indirect attainment value | | 0.539 |
| **Total attainment score** | | **2.747** |
| **Attainment status** | | **Attainment status** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.2 Assessment of SO2**

Table 4 12: Mapping of SO2 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO2** | **Performance Indicator** | **List of Courses considered** |
| 1. | An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | **SO2.1**: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as a global, cultural, social, environmental, and economic factor. | 16CS206 DESIGN AND ANALYSIS OF ALGORITHMS  16CS241 COMPUTER GRAPHICS  16CS208 OOP |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 13: SO2 Attainment against Rubric Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (2):**An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO2.1**: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as a global, cultural, social, environmental, and economic factor. | Develops a design strategy, including a plan of action, decomposition of work into subtasks, and satisfies the demands in various problem areas and create prototypes, simulations, and proof of concepts | Develops a design strategy independently with few errors. May need correction or some aspects need improvement to satisfy various problem areas and create prototypes, simulations, and proof of concepts. | Recognizes the need for a design strategy, but needs an example and guidance to satisfy various problem areas and create prototypes, simulations, and proof of concepts. |

The first approach for SO2 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.14 and table 4.15 shows the SO2 attainment of three highly correlated courses.

Table 4 14: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS206 DESIGN AND ANALYSIS OF ALGORITHMS | Mid 1 | 30 | 415 | 409 | 6 | 0 | 99% |
| Lab Internal | 10 | 446 | 446 | 0 | 0 | 100% |
| 2 | 16CS241 COMPUTER GRAPHICS | Weekly test 2 | 10 | 147 | 135 | 5 | 6 | 93% |
| Mid exam 1 | 30 | 151 | 151 | 0 | 0 | 100% |
| 3 | 16CS208 OOP | Internal Minor | 50 | 444 | 403 | 41 | 0 | 91% |
| Mid exam 1 | 30 | 435 | 434 | 0 | 1 | 100% |

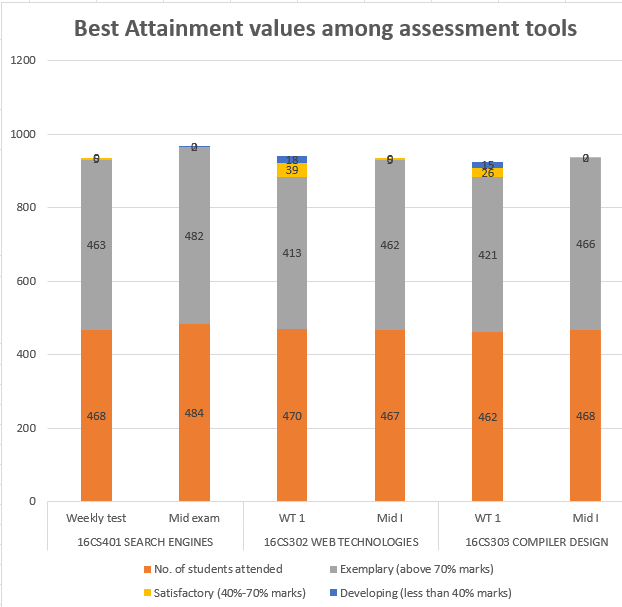


Figure 4 5: Best Attainment values among assessment tools

Table 4 15: SO2 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS206 DESIGN AND ANALYSIS OF ALGORITHMS | Internal Minor | CO1 CO2 CO3 | SO1 | 99% | Attained |
| Lab Internal | CO1 CO2 CO3 CO4 CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 100% | Attained |
| 2 | 16CS241 COMPUTER GRAPHICS | Weekly test 2 | CO2 | SO1, SO2, SO6 | 93% | Attained |
| Mid exam 1 | CO1 CO2 | SO1, SO2, SO6 | 100% | Attained |
| 3 | 16CS208 OOP | Internal Minor | CO1 CO2 CO3 CO4 CO5 | SO1, SO2,SO2,SO3,SO5,SO6,SO7 | 91% | Attained |
| Mid exam1 | CO1 | SO1 | 100% | Attained |

1. The second approach for SO2 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.16 shows the SO2 attainment of three highly correlated courses.

Table 4 16: Student Outcome 2 (SO2) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS206 DESIGN AND ANALYSIS OF ALGORITHMS | 2.50 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | **2.93** | Attained |
| 2 | 16CS241 COMPUTER GRAPHICS | 2.58 | 3.00 |  | 3.00 | 3.00 |  | 2.92 | Attained |
| 3 | 16CS208 OOP | 1.94 | 2.92 | 3.00 | 3.00 | 3.00 | 3.00 | 2.85 | Attained |

Chart, bar chart

Description automatically generated

Figure 4 6: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 17: Levels of attainment in each process

|  |  |
| --- | --- |
| **Types of survey** | **SO2** |
| Graduate Exit Survey | 2.50 |
| Alumni Survey | 0.00 |
| Employer Survey | 2.33 |
| Faculty Survey | 3.00 |
| Average | **1.9575** |
| 20 % of indirect attainment | **0.39** |

#### Attainment of SO2 from direct and indirect assessment:

Table 4 18: Student Outcome 2 (SO2) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS206 DESIGN AND ANALYSIS OF ALGORITHMS | 2.83 |
| 2 | 16CS241 COMPUTER GRAPHICS | 2.92 |
| 3 | 16CS208 OOP | 2.83 |
| 80% of direct attainment value | | **2.28** |
| 20% of indirect attainment value | | **0.39** |
| **Total attainment score** | | **2.678** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO3**

Table 4 19: Mapping of SO3 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO3** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | An ability to communicate effectively with a range of audiences. | SO3.1- An ability to communicate effectively with a range of audiences. | 16EL102-Softskill Laboratory  16CS206- Design and Analysis of Algorithms  16CS351- R Programming |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 20: SO3 Attainment against Rubric Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (3):** An ability to communicate effectively with a range of audiences | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO3.1**: An ability to communicate effectively with a range of audiences. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO3 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.21 and table 4.22 shows the SO3 attainment of three highly correlated courses.

Table 4 21: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16EL102-Softskill Laboratory | Internal lab | 50 | 497 | 457 | 39 | 1 | 92% |
| External lab | 50 | 497 | 461 | 35 | 1 | 93% |
| 2 | 16CS206- Design and Analysis of Algorithms | Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| Internal lab | 10 | 493 | 477 | 15 | 1 | 97% |
| 3 | 16CS351- R Programming | WT 1 | 10 | 92 | 88 | 2 | 2 | 96% |
| Mid I | 30 | 93 | 92 | 0 | 1 | 99% |

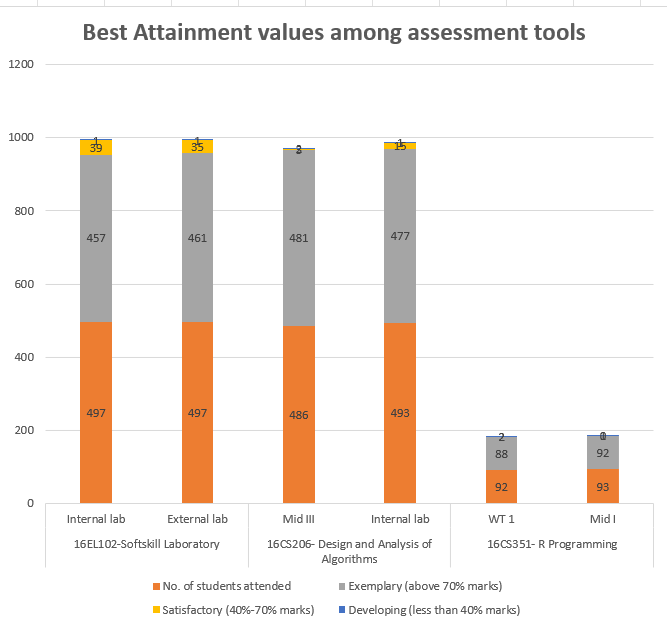


Figure 4 7: Best Attainment values among assessment tools

Table 4 22: SO attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16EL102-Softskill Laboratory | Internal lab | CO1 CO2 CO3 CO4 CO5 | SO1,SO2, SO3, SO4, SO5, SO7 | 92% | Attained |
| External lab | CO1 CO2 CO3 CO4 CO5 | SO1,SO2, SO3, SO4, SO5, SO7 | 93% | Attained |
| 2 | 16CS206- Design and Analysis of Algorithms | Mid III | CO4 CO5 | SO1,SO2, SO3, SO4, SO5, SO6 | 99% | Attained |
| Internal lab | CO1 CO2 CO3 CO4 CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 97% | Attained |
| 3 | 16CS351- R Programming | WT 1 | CO1 CO3 CO5 | SO1,SO2,SO6 | 96% | Attained |
| Mid I | CO1 CO3 CO5 | SO1,SO2,SO6 | 99% | Attained |

1. The second approach for SO3 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.23 shows the SO3 attainment of three highly correlated courses.

Table 4 23: Student Outcome 3 (SO3) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16EL102-Softskill Laboratory | - | 3.00 | - | - | 3.00 | - | 3.00 | Attained |
| 2 | 16CS206- Design and Analysis of Algorithms | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.80 | Attained |
| 3 | 16CS351- R Programming | 2.33 | - | - | 3.00 | - | - | 2.73 | Attained |

Chart, bar chart

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Figure 4 8: Level of attainment in each process

Table 4 24: Attainment values from indirect assessment

|  |  |
| --- | --- |
| **Types of survey** | **SO3.1** |
| Graduate Exit Survey | 3.00 |
| Alumni Survey | 2.00 |
| Employer Survey | 3.00 |
| Faculty Survey | 3.00 |
| Average | **2.75** |
| 20 % of indirect attainment | **0.55** |

#### Attainment of SO3 from direct and indirect assessment:

Table 4 25: Student Outcome 3 (SO3) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16EL102-Softskill Laboratory | 3.00 |
| 2 | 16CS206- Design and Analysis of Algorithms | 2.80 |
| 3 | 16CS351- R Programming | 2.73 |
| 80% of direct attainment value | | **2.27** |
| 20% of indirect attainment value | | 0.55 |
| **Total attainment score** | | **2.82** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO4**

*Table 4 26: Mapping of SO4 correlated courses with performance indicators*

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO4** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts | **SO4.1:** Recognize and act appropriately in circumstances requiring personal or professional ethics. | 16CS206- Design and Analysis of Algorithms  16CS404 – Mobile Communications  16CS351- R Programming |
| **SO4.2**: Recognize the influence of computational solutions that have been devised and executed on energy resource consumption and other environmental concerns. |
|  | **SO4.3**: Demonstrates ability to evaluate the effect of computational engineering solution on environment, society and economy. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 27: SO4 against rubric levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (4):**An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO4.1:** Recognize and act appropriately in circumstances requiring personal or professional ethics. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |
| **SO4.2**: Recognize the influence of computational solutions that have been devised and executed on energy resource consumption and other environmental concerns. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |
| **SO4.3**: Demonstrates ability to evaluate the effect of computational engineering solution on environment, society and economy. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO4 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.28 and table 4.29 shows the SO4 attainment of three highly correlated courses.

Table 4 28: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS206- Design and Analysis of Algorithms | Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| Internal lab | 10 | 493 | 477 | 15 | 1 | 97% |
| 2 | 16CS404 – Mobile Communications | Mid I | 30 | 485 | 484 | 0 | 1 | 100% |
| Internal minor | 50 | 485 | 485 | 0 | 0 | 100% |
| 3 | 16CS351- R Programming | WT 1 | 10 | 92 | 88 | 2 | 2 | 96% |
| Mid I | 30 | 93 | 92 | 0 | 1 | 99% |

Chart, bar chart

Description automatically generated

Figure 4 9: Best Attainment values among assessment tools

Table 4 29: attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS206- Design and Analysis of Algorithms | Mid III | CO4 CO5 | SO1,SO2, SO3, SO4, SO5, SO6 | 99% | Attained |
| Internal lab | CO1 CO2 CO3 CO4 CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 97% | Attained |
| 2 | 16CS404 – Mobile Communications | WT 1 | CO1 CO2 | SO1, SO2, SO3, SO4, SO5 | 100% | Attained |
| Mid I | CO1 CO2 CO3 CO4 | SO2, SO3, SO4, SO5, SO6,SO7 | 100% | Attained |
| 3 | 16CS351- R Programming | WT 1 | CO1 CO3 CO5 | SO1,SO2,SO6 | 96% | Attained |
| Mid I | CO1 CO3 CO5 | SO1,SO2,SO6 | 99% | Attained |

1. The second approach for SO4 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.30 shows the SO4 attainment of three highly correlated courses.

Table 4 30: Student Outcome 1 (SO4) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS206- Design and Analysis of Algorithms | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.80 | Attained |
| 2 | 16CS404 – Mobile Communications | 2.55 | 2.76 | 3.00 | 1.55 | 3.00 | 3.00 | 2.62 | Attained |
| 3 | 16CS351- R Programming | 2.33 | - | - | 2.33 | - | - | 2.73 | Attained |

Chart, bar chart

Description automatically generated

Figure 4 10: Level of attainment in each process

Attainment values from indirect assessment

Table 4 31: Attainment values from indirect assessment

|  |  |  |  |
| --- | --- | --- | --- |
| **Types of survey** | **SO4.1** | **SO4.2** | **SO4.3** |
| Graduate Exit Survey | 300 | 3.00 | 3.00 |
| Alumni Survey | 0.00 | 0.00 | 0.00 |
| Employer Survey | 3.00 | 2.00 | 2.00 |
| Faculty Survey | 3.00 | 3.00 | 3.00 |
| Average | **2.25** | **2.00** | **2.00** |
| 20 % of indirect attainment | **0.45** | **0.4** | **0.4** |

#### Attainment of SO4 from direct and indirect assessment:

Table 4 32: Student Outcome 4 (SO4) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS206- Design and Analysis of Algorithms | 2.80 |
| 2 | 16CS404 – Mobile Communications | 2.62 |
| 3 | 16CS351- R Programming | 2.73 |
| 80% of direct attainment value | | **2.17** |
| +20% of indirect attainment value | | 0.41 |
| **Total attainment score** | | **2.58** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO5**

Table 4 33: Mapping of SO4 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO5** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | **SO5**: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.. | **SO5.1:** Contribute in a team to the formulation and selection of concepts to satisfy objectives and goals. | 16CS206-Design and Analysis of Algorithms  16CS302-Web Technology  16CS351-R Programming |
| **SO5.2:** Capable of planning, sharing and executing task duties in order to work well in a team by generating a collaborative and inclusive atmosphere. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 34: SO5 against rubric levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (5):**An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO5.1:** Contribute in a team to the formulation and selection of concepts to satisfy objectives and goals. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able toapply learned skills from class room or text book knowledge to solve complex problems. |
| **SO5.2:** Capable of planning, sharing and executing task duties in order to work well in a team by generating a collaborative and inclusive atmosphere. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |

The first approach for SO5 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.35 and table 4.36 shows the SO5 attainment of three highly correlated courses.

Table 4 35: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | 10 | 485 | 359 | 91 | 35 | 74% |
| Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| 2 | 16CS302-Web Technology | WT 1 | 10 | 470 | 413 | 39 | 18 | 88% |
| Mid I | 30 | 467 | 462 | 5 | 0 | 99% |
| 3 | 16CS351-R Programming | WT 1 | 10 | 92 | 88 | 2 | 2 | 96% |
| Mid I | 30 | 93 | 92 | 0 | 1 | 99% |

Chart, bar chart, waterfall chart

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Figure 4 11: Best Attainment values among assessment tools

Table 4 36: SO5 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 74% | ATTAINED |
| Mid III | CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 99% | ATTAINED |
| 2 | 16CS302-Web Technology | Weekly test | CO1 | SO1, SO6 | 88% | Attained |
| Mid exam | CO1 CO2 | SO1, SO2 | 99% | Attained |
| 3 | 16CS351-R Programming | WT 1 | CO4 | SO2, SO3, SO4, SO5, SO6 | 86% | ATTAINED |
| Mid I | CO4 | SO2, SO3, SO4, SO5, SO6 | 99% | ATTAINED |

1. The second approach for SO5 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.37 shows the SO5 attainment of three highly correlated courses.

Table 4 37: Student Outcome5 (SO5) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS206-Design and Analysis of Algorithms | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.83 | ATTAINED |
| 2 | 16CS302-Web Technology | 3.00 | 3.00 | 2.75 | 2.75 | 3.00 | 2.75 | 2.85 | Attained |
| 3 | 16CS351-R Programming | 2.33 | - | - | 3.00 | - | - | 2.73 | ATTAINED |

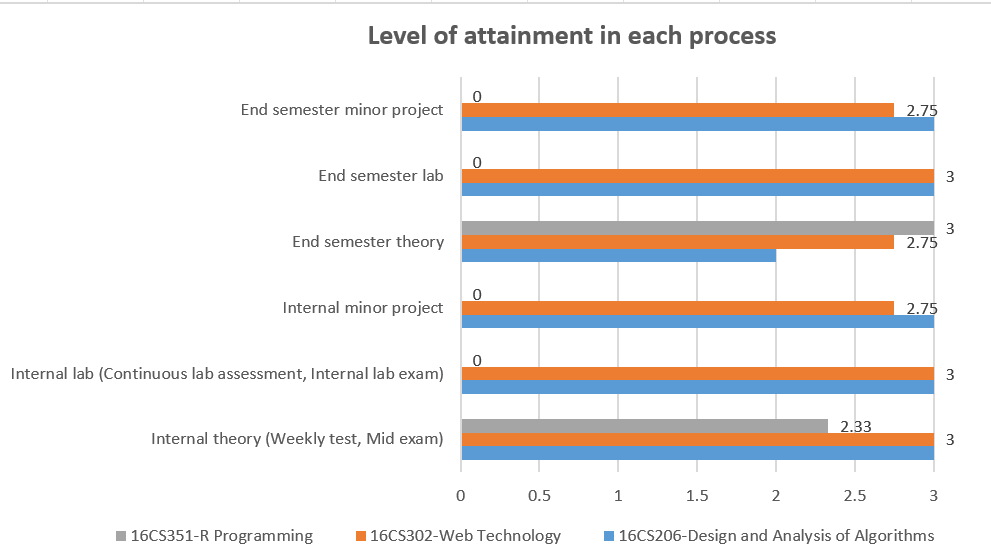


Figure 4 12: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 38: Attainment values from indirect assessment

|  |  |  |
| --- | --- | --- |
| **Types of survey** | **SO5.1** | **SO5.2** |
| Graduate Exit Survey | 2.00 | 3.00 |
| Alumni Survey | 3.00 | 3.00 |
| Employer Survey | 3.00 | 2.55 |
| Faculty Survey | 3.00 | 3.00 |
| Average | **2.75** | **2.75** |
| 20 % of indirect attainment | **0.55** | **0.55** |

#### Attainment of SO5 from direct and indirect assessment:

Table 4 39: Outcome 5 (SO5) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS206-Design and Analysis of Algorithms | 2.83 |
| 2 | 16CS302-Web Technology | 2.85 |
| 3 | 16CS351-R Programming | 2.73 |
| 80% of direct attainment value | | **2.24** |
| 20% of indirect attainment value | | **0.55** |
| **Total attainment score** | | **2.79** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.2 Assessment of SO6**

Table 4 40: Mapping of SO6 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO6** | **Performance Indicator** | **List of Courses considered** |
| 1. | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | **SO6.1:** Demonstrates ability to use modern tools for experimental data collection and result presentation.  **SO6.2**: Capability to analyze and interpret data to make the appropriate decision(s), and draw conclusion(s) | 16CS206-Design and Analysis of Algorithms  16CS303-Compiler Design  16CS304-Operating Systems |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 41: SO6 against rubric level

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (6):**An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO6.1:** Demonstrates ability to use modern tools for experimental  data collection and result presentation.  **SO6.2**: Capability to analyze and interpret data to make the appropriate decision(s), and draw conclusion(s) | Develops a design strategy, including a plan of action, decomposition of work into subtasks, and satisfies the demands in various problem areas and create prototypes, simulations, and proof of concepts | Develops a design strategy independently with few errors. May need correction or some aspects need improvement to satisfy various problem areas and create prototypes, simulations, and proof of concepts. | Recognizes the need for a design strategy, but needs an example and guidance to satisfy various problem areas and create prototypes, simulations, and proof of concepts. |

The first approach for SO6 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.42 and table 4.41 shows the SO6 attainment of three highly correlated courses.

Table 4 42: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | 10 | 485 | 359 | 91 | 35 | 74% |
| Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| 2 | 16CS303-Compiler Design | WT 1 | 10 | 462 | 421 | 26 | 15 | 91% |
| Mid I | 30 | 468 | 466 | 2 | 0 | 100% |
| 3 | 16CS304-Operating Systems | WT 1 | 10 | 462 | 398 | 45 | 19 | 86% |
| Mid I | 30 | 470 | 467 | 1 | 2 | 99% |

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Figure 4 13: Best Attainment values among assessment tools

Table 4 43: SO6 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 74% | ATTAINED |
| Mid III | CO5 | SO1, SO2,SO4, SO5, SO6 | 99% | ATTAINED |
| 2 | 16CS303-Compiler Design | WT 1 | CO2,CO3,CO4 | SO1,SO2,SO6,SO7 | 91% | ATTAINED |
| Mid I | CO2,CO3,CO4 | SO1,SO2,SO6,SO7 | 100% | ATTAINED |
| 3 | 16CS304-Operating Systems | WT 1 | CO5 | SO6 | 86% | ATTAINED |
| Mid I | CO5 | SO6 | 99% | ATTAINED |

1. The second approach for SO6 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.44 shows the SO6 attainment of three highly correlated courses.

Table 4 44: Student Outcome 6 (SO6) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS206-Design and Analysis of Algorithms | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.83 | ATTAINED |
| 2 | 16CS303-Compiler Design | 2.67 |  |  | 3.00 |  |  | 2.83 | ATTAINED |
| 3 | 16CS304-Operating Systems | 3.0 | 3.00 | 3.00 | 3.0 | 3.00 | 3.00 | 3.0 | ATTAINED |

A picture containing table

Description automatically generated

Figure 4 14: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 45: Attainment values from indirect assessment

|  |  |  |
| --- | --- | --- |
| **Types of survey** | **SO6.1** | **SO6.2** |
| Graduate Exit Survey | 3.00 | 3.00 |
| Alumni Survey | 2.00 | 2.00 |
| Employer Survey | 3.00 | 2.67 |
| Faculty Survey | 3.00 | 3.00 |
| Average | **2.75** | **2.66** |
| 20 % of indirect attainment | **0.55** | **0.53** |

#### Attainment of SO6 from direct and indirect assessment:

Table 4 46: Student Outcome 6 (SO6) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS206-Design and Analysis of Algorithms | 2.83 |
| 2 | 16CS303-Compiler Design | 2.83 |
| 3 | 16CS304-Operating Systems | 3.0 |
| 80% of direct attainment value | | **2.30** |
| 20% of indirect attainment value | | **0.54** |
| **Total attainment score** | | **2.84** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO7**

Table 4 47: Mapping of SO7 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO7** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | **SO7.1:**An ability to acquire and apply new knowledge as needed, using appropriate learning strategies | 16CS208-OOPS  16CS303-Compiler Design  16EL102 - Softskill Laboratory |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 48: SO7 against rubric levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (7):**An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO7.1:**An ability to acquire and apply new knowledge as needed, using appropriate learning strategies | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO7 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.49 and table 4.50 shows the SO7 attainment of three highly correlated courses.

Table 4 49: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS208-OOPS | WT 1 | 10 | 475 | 408 | 44 | 23 | 86% |
| Mid II | 30 | 486 | 463 | 17 | 6 | 95% |
| 2 | 16CS303-Compiler Design | WT 1 | 10 | 462 | 421 | 26 | 15 | 91% |
| Mid I | 30 | 468 | 466 | 2 | 0 | 100% |
| 3 | 16EL102 - Softskill Laboratory | INTERNAL LAB | 50 | 497 | 457 | 39 | 1 | 92% |
| EXTERNAL LAB | 50 | 497 | 461 | 35 | 1 | 93%% |

Figure 4 15: Best Attainment values among assessment tools

Table 4 50: SO attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS208-OOPS | WT 1 | CO4, CO5 | SO2, SO3, SO5, SO7 | 86% | ATTAINED |
| Mid II | CO4, CO5 | SO2, SO3, SO5, SO7 | 95% | ATTAINED |
| 2 | 16CS303-Compiler Design | WT 1 | CO2,CO3,CO4 | SO1,SO2,SO6,SO7 | 91% | ATTAINED |
| Mid I | CO2,CO3,CO4 | SO1,SO2,SO6,SO7 | 100% | ATTAINED |
| 3 | 16EL102 - Softskill Laboratory | INTERNAL LAB | CO1, CO3, CO4 | SO1, SO3, SO4,SO5,SO7 | 92% | ATTAINED |
| EXTERNAL LAB | CO1, CO3, CO4 | SO1, SO3, SO4,SO5,SO7 | 93% | ATTAINED |

1. The second approach for SO7 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.51 shows the SO7 attainment of three highly correlated courses.

Table 4 51:Student Outcome 7 (SO7) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS208-OOPS | 2.04 | 2.86 | 3.00 | 2.00 | 3.00 | 3.00 | 2.65 | ATTAINED |
| 2 | 16CS303-Compiler Design | 2.67 |  |  | 3.00 |  |  | 2.83 | ATTAINED |
| 3 | 16EL102 - Softskill Laboratory |  | 3.00 |  |  | 3.00 |  | 3.0 | ATTAINED |

Figure 4 16: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 52: Attainment values from indirect assessment

|  |  |
| --- | --- |
| **Types of survey** | **SO7.1** |
| Graduate Exit Survey | 2.00 |
| Alumni Survey | 3.00 |
| Employer Survey | 1.75 |
| Faculty Survey | 3.00 |
| Average | **2.43** |
| 20 % of indirect attainment | **0.48** |

#### Attainment of SO7 from direct and indirect assessment:

Table 4 53: Student Outcome 7 (SO7) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS208-OOPS | 2.65 |
| 2 | 16CS303-Compiler Design | 2.83 |
| 3 | 16EL102 - Softskill Laboratory | 3.0 |
| 80% of direct attainment value | | **2.26** |
| 20% of indirect attainment value | | **0.48** |
| **Total attainment score** | | **2.74** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**ATTAINMENT OF ALL STUDENT OUTCOMES**

Table 4 54: Listed Courses attainment for all Student Outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course code with Name** | SO1 | SO2 | SO3 | SO4 | SO5 | SO6 | SO7 |
| 16CS201 Database Management Systems | 2.13 | 1.93 | 2.09 | 2.39 |  | 2.25 |  |
| 16CS202 Data Structures | 2.29 | 2.30 |  |  |  |  |  |
| 16CS203 Digital Logic Design | 2.79 | 2.50 |  |  |  |  |  |
| 16CS204 Discrete Mathematical Structures | 2.33 | 2.23 |  |  |  | 1.96 |  |
| 16CS205 Computer Organization and Architecture | 1.91 | 2.01 |  |  |  | 1.90 |  |
| 16CS206 Design and Analysis of Algorithms | 2.35 | 2.80 | 2.80 | 2.80 | 2.80 | 2.78 |  |
| 16CS208 Object Oriented Programming Through Java | 2.39 | 2.65 | 2.65 |  | 2.65 | 2.67 | 2.65 |
| 16CS241 Computer Graphics | 2.83 | 2.83 |  |  |  | 2.83 |  |
| 16CS242 Scripting Languages | 2.41 | 2.42 |  |  | 2.59 | 2.53 | 2.59 |
| 16CS245 Advanced Databases | 2.39 | 2.39 |  |  |  | 2.50 |  |
| 16CS246 Linux/Unix & Shell Programming | 2.33 | 2.52 |  |  |  |  |  |
| 16EC270 Embedded Linux | 2.02 |  |  |  |  | 2.00 |  |
| 16EL102 Softskill Laboratory | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |  | 3.00 |
| 16EL103 Professional Communications Laboratory |  |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 16HS202 Probability and Statistics | 2.58 | 2.58 |  |  |  |  |  |
| 16HS219 Indian History and Culture |  |  |  | 2.48 | 2.48 |  |  |
| 16MS201 Management Science | 2.33 | 2.00 |  |  |  | 2.18 |  |
| 16MS202 Principles and Practice of Management | 2.53 | 2.80 | 2.20 | 2.13 | 2.80 |  | 2.00 |
| 16CS401 Search Engines | 3.00 | 3.00 | 2.20 | 2.20 |  | 2.60 |  |
| 16CS402 Embedded Systems | 2.28 | 2.24 | 2.16 |  |  | 2.31 |  |
| 16CS403 Information Security | 2.62 | 2.20 |  | 2.46 |  | 2.67 |  |
| 16CS404 Mobile Communication | 2.63 | 2.50 | 2.60 | 2.53 | 2.50 | 2.53 | 2.60 |
| 16CS441 Pattern Recognition | 2.63 | 2.50 | 2.53 | 2.43 | 2.53 | 2.50 |  |
| 16CS301 Software Engineering | 2.27 | 2.46 |  |  | 2.30 | 2.38 | 2.33 |
| 16CS302 Web Technologies | 2.80 | 2.70 | 2.60 | 2.93 |  | 2.97 |  |
| 16CS303 Compiler Design | 2.83 | 2.87 |  |  |  | 2.87 | 2.83 |
| 16CS304 Operating Systems | 2.18 | 2.36 |  |  |  | 3.00 |  |
| 16CS341 Fundamental of Image Processing | 2.72 | 2.72 |  |  |  |  |  |
| 16CS342 Open Systems for Web Technologies | 2.71 | 2.72 |  |  |  | 2.65 |  |
| 16CS345 Distributed Systems | 2.34 | 2.63 | 2.32 |  | 2.63 | 2.38 | 2.42 |
| 16CS351 R Programming | 2.60 | 2.50 | 2.73 | 2.73 | 2.73 | 2.58 |  |
| 16CS348 Embedded C | 2.69 | 2.73 |  |  |  | 2.70 |  |
| **Student Outcomes (S0)** | **2.50** | **2.52** | **2.53** | **2.59** | **2.67** | **2.53** | **2.60** |

Figure 4 17: ATTAINMENT OF ALL STUDENT OUTCOMES

**A.2 EALUATION OF STUDENT OUTCOMES (AS PER CAC)**

**A.1Course Outcomes**

Each course has a set of outcomes called “Course Outcomes” or COs. The COs of a course are the abilities targeted to be attained by the students through the various topics taught to them in the course. For CSE programme the COs are part of the syllabus and are included in the curriculum book. The syllabus for each course with the COs is also provided in Appendix A - Course Syllabi. An example of the set of COs for the course 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS is shown below. COs are important because they are the basis of all direct assessments of SOs.

**Course Outcomes**:

Upon successful completion of this course, students should be able to:

CO1: Understand different algorithmic design strategies like divide and conquer, greedy, dynamic programming, backtracking etc.

CO2:Apply various design algorithms to solve a given problem.

CO3:Analyze the efficiency of a given algorithm using time and space complexity theory.

CO4: Investigate which design strategy is efficient to solve a given problem scenario.

CO5: Synthesize new algorithms for solving given problems based on dynamic programming and backtracking techniques and analyze them.

**A.2 CO-SO Mapping**

The ability attained by students in a CO may be linked to an ability represented by one or more SOs. Therefore, CO-SO map is required to show this linking using the 1-3 logic. A typical CO-SO map for the course 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS is shown below. A value of 3 indicates the CO is significantly contributing towards the relevant SO. Since SOs are linked to the COs of various core courses through the CO-SO mapping, if the COs of particular test are attained to the required level of satisfaction, the relevant SOs are also assumed to be attained to the required level of satisfaction. Based on this proposition, the most important part of our SO assessment process is to track the attainment and satisfaction of COs in various courses. The data obtained for CO satisfaction are then mapped to SO satisfaction data by using CO-SO mapping.

Table 4 55: 16CS206 - Design and Analysis of Algorithm CO-SO Mapping

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SOs==> | SO1.1 | SO1.2 | SO2 | SO3 | SO4.1 | SO4.2 | SO4.3 | SO5.1 | SO5.2 | SO6.1 | SO6.2 | SO6.3 |
| CO 1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO 2 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO 4 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO 5 | - | 2 | 3 | 2 | - | - | 3 | - | 2 | - | 2 | - |
| **Avg.** | **2.50** | **2.67** | **3.00** | **2.00** | - | - | **3.00** | **-** | **2.00** | **3.00** | **2.00** | **2.50** |

**A.3 Relationship of highly correlated courses in the curriculum to the student outcomes**

The courses were carefully chosen to create linkage across the entire CSE curriculum for assessment, evaluation and continuous improvement. Among these courses, three highly correlated courses are selected for direct attainment of each SOs. The Articulation Matrix (also referred to as Analysis of Course Content Matrix) helps to choose the particular course for SO assessment.

Table 4 56: Relationship of highly correlated courses in the curriculum to SO's

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code with Title** | **SO1.1** | **SO1.2** | **SO2** | **SO3** | **SO4.1** | **SO4.2** | **SO4.3** | **SO5.1** | **SO5.2** | **SO6.1** | **SO6.2** | **SO6.3** |
| 16CS201 Database Management Systems | 2.19 | 2.07 | 1.93 | 2.25 |  |  |  |  |  | 2.09 | 2.39 |  |
| 16CS202 Data Structures | 2.22 | 2.37 | 2.30 |  |  |  |  |  |  |  |  |  |
| 16CS203 Digital Logic Design | 2.73 | 2.85 | 2.50 |  |  |  |  |  |  |  |  |  |
| 16CS204 Discrete Mathematical Structures | 2.14 | 2.52 | 2.23 |  |  |  |  |  |  | 1.96 |  |  |
| 16CS205 Computer Organization and Architecture |  | 1.91 | 2.01 |  |  |  |  |  |  | 1.90 |  |  |
| 16CS206 Design and Analysis of Algorithms | 1.99 | 2.70 | 2.80 | 2.80 |  |  | 2.80 |  | 2.80 | 2.76 | 2.80 |  |
| 16CS208 Object Oriented Programming Through Java | 2.37 | 2.42 | 2.65 | 2.65 |  |  |  | 2.65 | 2.65 |  | 2.67 | 2.65 |
| 16CS241 Computer Graphics | 2.83 | 2.83 | 2.83 |  |  |  |  |  |  | 2.83 |  |  |
| 16CS242 Scripting Languages | 2.43 | 2.39 | 2.42 |  |  |  |  |  | 2.59 | 2.48 | 2.59 | 2.59 |
| 16CS245 Advanced Databases | 2.51 | 2.28 | 2.39 |  |  |  |  |  |  |  | 2.50 |  |
| 16CS246 Linux/Unix & Shell Programming | 2.24 | 2.43 | 2.52 |  |  |  |  |  |  |  |  |  |
| 16EC270 Embedded Linux | 2.02 | 2.02 |  |  |  |  |  |  |  | 2.00 |  |  |
| 16EL102 Softskill Laboratory |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |  |  |  | 3.00 |
| 16EL103 Professional Communications Laboratory |  |  |  | 3.00 | 3.00 | 3.00 |  | 3.00 |  |  | 3.00 | 3.00 |
| 16HS202 Probability and Statistics | 2.58 | 2.58 | 2.58 |  |  |  |  |  |  |  |  |  |
| 16HS219 Indian History and Culture |  |  |  |  | 2.48 |  |  | 2.48 |  |  |  |  |
| 16MS201 Management Science | 2.49 | 2.18 | 2.00 |  |  |  |  |  |  | 2.18 |  |  |
| 16MS202 Principles and Practice of Management | 2.60 | 2.47 | 2.80 | 2.20 | 2.13 |  |  | 2.80 |  |  |  | 2.00 |
| 16CS401 Search Engines | 2.71 | 2.64 | 2.64 |  |  |  |  |  | 2.71 | 2.71 | 2.64 | 2.71 |
| 16CS402 Embedded Systems | 2.31 | 2.24 | 2.25 | 2.27 |  |  |  |  |  |  | 2.16 | 2.27 |
| 16CS403 Information Security | 2.71 | 2.52 | 2.20 |  | 2.46 |  |  |  |  | 2.67 |  |  |
| 16CS404 Mobile Communication | 2.69 | 2.65 | 2.60 | 2.66 | 2.60 | 2.66 | 2.60 | 2.60 | 2.60 | 2.68 | 2.64 | 2.66 |
| 16CS411 Project | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |  |  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 16CS301 Software Engineering | 2.20 | 2.33 | 2.46 |  |  |  |  |  | 2.30 | 2.42 | 2.35 | 2.33 |
| 16CS302 Web Technologies | 2.90 | 2.60 | 2.80 | 2.47 |  |  |  | 2.76 |  | 2.76 | 2.76 |  |
| 16CS303 Compiler Design | 2.83 | 2.83 | 2.87 |  |  |  |  |  |  | 2.87 | 2.87 | 2.83 |
| 16CS304 Operating Systems | 2.44 | 1.92 | 2.36 |  |  |  |  |  |  |  | 3.00 |  |
| 16CS341 Fundamental of Image Processing | 2.72 | 2.72 | 2.72 |  |  |  |  |  |  |  |  |  |
| 16CS342 Open Systems for Web Technologies | 2.75 | 2.68 | 2.72 |  |  |  |  |  |  |  | 2.65 |  |
| 16CS345 Distributed Systems | 2.35 | 2.32 | 2.63 | 2.32 |  |  |  | 2.63 |  | 2.10 | 2.67 | 2.42 |
| 16CS351 R Programming | 2.47 | 2.73 | 2.50 | 2.73 |  |  | 2.73 | 2.73 |  | 2.43 | 2.73 |  |
| 16CS348 Embedded C | 2.72 | 2.65 | 2.73 |  |  |  |  |  |  | 2.80 | 2.60 |  |
| 16CS441 Pattern Recognition | 2.83 | 2.55 | 2.80 | 2.43 |  |  |  | 2.73 |  | 2.73 | 2.73 |  |
| 16CS411 Project Work | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |

**A.4Attainment level for student outcomes**

The CSE programme selected two types of evaluation approaches with three levels of achievement to ensure there was a clear distinction between work that met the department’s standards. The approaches are

1. Best attainment values among all assessment tools are considered with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level.
2. The attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is1. Further the attainment is obtained by the weighted level of questions mapped with COs.

After assessment, each student outcomes follows one of the three rubric levels:

Table 4 57: Rubric Levels

|  |  |  |
| --- | --- | --- |
| **3: Exemplary** | **2: Satisfactory** | **1: Developing** |
| Exceeds expectations about understanding and application. | Understands the concept and applies it properly thereby meeting minimum expectations or requirements. | Partially understands the concept, but does not apply it properly, and thus fails to meet expectations. |

**A.5ASSESSMENT CYCLE: 2017-2021 BATCH**

**A.5.1 Assessment of SO1**

Table 4.5: Mapping of SO1 correlated courses with performance indicators

Table 4 58: Mapping of SO1 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO1** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.. | **SO1.1** Apply principles of computing, science, and mathematics skills to solve complex computing problems. | 16CS241-Computer graphics  16CS441-Pattern Recognition  16CS303-Compiler Design |
| **SO1.2** Ability to identify problems in the area of computing. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 59: SO1 against the Rubrics Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (1):**An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO1.1**: Apply principles of computing, science, and mathematics skills to solve complex computing problems. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able toapply learned skills from class room or text book knowledge to solve complex problems. |
| **SO1.2**: Ability to identify problems in the area of computing. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |

The first approach for SO1 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.60 and table 4.61 shows the SO1 attainment of three highly correlated courses.

Table 4 60: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS241-Computer graphics | WT 3 | 10 | 94 | 87 | 4 | 3 | 93% |
| Mid II | 30 | 110 | 109 | 1 | 0 | 99% |
| 2 | 16CS441-Pattern Recognition | WT 3 | 10 | 105 | 104 | 1 | 0 | 99% |
| Mid 1 | 30 | 103 | 101 | 2 | 0 | 98% |
| 3 | 16CS303-Compiler Design | WT 1 | 10 | 463 | 422 | 26 | 15 | 91% |
| Mid I | 30 | 469 | 467 | 2 | 0 | 100% |

Figure 4 18: Best Attainment Values Among Assessment Tools

Table 4 61: SO attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS241-Computer graphics | WT 3 | CO2 | SO1,SO2,SO6 | 93% | Attained |
| Mid II | CO2,CO3 | SO1,SO2,SO6 | 99% | Attained |
| 2 | 16CS441-Pattern Recognition | WT 3 | CO3 | SO1 | 99% | Attained |
| Mid 1 | CO1 CO2 | SO1 | 98% | Attained |
| 3 | 16CS303-Compiler Design | WT 1 | CO1 | SO1 | 91% | Attained |
| Mid I | CO1,CO2,CO3 | SO1,SO2,SO6 | 100% | Attained |

1. The second approach for SO1 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.62 shows the SO1 attainment of three highly correlated courses.

Table 4 62: Student Outcome 1 (SO1) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS241-Computer graphics | 2.17 | 3.00 | - | 3.00 | 3.00 | - | 2.83 | Attained |
| 2 | 16CS441-Pattern Recognition | 2.63 | 3.00 | 2.75 | 2.5 | 3.00 | 2.75 | 2.69 | Attained |
| 3 | 16CS303-Compiler Design | 2.57 | - | - | 3.00 | - | - | 2.83 | Attained |

Figure 4 19: Levels of Attainment in Each Process

Table 4 63: Attainment values from indirect assessment

|  |  |  |
| --- | --- | --- |
| **Types of survey** | **SO1.1** | **SO1.2** |
| Graduate Exit Survey | 3.00 | 3.00 |
| Alumni Survey | 3.00 | 3.00 |
| Employer Survey | 2.67 | 2.67 |
| Faculty Survey | 3.00 | 3.00 |
| Average | **2.91** | **2.91** |
| 20 % of indirect attainment | **0.58** | **0.58** |

#### Attainment of SO1 from direct and indirect assessment:

Table 4 64: : Student Outcome 1 (SO1) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS241-Computer graphics | 2.83 |
| 2 | 16CS441-Pattern Recognition | 2.69 |
| 3 | 16CS303-Compiler Design | 2.83 |
| 80% of direct attainment value | | **2.23** |
| 20% of indirect attainment value | | **0.58** |
| **Total attainment score** | | **2.81** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.2 Assessment of SO2**

Table 4 65: Mapping of SO2 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO2** | **Performance Indicator** | **List of Courses considered** |
| 1. | Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline. | **SO2.1**: Design problem and its constraints to satisfy demands of computing requirements in various problem areas to implement the design methodologies | 16CS241-Computer graphics  16CS441-Pattern Recognition  16CS303-Compiler Design |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 66: SO2 Attainment against Rubric Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (2):** Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO2.1**: Design problem and its constraints to satisfy demands of computing requirements in various problem areas to implement the design methodologies.  . | Develops a design strategy, including a plan of action, decomposition of work into subtasks, and satisfies the demands in various problem areas and create prototypes, simulations, and proof of concepts | Develops a design strategy independently with few errors. May need correction or some aspects need improvement to satisfy various problem areas and create prototypes, simulations, and proof of concepts. | Recognizes the need for a design strategy, but needs an example and guidance to satisfy various problem areas and create prototypes, simulations, and proof of concepts. |

The first approach for SO2 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.67 and table 4.68 shows the SO2 attainment of three highly correlated courses.

Table 4 67: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS241-Computer graphics | WT 3 | 10 | 94 | 87 | 4 | 3 | 93% |
| Mid II | 30 | 110 | 109 | 1 | 0 | 99% |
| 2 | 16CS441-Pattern Recognition | WT1 | 10 | 105 | 104 | 1 | 0 | 99% |
| Mid 1 | 30 | 103 | 101 | 2 | 0 | 98% |
| 3 | 16CS303-Compiler Design | WT 1 | 10 | 463 | 422 | 26 | 15 | 91% |
| Mid I | 30 | 469 | 467 | 2 | 0 | 100% |

Figure 4 20:Best Attainment values among assessment tools

Table 4 68: SO2 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS241-Computer graphics | WT 3 | CO2 | SO1,SO2,SO6 | 93% | Attained |
| Mid II | CO2,CO3 | SO1,SO2,SO6 | 99% | Attained |
| 2 | 16CS441-Pattern Recognition | WT1 | CO3 | SO1 | 99% | Attained |
| Mid 1 | CO1 CO2 | SO1 | 98% | Attained |
| 3 | 16CS303-Compiler Design | WT 1 | CO1 | SO1 | 91% | Attained |
| Mid I | CO1,CO2,CO3 | SO1,SO2,SO6 | 100% | Attained |

1. The second approach for SO2 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.69 shows the SO2 attainment of three highly correlated courses.

Table 4 69: Student Outcome 2 (SO2) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS241-Computer graphics | 2.17 | 3.00 | - | 3.00 | 3.00 | - | 2.83 | Attained |
| 2 | 16CS441-Pattern Recognition | 2.75 | 3.00 | 2.50 | 3.00 | 3.00 | 2.50 | 2.80 | Attained |
| 3 | 16CS303-Compiler Design | 2.67 | - | - | 3.00 | - | - | 2.87 | Attained |

Figure 4 21: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 70: Levels of attainment in each process

|  |  |
| --- | --- |
| **Types of survey** | **SO2** |
| Graduate Exit Survey | 3.00 |
| Alumni Survey | 0.00 |
| Employer Survey | 2.33 |
| Faculty Survey | 3.00 |
| Average | **2.08** |
| 20 % of indirect attainment | **0.41** |

#### Attainment of SO2 from direct and indirect assessment:

Table 4 71: Student Outcome 2 (SO2) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS241-Computer graphics | 2.83 |
| 2 | 16CS441-Pattern Recognition | 2.80 |
| 3 | 16CS303-Compiler Design | 2.87 |
| 80% of direct attainment value | | **2.26** |
| 20% of indirect attainment value | | **0.41** |
| **Total attainment score** | | **2.67** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO3**

Table 4 72: Mapping of SO3 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO3** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | Communicate effectively in a variety of professional contexts. | SO3.1- Able to communicate effectively with peers utilizing technical expertise to address target audience. | 16CS206-Design and Analysis of Algorithms  16CS441-PATTERN RECOGNISATION  16EL102 - Softskill Laboratory |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 73: SO3 Attainment against Rubric Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (3):** Communicate effectively in a variety of professional contexts | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO3.1**:Able to communicate effectively with peers utilizing technical expertise to address target audience | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO3 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.74 and table 4.75 shows the SO3 attainment of three highly correlated courses.

Table 4 74: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | 10 | 485 | 359 | 91 | 35 | 74% |
| Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| 2 | 16CS441-PATTERN RECOGNISATION | WT 3 | 10 | 105 | 104 | 1 | 0 | 99% |
| Mid I | 30 | 103 | 101 | 2 | 0 | 98% |
| 3 | 16EL102 - Softskill Laboratory | Internal lab | 50 | 496 | 457 | 38 | 1 | 92% |
| EXternal lab | 50 | 497 | 461 | 35 | 1 | 93% |

Figure 4 22: Best Attainment values among assessment tools

Table 4 75: SO attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS206-Design and Analysis of Algorithms | WT 2 | CO5 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 74% | ATTAINTED |
| Mid III | CO5 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 99% | ATTAINTED |
| 2 | 16CS441-PATTERN RECOGNISATION | WT 3 | CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 99% | ATTAINTED |
| Mid I | CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 98% | ATTAINTED |
| 3 | 16EL102 - Softskill Laboratory | Internal lab | CO1, CO2, CO3, CO4 | SO1,SO2,SO3,SO4,SO4,SO5 | 92% | ATTAINTED |
| EXternal lab | CO1, CO2, CO3, CO4 | SO1,SO2,SO3,SO4,SO4,SO5 | 93% | ATTAINTED |

1. The second approach for SO3 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.76 shows the SO3 attainment of three highly correlated courses.

Table 4 76: Student Outcome 3 (SO3) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS206-Design and Analysis of Algorithms | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.80 | ATTAINED |
| 2 | 16CS441-PATTERN RECOGNISATION | 2.50 | 2.00 | 2.50 | 3.00 | 2.00 | 2.50 | 2.42 | ATTAINED |
| 3 | 16EL102 - Softskill Laboratory |  | 3.00 |  |  | 3.00 |  | 3.0 | ATTAINED |

Figure 4 23: Level of attainment in each process

Table 4 77: Attainment values from indirect assessment

|  |  |
| --- | --- |
| **Types of survey** | **SO3.1** |
| Graduate Exit Survey | 3.00 |
| Alumni Survey | 2.00 |
| Employer Survey | 3.00 |
| Faculty Survey | 3.00 |
| Average | **2.75** |
| 20 % of indirect attainment | **0.55** |

#### Attainment of SO3 from direct and indirect assessment:

Table 4 78: Student Outcome 3 (SO3) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS206-Design and Analysis of Algorithms | 2.80 |
| 2 | 16CS441-PATTERN RECOGNISATION | 2.42 |
| 3 | 16EL102 - Softskill Laboratory | 3.0 |
| 80% of direct attainment value | | **2.19** |
| 20% of indirect attainment value | | **0.55** |
| **Total attainment score** | | **2.74** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO4**

Table 4 79: Mapping of SO4 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO4** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. | **SO4.1:** Recognize the professional responsibilities in computing to achieve computational solutions. | 16CS411 -PROJECT  16CS441-PATTERN RECOGNISATION  16CS404- MOBILE COMPUTING |
| **SO4.2**: Demonstrates ability to judge the effect of computational engineering solution in computing discipline. |
|  | **SO4.3**: Recognize and act appropriately in circumstances requiring personal or professional ethics. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 80: SO4 against rubric levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (4):** Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO4.1:** Recognize the professional responsibilities in computing to achieve computational solutions. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |
| **SO4.2**: Demonstrates ability to judge the effect of computational engineering solution in computing discipline | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |
| **SO4.3**: Recognize and act appropriately in circumstances requiring personal or professional ethics.. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO4 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.81 and table 4.82 shows the SO4 attainment of three highly correlated courses.

Table 4 81: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS411 -PROJECT | Internal minor | 50 | 430 | 388 | 42 | 0 | 90% |
| External minor | 50 | 429 | 364 | 65 | 0 | 85% |
| 2 | 16CS441-PATTERN RECOGNISATION | WT 3 | 10 | 105 | 104 | 1 | 0 | 99% |
| Mid I | 30 | 103 | 101 | 2 | 0 | 98% |
| 3 | 16CS404- MOBILE COMPUTING | WT 1 | 10 | 468 | 453 | 13 | 2 | 97% |
| Mid I | 30 | 485 | 484 | 0 | 1 | 100% |

Figure 4 24: Best Attainment values among assessment tools

Table 4 82: attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS411 -PROJECT | Internal minor | CO4 | SO3 | 90% | ATTAINED |
| EXternal minor | CO4 | SO3 | 85% | ATTAINED |
| 2 | 16CS441-PATTERN RECOGNISATION | WT 3 | CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 99% | ATTAINTED |
| Mid I | CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 98% | ATTAINTED |
| 3 | 16CS404- MOBILE COMPUTING | WT 1 | CO1,CO2,CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 97% | ATTAINED |
| Mid I | CO1,CO2,CO3,CO4 | SO1,SO2,SO3,SO4,SO4,SO5,SO6 | 100% | ATTAINED |

1. The second approach for SO4 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.83 shows the SO1 attainment of three highly correlated courses.

Table 4 83: Student Outcome 1 (SO4) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS411 -PROJECT |  |  | 3.00 |  |  | 3.00 | 3.0 | ATTAINED |
| 2 | 16CS441-PATTERN RECOGNISATION | 2.50 | 2.00 | 2.50 | 3.00 | 2.00 | 2.50 | 2.42 | ATTAINED |
| 3 | 16CS404- MOBILE COMPUTING | 2.56 | 2.76 | 3.0 | 1.56 | 3.0 | 3.0 | 2.65 | ATTAINED |

Figure 4 25: Level of attainment in each process

Attainment values from indirect assessment

Table 4 84: Attainment values from indirect assessment

|  |  |  |  |
| --- | --- | --- | --- |
| **Types of survey** | **SO4.1** | **SO4.2** | **SO4.3** |
| Graduate Exit Survey | 3.00 | 3.00 | 3.00 |
| Alumni Survey | 0.00 | 0.00 | 0.00 |
| Employer Survey | 2.00 | 2.00 | 3.00 |
| Faculty Survey | 3.00 | 2.50 | 3.00 |
| Average | **2.00** | **1.875** | **2.25** |
| 20 % of indirect attainment | **0.40** | **0.37** | **0.50** |

#### Attainment of SO4 from direct and indirect assessment:

Table 4 85: Student Outcome 4 (SO4) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | *16CS411 -PROJECT* | 3.0 |
| 2 | 16CS441-PATTERNRECOGNISATION | 2.42 |
| 3 | 16CS404- MOBILE COMPUTING | 2.64 |
| 80% of direct attainment value | | **2.14** |
| +20% of indirect attainment value | | **0.42** |
| **Total attainment score** | | **2.56** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.1 Assessment of SO5**

Table 4 86: Mapping of SO4 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO5** | **Performance Indicator’s** | **List of Courses considered** |
| 1. | **SO5**: Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline. | **SO5.1:**Contribute in a team to the formulation and selection of concepts to satisfy objectives and goals in program discipline. | 16CS401 SEARCH ENGINES  16CS206 DESIGN AND ANALASYS OF ALGORITHMS  16CS411 PROJECT |
| **SO5.2:** Capable of planning, sharing and executing task duties in order to work well in a team by generating a collaborative and inclusive atmosphere. |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 87: SO5 against rubric levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (5):** Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline. | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO5.1:**Contribute in a team to the formulation and selection of concepts to satisfy objectives and goals in program discipline. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able toapply learned skills from class room or text book knowledge to solve complex problems. |
| **SO5.2:** Capable of planning, sharing, and executing task duties in order to work well in a team by generating a collaborative and inclusive atmosphere. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |

The first approach for SO5 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.88 and table 4.89 shows the SO5 attainment of three highly correlated courses.

Table 4 88: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS401 SEARCH ENGINES | WT 1 | 10 | 468 | 463 | 5 | 0 | 99% |
| Mid I | 30 | 484 | 482 | 0 | 2 | 100% |
| 2 | 16CS206 DESIGN AND ANALASYS OF ALGORITHMS | WT 2 | 10 | 485 | 359 | 91 | 35 | 74% |
| Mid III | 30 | 486 | 481 | 3 | 2 | 99% |
| 3 | 16CS411 PROJECT | Internal minor | 1 | 50 | 486 | 435 | 51 | 90% |
| External minor | 1 | 50 | 430 | 365 | 65 | 85% |

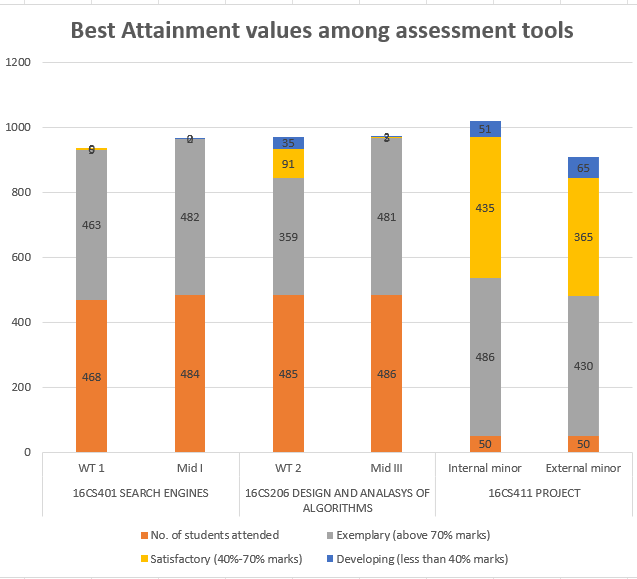


Figure 4 26: Best Attainment values among assessment tools

Table 4 89: SO5 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS401 SEARCH ENGINES | Weekly test | CO1 | SO1, SO2, SO5, SO6 | 99% | Attained |
| Mid exam | CO1 CO2 | SO1, SO2, SO5, SO6 | 100% | Attained |
| 2 | 16CS206 DESIGN AND ANALASYS OF ALGORITHMS | Weekly test | CO2 CO4 | SO1, SO2, SO3, SO4, SO5, SO6 | 74% | Attained |
| Mid exam | CO4 CO5 | SO1, SO2, SO3, SO4, SO5, SO6 | 99% | Attained |
| 3 | 16CS411 PROJECT | Internal minor | CO1 CO2 CO3 CO4 CO5 CO6 | SO1, SO2,SO3,SO4 SO5, SO6 | 90% | Attained |
| External minor | CO1 CO2 CO3 CO4 CO5 CO6 | SO2,SO3,SO4 SO5, SO6 | 85% | Attained |

1. The second approach for SO5 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.90 shows the SO5 attainment of three highly correlated courses.

Table 4 90: Student Outcome5 (SO5) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS401 SEARCH ENGINES | 2.88 |  |  | 2.60 |  |  | 2.74 | Attained |
| 2 | 16CS206 DESIGN AND ANALASYS OF ALGORITHMS | 3.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2.83 | Attained |
| 3 | 16CS411 PROJECT |  |  | 3.00 |  |  | 3.00 | 3.00 | Attained |

Figure 4 27: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 91: Attainment values from indirect assessment

|  |  |  |
| --- | --- | --- |
| **Types of survey** | **SO5.1** | **SO5.2** |
| Graduate Exit Survey | 2.00 | 3.00 |
| Alumni Survey | 3.00 | 3.00 |
| Employer Survey | 3.00 | 2.50 |
| Faculty Survey | 3.00 | 3.00 |
| Average | **2.75** | **2.87** |
| 20 % of indirect attainment | **0.55** | **0.57** |

#### Attainment of SO5 from direct and indirect assessment:

Table 4 92: Outcome 5 (SO5) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS401 SEARCH ENGINES | 2.74 |
| 2 | 16CS206 DESIGN AND ANALASYS OF ALGORITHMS | 2.83 |
| 3 | 16CS411 PROJECT | 3.00 |
| 80% of direct attainment value | | **2.28** |
| 20% of indirect attainment value | | 0.55 |
| **Total attainment score** | | **2.83** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**A.5.2 Assessment of SO6**

Table 4 93: Mapping of SO6 correlated courses with performance indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **ABET SO6** | **Performance Indicator** | **List of Courses considered** |
| 1. | Apply computer science theory and software development fundamentals to produce computing based solutions | **SO6.1:**Capability to analyze and interpret data to make the appropriate decision(s), and draw solutions  **SO6.2**: Demonstrates ability to use modern tools for experimental data collection for computing based solutions.  **SO6.3** Recognize the importance of accepting personal responsibility for lifelong learning | 16CS241-Computer graphics  16CS441-Pattern Recognition  16CS303-Compiler Design |

As student performances are quantified, PMAC have established a threshold that at least 70% of all students in a course should be in the exemplary levels. In general, this assessment has been performed in a direct way, by means of week test, mid exam, lab, end exam, minor project and internship/projects.

Table 4 94: SO6 against rubric level

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Outcome (6):**Apply computer science theory and software development fundamentals to produce computing based solutions | | | |
| Performance indicator | Proficiency/Performance Scale | | |
| 3: Exemplary | 2: Satisfactory | 1: Developing |
| **SO6.1:** Capability to analyze and interpret data to make the appropriate decision(s), and draw solutions | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |
| **SO6.2**: Demonstrates ability to use modern tools for experimental data collection for computing based solutions. | Fully able to understand or identify problems. | Reasonably able to understand or identify problems. | Poor ability to understand and identify the problems. |
| **SO6.3**: Recognize the importance of accepting personal responsibility for lifelong learning. | Excel to apply learned skills from class room or text book knowledge to solve complex problems. | Good to apply learned skills from class room or text book knowledge to solve complex problems. | Somewhat able to apply learned skills from class room or text book knowledge to solve complex problems. |

The first approach for SO6 attainment is by considering best attainment values among all assessment tools with a threshold set by PMAC that at least 70% of the maximum mark of each assessment tool in a course should be in the exemplary level. Table 4.95 and table 4.96 shows the SO6 attainment of three highly correlated courses.

Table 4 95: Percentage of achievement based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **Max marks** | **No. of students attended** | **No. of students attained  (based on the rubrics)** | | | **Percentage of Achievement** |
| Exemplary (above 70% marks) | Satisfactory (40%-70% marks) | Developing (less than 40% marks) |
| 1 | 16CS241-Computer graphics | WT 3 | 10 | 94 | 87 | 4 | 3 | 93% |
| Mid II | 30 | 110 | 109 | 1 | 0 | 99% |
| 2 | 16CS441-Pattern Recognition | WT3 | 10 | 105 | 104 | 1 | 0 | 99% |
| Mid 1 | 30 | 103 | 101 | 2 | 0 | 98% |
| 3 | 16CS303-Compiler Design | WT 1 | 10 | 463 | 422 | 26 | 15 | 91% |
| Mid I | 30 | 469 | 467 | 2 | 0 | 100% |

Figure 4 28: Best Attainment values among assessment tools

Table 4 96: SO6 attainment status based on the best attainment values among assessment tools

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Type of exam** | **COs mapped with particular assessment** | **Mapped SO’s** | **Percentage of students attained** | **Status of attainment** |
| 1 | 16CS241-Computer graphics | WT 3 | CO2 | SO1,SO2,SO6 | 93% | Attained |
| Mid II | CO2,CO3 | SO1,SO2,SO6 | 99% | Attained |
| 2 | 16CS441-Pattern Recognition | WT3 | CO3 | SO1 | 99% | Attained |
| Mid 1 | CO1 CO2 | SO1 | 98% | Attained |
| 3 | 16CS303-Compiler Design | WT 1 | CO1 | SO1 | 91% | Attained |
| Mid I | CO1,CO2,CO3 | SO1,SO2,SO6 | 100% | Attained |

1. The second approach for SO6 attainment is measured in terms of average percentage of students getting the set target marks in each assessment tool. If the percentage is greater than or equal to 80% then the attainment level is 3. If the percentage is between 70% to 80% then the attainment level is 2. If the percentage is less than 70% then the attainment level is 1. Further the attainment is obtained by the weighted level of questions mapped with COs. Table 4.97 shows the SO6 attainment of three highly correlated courses.

Table 4 97: Student Outcome 6 (SO6) based on the levels of attainment in each assessment tool of the three sample subjects

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Course code with name** | **Levels of attainment in each process** | | | | | | **Over all attainment (out of 3 scale)** | **Status of attainment** |
| Internal theory (Weekly test, Mid exam) | Internal lab (Continuous lab assessment, Internal lab exam) | Internal minor project | End semester theory | End semester lab | End semester minor project |
| 1 | 16CS241-Computer graphics | 2.17 | 3.00 | - | 3.00 | 3.00 | - | 2.83 | Attained |
| 2 | 16CS441-Pattern Recognition | 2.60 | 2.96 | 2.67 | 3.00 | 2.50 | 2.67 | 2.73 | Attained |
| 3 | 16CS303-Compiler Design | 2.64 | - | - | 3.00 | - | - | 2.86 | Attained |

Figure 4 29: Levels of attainment in each process

Attainment values from indirect assessment

Table 4 98: Attainment values from indirect assessment

|  |  |  |  |
| --- | --- | --- | --- |
| **Types of survey** | **SO6.1** | **SO6.2** | **SO6.3** |
| Graduate Exit Survey | 3.00 | 3.00 | 2.00 |
| Alumni Survey | 2.00 | 2.00 | 3.00 |
| Employer Survey | 2.67 | 3.00 | 1.75 |
| Faculty Survey | 3.00 | 3.00 | 3.00 |
| Average | **2.66** | **2.75** | **2.43** |
| 20 % of indirect attainment | **0.53** | **0.55** | **0.48** |

#### Attainment of SO6 from direct and indirect assessment:

Table 4 99: Student Outcome 6 (SO6) based on the average of all assessment tools of three subjects

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Course code with name** | **Over all attainment (out of 3 scale)** |
|
| 1 | 16CS241-Computer graphics | 2.83 |
| 2 | 16CS441-Pattern Recognition | 2.73 |
| 3 | 16CS303-Compiler Design | 2.86 |
| 80% of direct attainment value | | **2.24** |
| 20% of indirect attainment value | | **0.52** |
| **Total attainment score** | | **2.76** |
| **Attainment status** | | **Attained** |

**Maintenance of results and documents:**

All the required data for the assessment process are available in the VFSTR portal and the evaluation sheets of attainment are filed in CSE department and individual assessment for the courses are also available in the course files.

**ATTAINMENT OF ALL STUDENT OUTCOMES**

Table 4 100: List of courses attainment for all student outcomes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Code with Title** | **SO1** | **SO2** | **SO3** | **SO4** | **SO5** | **SO6** |
| 16CS201 Database Management Systems | 2.13 | 1.93 | 2.25 |  |  | 2.24 |
| 16CS202 Data Structures | 2.291667 | 2.3 |  |  |  |  |
| 16CS203 Digital Logic Design | 2.790079 | 2.5 |  |  |  |  |
| 16CS204 Discrete Mathematical Structures | 2.33 | 2.23 |  |  |  | 1.96 |
| 16CS205 Computer Organization and Architecture | 1.91 | 2.01 |  |  |  | 1.90 |
| 16CS206 Design and Analysis of Algorithms | 2.35 | 2.80 | 2.80 | 2.80 | 2.80 | 2.78 |
| 16CS208 Object Oriented Programming Through Java | 2.39 | 2.65 | 2.65 |  | 2.65 | 2.66 |
| 16CS241 Computer Graphics | 2.83 | 2.83 |  |  |  | 2.83 |
| 16CS242 Scripting Languages | 2.41 | 2.42 |  |  | 2.59 | 2.55 |
| 16CS245 Advanced Databases | 2.39 | 2.39 |  |  |  | 2.50 |
| 16CS246 Linux/Unix & Shell Programming | 2.33 | 2.52 |  |  |  |  |
| 16EC270 Embedded Linux | 2.02 |  |  |  |  | 2.00 |
| 16EL102 Soft skill Laboratory | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 16EL103 Professional Communications Laboratory |  |  | 3.00 | 3.00 | 3.00 | 3.00 |
| 16HS202 Probability and Statistics | 2.58 | 2.58 |  |  |  |  |
| 16HS219 Indian History and Culture |  |  |  | 2.48 | 2.48 |  |
| 16MS201 Management Science | 2.33 | 2.00 |  |  |  | 2.18 |
| 16MS202 Principles and Practice of Management | 2.53 | 2.80 | 2.20 | 2.13 | 2.80 | 2.00 |
| 16CS401 Search Engines | 2.68 | 2.64 |  |  | 2.71 | 2.69 |
| 16CS402 Embedded Systems | 2.28 | 2.25 | 2.27 |  |  | 2.21 |
| 16CS403 Information Security | 2.62 | 2.20 |  | 2.46 |  | 2.67 |
| 16CS404 Mobile Communication | 2.67 | 2.60 | 2.66 | 2.62 | 2.60 | 2.66 |
| 16CS411 Project | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 16CS301 Software Engineering | 2.27 | 2.46 |  |  | 2.30 | 2.37 |
| 16CS302 Web Technologies | 2.75 | 2.80 | 2.47 |  | 2.76 | 2.76 |
| 16CS303 Compiler Design | 2.83 | 2.87 |  |  |  | 2.86 |
| 16CS304 Operating Systems | 2.18 | 2.36 |  |  |  | 3.00 |
| 16CS341 Fundamental of Image Processing | 2.72 | 2.72 |  |  |  |  |
| 16CS342 Open Systems for Web Technologies | 2.71 | 2.72 |  |  |  | 2.65 |
| 16CS345 Distributed Systems | 2.34 | 2.63 | 2.32 |  | 2.63 | 2.40 |
| 16CS351 R Programming | 2.60 | 2.50 | 2.73 | 2.73 | 2.73 | 2.58 |
| 16CS348 Embedded C | 2.69 | 2.73 |  |  |  | 2.70 |
| 16CS441 Pattern Recognition | 2.69 | 2.80 | 2.43 |  | 2.73 | 2.73 |
| **Student Outcomes (S0)** | **2.50** | **2.54** | **2.60** | **2.69** | **2.72** | **2.55** |

Figure 4 30: Attainment of all Student Outcomes

**B. CONTINOUS IMPROVEMENT**

**B.1 EVALUATION OF STUDENT OUTCOMES (AS PER EAC)**

Table 4 101: EVALUATION OF STUDENT OUTCOMES (AS PER EAC)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Student outcome** | **Course** | **Final Verdict of SOs** | **Remedial Action for SOs** |
| 1 | SO1 | 16CS401 SEARCH ENGINES | 1% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 99% of students attained, so no need of remedial actions. |
| 2 | 16CS241 COMPUTER GRAPHICS | 7% of students could not be able to understand and identify the problems. | 93% of students attained, so no need of remedial actions. |
| 3 | 16CS303 COMPILER DESIGN | 10% of students could not be able to apply engineering principles. | Instructor gives additional practice to apply engineering principles to solve the problems. |
| 4 | SO2 | 16CS401 SEARCH ENGINES | 1% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 99% of students attained, so no need of remedial actions. |
| 5 | 16CS302 WEB TECHNOLOGIES | 12% of students could not be able to apply the engineering knowledge to design a problem. | Instructors must take additional classes as well as must give more problems for practice. |
| 6 | 16CS303 COMPILER DESIGN | 10% of students could not be able to apply engineering principles. | Instructor gives additional practice to apply engineering principles to solve the problems. |
| 7 | S03 | 16EL102-SOFTSKILL LABORATORY | 8% of students could not be able to understand and identify the problems in communication. | Instructor gives additional practice to communication in groups for solving the problems. |
| 8 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 3% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 9 | 16CS351- R PROGRAMMING | 4% of students could not be able to apply the programming knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more programs for practice. |
| 10 | S04 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 3% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 11 | 16CS404 – MOBILE COMMUNICATIONS | All students able to understand and identify the problems. | Attained and no need of additional classes |
| 12 | 16CS351- R PROGRAMMING | 4% of students could not be able to apply the programming knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more programs for practice. |
| 13 | S05 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 3% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 14 | 16CS302 WEB TECHNOLOGIES | 12% of students could not be able to apply the engineering knowledge to design a problem. | Instructors must take additional classes as well as must give more problems for practice. |
| 15 | 16CS351- R PROGRAMMING | 4% of students could not be able to apply the programming knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more programs for practice. |
| 16 | S06 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 3% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 17 | 16CS303 COMPILER DESIGN | 10% of students could not be able to apply engineering principles. | Instructor gives additional practice to apply engineering principles to solve the problems. |
| 18 | 16CS304-OPERATING SYSTEMS | 13% of students could not be able to apply the engineering knowledge to solve the given problems in web designs. | Instructor gives additional practice to apply engineering principles to solve the problems. |
| 19 | S07 | 16CS208-OOPS | 14% of students could not be able to apply the programming knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more programs for practice. |
| 20 | 16CS303-COMPILER DESIGN | 7% of students could not be able to understand and identify the problems. | 93% of students attained, so no need of remedial actions. |
| 21 | 16EL102 - SOFTSKILL LABORATORY | 8% of students could not be able to understand and identify the problems in communication. | Instructor gives additional practice to communication in groups for solving the problems. |

**B.2 EVALUATION OF STUDENT OUTCOMES (AS PER CAC)**

Table 4 102: Evaluation of Student Outcomes (As per CAC)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Student outcome** | **Course** | **Final Verdict of SO1** | **Remedial Action for SO1** |
| 1 | SO1 | 16CS241-COMPUTER GRAPHICS | 7% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 93% of students attained, so no need of remedial actions. |
| 2 | 16CS441-PATTERN RECOGNITION | 1% of students could not be able to apply Problem Solving principles. | 99% of students attained, so no need of remedial actions. |
| 3 | 16CS303-COMPILER DESIGN | 9% of students could not be able to understand and identify the problems. | 91% of students attained, so no need of remedial actions. |
| 4 | SO2 | 16CS241-COMPUTER GRAPHICS | 7% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 93% of students attained, so no need of remedial actions. |
| 5 | 16CS441-PATTERN RECOGNITION | 1% of students could not be able to apply Problem Solving principles. | 99% of students attained, so no need of remedial actions. |
| 6 | 16CS303-COMPILER DESIGN | 9% of students could not be able to understand and identify the problems. | 91% of students attained, so no need of remedial actions. |
| 7 | S03 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 26% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 8 | 16CS441-PATTERN RECOGNITION | 1% of students could not be able to apply Problem Solving principles. | 99% of students attained, so no need of remedial actions. |
| 9 | 16EL102 - SOFTSKILL LABORATORY | 8% of students could not be able to understand and identify the problems in communication. | Instructor gives additional practice to communication in groups for solving the problems. |
| 10 | S04 | 16CS411 -PROJECT | Students could not be able to handle real time projects | Through the continuous support from the allotted guide from university they improved their performance. |
| 11 | 16CS441-PATTERN RECOGNITION | 1% of students could not be able to apply Problem Solving principles. | 99% of students attained, so no need of remedial actions. |
| 12 | 16CS404- MOBILE COMPUTING | 3% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 97% of students attained, so no need of remedial actions. |
| 13 | S05 | 16CS401 SEARCH ENGINES | 1% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 99% of students attained, so no need of remedial actions. |
| 14 | 16CS206- DESIGN AND ANALYSIS OF ALGORITHMS | 26% of students could not be able to apply the engineering knowledge to solve the given problems. | Instructors must take additional classes as well as have to give more problems for practice. |
| 15 | 16CS411 -PROJECT | Students could not be able to handle real time projects | Through the continuous support from the allotted guide from university they improved their performance. |
| 16 | S06 | 16CS241-COMPUTER GRAPHICS | 7% of students could not be able to apply engineering principles and  could not understand and identify the problems. | 93% of students attained, so no need of remedial actions. |
| 17 | 16CS441-PATTERN RECOGNITION | 1% of students could not be able to apply Problem Solving principles. | 99% of students attained, so no need of remedial actions. |
| 18 | 16CS303-COMPILER DESIGN | 9% of students could not be able to understand and identify the problems. | 91% of students attained, so no need of remedial actions. |