OUTCOME BASED EDUCATION
&
ACCREDITATION

BACHELOR OF TECHNOLOGY

(COMPUTER SCIENCE AND ENGINEERING)

Department of Computer Science and Engineering

GOKARAJU RANGARAJU
Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad

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Outcome Based Education and Accreditation

1. Introduction

"Outcomes Based Education" (OBE) of Engineering qualifications gives recognition to graduates for the knowledge, skills and attitudes/behaviors they have acquired upon just completion of a program and after 4 to 5 years of graduation. This system is student centered instruction that focuses on measuring student performance i.e. outcomes of the Program and at the same time enabling students to develop new skills that prepare them to stand out with their global counterparts..

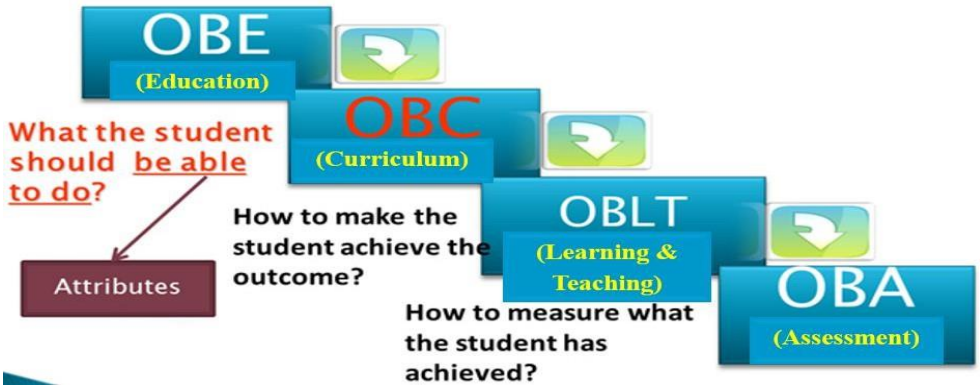
Outcome Based Accreditation (OBA) is an Assessment of the Performance of the Program/Institution as per the Accreditation Criteria defined in terms of Outcomes and other key Constituents.

Outcome Based Curriculum (OBC) is prepared keeping in mind that what the student should be able to do at end of the Program.

Outcome Based Learning &Teaching (OBLT) methods are developed to make the student achieve the Outcomes.

Outcome Based Assessments (OBA) methods are designed to measure what the student has achieved at end of the Program in terms of Knowledge, Skills, and Attitude/Behavior.

Key Constituents of OBE The Key Constituents of OBE are Vision, Mission, Program Educational Objectives (PEO), Program Outcomes (PO), Graduate Attributes (GA), Course Outcomes (CO), Assessments, Rubrics, Mapping, Evaluation andGrading.



Accreditation

It is a process of quality assurance and improvement, whereby a program in an approved Institution is critically appraised to verify that the Institution/program continues to meet and/or exceed the Norms and Standards prescribed by regulator from time to time. It is a kind of recognition which indicates that a program/Institution fulfills certain standards.

- It is a peer review process that assures the quality of post-secondary education students receive.
- Educational institutions or program volunteer to undergo this review periodically to determine if certain criteria are being met
- It is important to understand that accreditation is not a ranking system. It is simply assurance that a program or institution meets established quality standards.

There are two types of accreditation- Institution and Program.

- Institutional accreditation evaluates overall institutional quality. One form of institutional accreditation is accreditation of Colleges and Universities. (National Assessment & Accreditation Council-NAAC under UGC)
- Program accreditation examines specific program of study rather than institution as a whole. (National Board of Accreditation-NBA under AICTE)

Importance and Significance of Accreditation

- To make the institute/department/program aware of the weaknesses of the program offered by it and act on suggestions for improvement.
- To encourage the institute to move continuously towards the improvement of quality of its program, and the pursuit of excellence.
- To facilitate institutions for updating themselves in program curriculum, teaching and learning processes, faculty achievements students' skills/abilities/knowledge.
- To improve student enrollment both in terms of quality and quantity.
- To facilitate receiving of grants from Government regulatory bodies and institutions/agencies.
- To attain international recognition of accredited degrees awarded.
- To facilitate the mobility of graduated students and professionals.
- To enhance employability of graduates.
- To create sound and challenging academic environment in the Institution, and contributes to social and economic development of the country by producing high quality technical manpower.

2. Washington Accord

The Washington Accord Agreement recognizes that

"Accreditation of engineering ac academic programs is a key foundation for the practice of engineering at the professional level in each of the countries or territories covered by the Accord."

The Washington Accord was sign in 1989.It is an agreement between the bodies responsible for accrediting professional engineering degree programs in each of the signatory countries. It recognizes the substantial equivalency of programs accredited by those bodies and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. The Washington Accord covers professional engineering undergraduate degrees. Postgraduate-level programs are not covered by the Accord. The Washington Accord Agreement applies only to accreditations conducted by the signatories within their respective national or territorial boundaries.

Agreements covering qualifications in engineering

There are three agreements covering mutual recognition in respect of qualification in engineering:

The Washington Accord signed in 1989 was the first -it recognizes substantial equivalence in the accreditation of qualifications in professional engineering, normally of four years duration.

The Sydney Accord signed in 2001 and recognises substantial equivalence in the accreditation of qualifications in engineering technology, normally of three years duration.

The Dublin Accord signed in 2002 and recognises substantial equivalence in the accreditation of qualifications in technician engineering, normally of two years duration.

The Washington Accord pertains to engineering programs accredited by its signatories within their respective jurisdiction starting in 1989. There are 15 Signatories to the Washington Accord as on today. Signatories to the Washington Accord are organizations responsible for accrediting engineering programs in Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States (1989); Hong Kong (1995), South Africa (1999), Japan (2005), Singapore (2006),Korea, Chinese Taipei (2007), Malaysia (2009), Turkey (2011), Russia (2012). Signatories have full rights of participation in the Accord.

Washington Accord Agreement states:

- Accreditation criteria, policies and procedures of the signatories have been verified comparable
- Accreditation decisions made by one signatory are acceptable to the other signatories
- Recognition applies only to accreditations conducted within the signatory's national or territorial boundaries.
- Mutual recognition of accredited engineering programs
- Benchmarking standards for engineering education
- Graduate Attributes (GA) represent the generally agreed reference for accredited programs
- Bench marking accreditation policies and processes

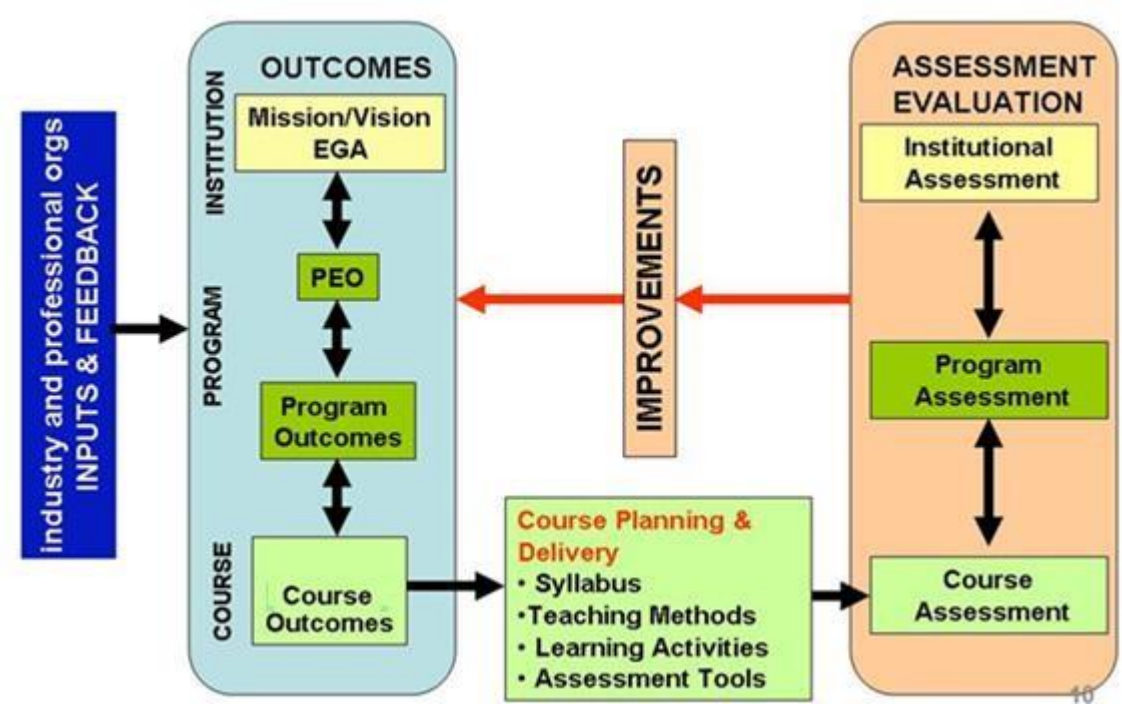
The Signatories will identify and encourage the implementation best practice for the academic preparation of engineers by mutual monitoring regular communication and sharing of information: accreditation criteria, systems, procedures, manuals, publications list of accredited programs; invitations to observe accreditation visits; and invitations to observe meetings of any boards.

"Getting into Washington Accord is like getting into the UN Security Council,"

Organizations holding provisional status have been identified as having qualification accreditation or recognition procedures that are potentially suitable for the purposes of the Accord; those organizations are further developing those procedures with the goal of achieving signatory status in due course; qualifications accredited or recognized by organizations holding provisional status are not recognized by the signatories:

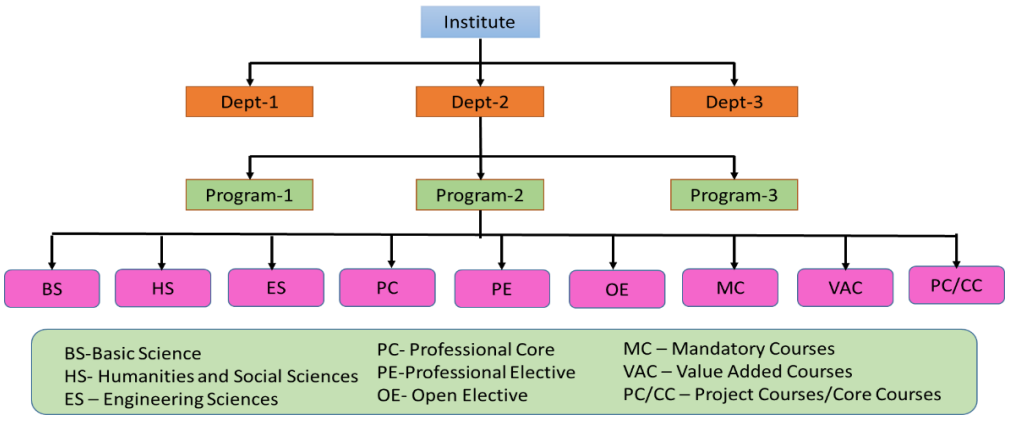
3. Outcome Based Education (OBE) Framework

The OBE Framework shown below presents a pictorial clarification of the hierarchical relationships among several different terminologies such as Vision, Mission, Program Educational Objectives, Program Outcomes, Course Outcomes etc. and also Assessment Plan.



Institute and Courses Relationship

An Institute may have several Departments such as Mechanical Engineering, Electrical & Electronics Engineering, Electronics& Communication Engineering, Computer Science Engineering, etc. Each Department may be conducting several Programs such as B.Tech in any Engineering, M.Tech in any Engineering, Diploma and Certificate programs. Each Program may have of several Courses such as shown inthe flow diagram below. Each course has a syllabus with itscontents.



4. Definitions

Vision and Mission

Vision

A vision statement is a mental big picture idea of what you want to accomplish orachieve. The vision statement should be concise and easy toremember.Because it is easy to remember, it is easy for everyone in the organization to focus on the vision. When people focus on the vision, their daily activities are automatically directed towards achieving the vision.

Mission

A statement of mission is a general statement of how you will achieve your vision

- There is a very close relationship between the vision andmission.
- The mission is an action statement that usually begins with the word "to". Once again it is a verysimple and direct statement that is easy to understand andremember.
- Your mission statement should be simple. However, creating the statement is usually not easy. It may require several drafts. The statement needs to capture the very essence of what your business or organization will achieve and how you will achieveit.

Program Educational Objectives (PEOs)

Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Program Outcomes (POs)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

Course Outcomes (COs)

Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Assessment

Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.

Evaluation

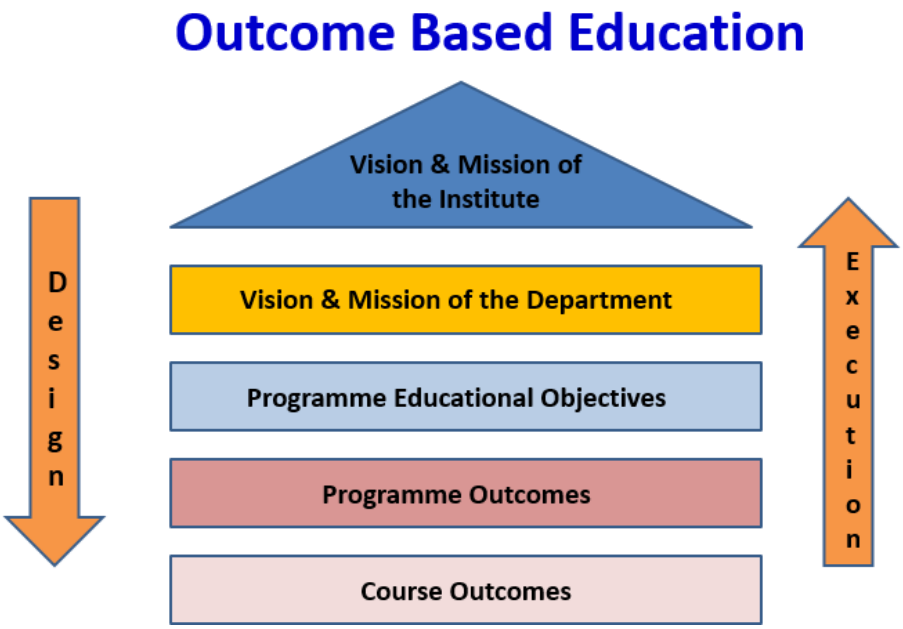
Evaluation is one or more processes, done by the evaluation team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program.

Mapping

Mapping is the process of representing, preferably in matrix form, the correlation among the parameters. It may be done for one to many, many to one, and many to many parameters.

Rubrics

Rubrics provide a powerful tool for assessment and grading of student work. They can also serve as a transparent and inspiring guide to learning. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students your expectations in the assessment, and what you consider important.



5. Vision, Mission, PEOs, POs, PSOs and COs

Institute Vision:

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Institute Mission:

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Vision and Mission of the Department:

Vision of the Department:

"To be a center of global excellence and to emerge as a valuable resource for industry and society".

Mission of the Department

1. To produce qualified and competent computer professionals with international standards.
2. To foster innovative and application oriented research capabilities of young minds for the progress of society.
3. To inculcate strong ethical values and professional behavior so as to adapt to the emerging changes in the field of computing technology.

Programme Educational Objectives

PEOs are the expected achievements of graduates in their career. They are expected to perform and achieve during the first few years after graduation. Every programme is to prepare graduates to accomplish after 3 to 5 years of graduation. These must be realistic and attainable which addresses needs of the stakeholders.

B. Tech (CSE)

PEO1: Graduates will be prepared for a successful career in Computer Science discipline and related industry to meet the needs of the nation and leading industries and also to excel in postgraduate programs.

PEO2: Graduates will continue to learn and apply the acquired knowledge to solve engineering problems and appreciation of the arts, humanities and social sciences.

PEO3: Graduates will have good and broad scientific and engineering knowledgebase so as to comprehend, analyze, design and create novel products and solutions for real-time applications.

PEO4: Graduates will understand professional and ethical responsibility, develop leadership, utilize membership opportunities, develop effective communication skills, teamwork skills, multidisciplinary approach and life-long learning required for a successful professional career.

Program Outcomes (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behaviour that students acquire through the program. The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering graduate. These should be inline with the Graduate Attributes(GA) as defined by the Washington Accord:

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

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

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

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

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

PO 6:The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

PO 10:Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

PROGRAM SPECIFIC OUTCOMES(PSOs):

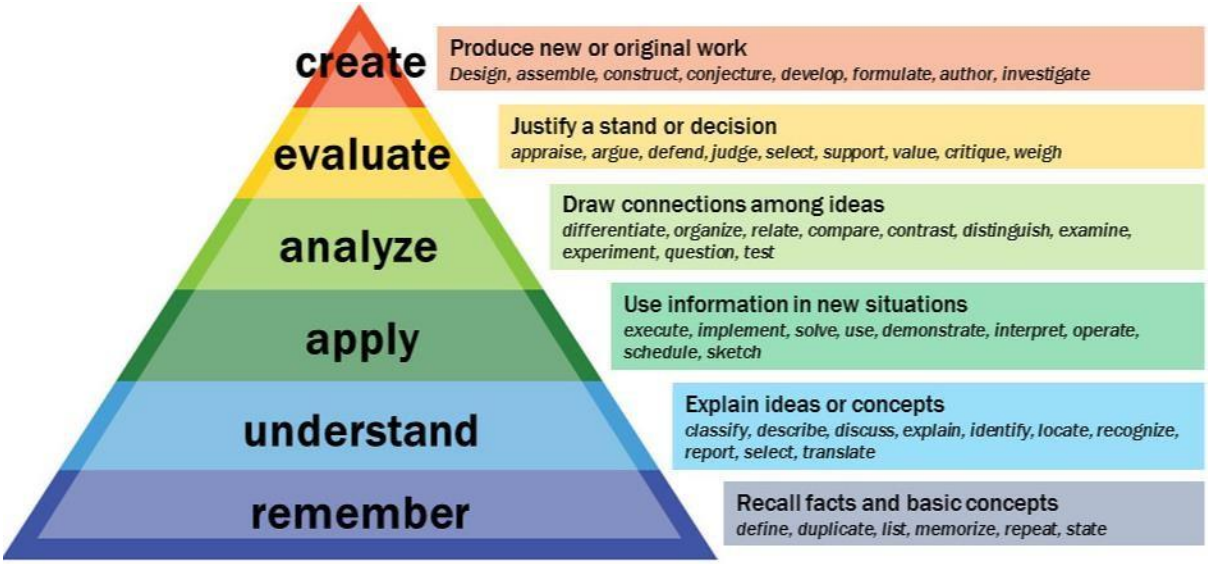
PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required. These are the statements, which are specific to the particular program. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.

PSO1: Emerging Technologies: Apply the concepts of Computer Science and Engineering to learn the emerging technologies and to develop inventive solutions.

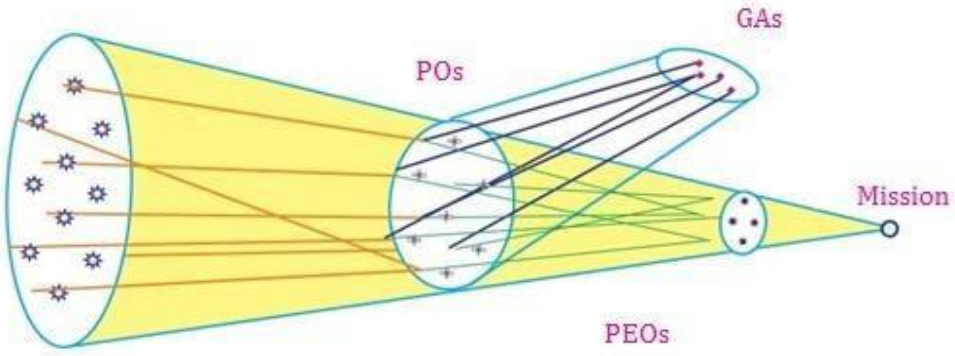
PSO2: Industry oriented technical skills: To foster industrial focused technical skills in Computer science and Engineering through value added courses and, to create a futuristic equipped professional.

Course Outcomes (COs)

Course Outcomes describe what students are expected to know and be able to do at the time of completion of the course. These relate to the skills, knowledge, and behaviors/attitudes that the students / learners acquire as they progress through the course. These are specific and be measurable. For each course there would be 5 – 7 outcomes. These COs are written as per Blooms taxonomy



Relationship between PEOs, POs and COs



ProgramEducationalObjectives(PEOs)areassessedafewyears (3to5years)after Graduation.

Program Outcomes (POs) are assessed during and upon Graduation

Course Outcomes (COs) are assessed upon Course Completion.

6. Assessment Methods and Evaluation

Assessment

Assessment is one or more processes that identify, collect, use and prepare data to evaluate the attainment of student outcomes and program educational objectives. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods maybe used as part of an assessment process.

"Assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development."

Assessment Methods and Evaluation

Program Educational Objectives

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of students after they graduate from the program. Consequently, assessment and evaluation of the objectives requires assessment tools that can be applied after graduation. The PEO's assessment process and methods are tabulated.

S.No.	Method	Assessment Tool	Description
1	Direct	Oral & Written Exams	Objective, subjective, theory, practical, seminar and viva evaluation
2		Projects	Mini & Major project evaluation
3	Indirect	Student Exit Survey	Passing out students
4		Alumni Survey	Old batches of the students
5		Employer Survey	Industries which recruit our students
6		Industry Survey	Leading industry in the domain of programme

The continuous process of assignments, direct and indirect assessments and evaluation will lead to the revision and refinement of the PEOs.

Program Outcomes

The attainment of POs may be assessed by direct and indirect methods. Direct methods of assessment are essentially accomplished by the direct examination or observation of students' knowledge or skills against measurable performance indicators. On the other hand, indirect methods of assessment are based on ascertaining opinion or self-report. Theresults of assessment of each PO for two to three assessment years shall be indicated as they play a vital role inimplementing the continuous improvement process of the program.

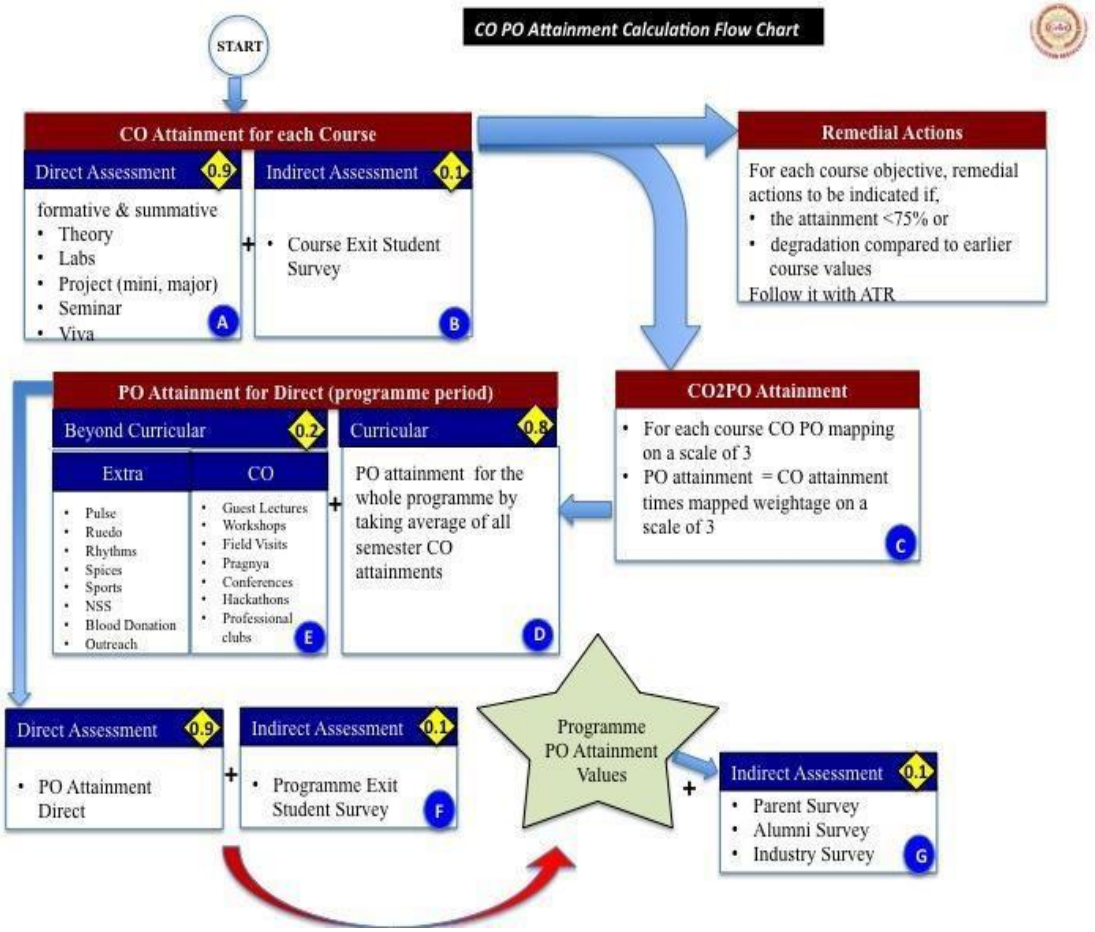
7. Mapping

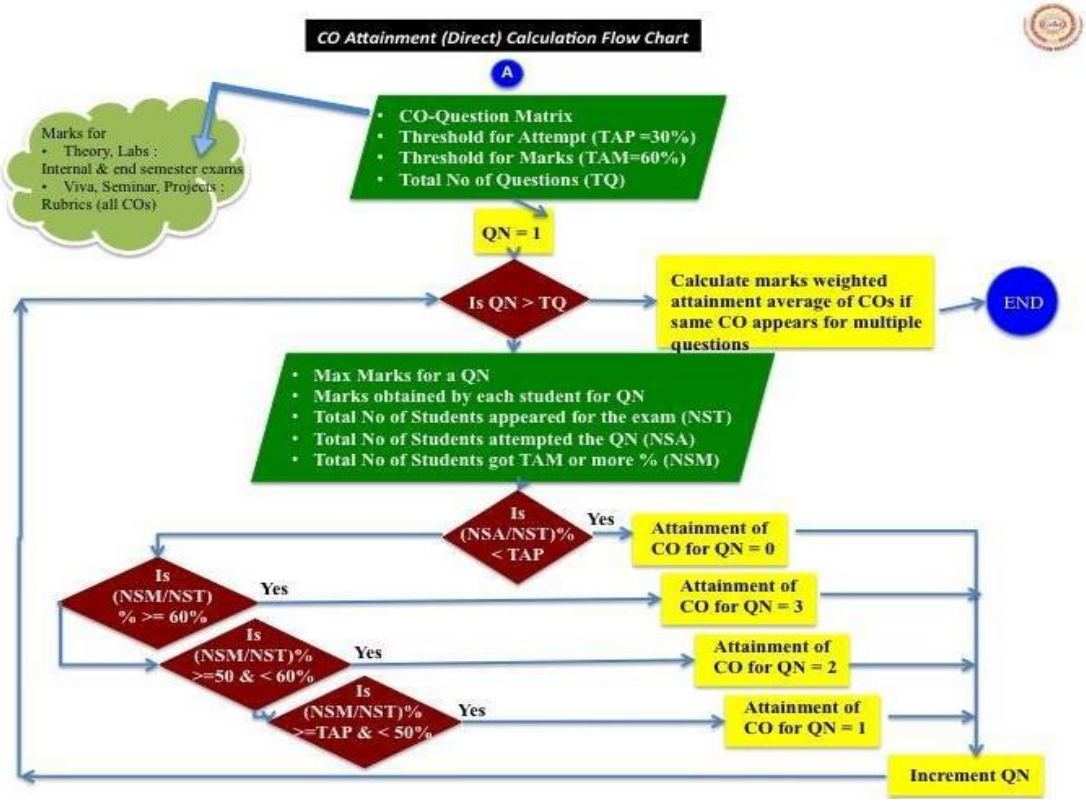
Program Articulation Matrix

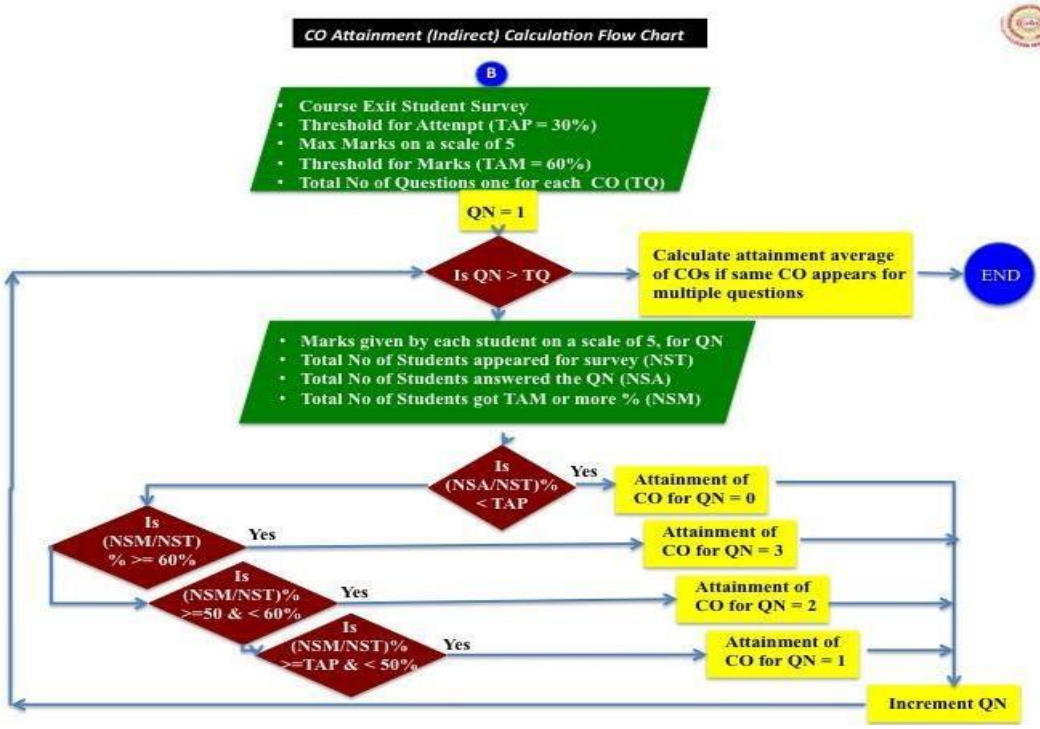
Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C101														
C202														
C303														
....														
....														
C4..														

Course Articulation Matrix

Course	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1															
CO2															
CO3															
CO4															
CO5															


CO PO Attainment Calculation Flow Chart
START
CO Attainment for each Course
Direct Assessment
0.9
formative & summative
Theory
Labs
Project (mini, major)
Seminar
Viva
A
Indirect Assessment
0.1
Course Exit Student Survey
B
Remedial Actions
For each course objective, remedial actions to be indicated if,
the attainment <75% or
degradation compared to earlier course values
Follow it with ATR
CO2PO Attainment
For each course CO PO mapping on a scale of 3
PO attainment = CO attainment times mapped weightage on a scale of 3
C
PO Attainment for Direct (programme period)
Beyond Curricular
0.2
Extra
Pulse
Ruedo
Rhythms
Spices
Sports
NSS
Blood Donation
Outreach
CO
Guest Lectures
Workshops
Field Visits
Pragnya
Conferences
Hackathons
Professional clubs
E
Curricular
0.8
PO attainment for the whole programme by taking average of all semester CO attainments
D
Direct Assessment
0.9
PO Attainment Direct
Indirect Assessment
0.1
Programme Exit Student Survey
F
Programme PO Attainment Values
Indirect Assessment
0.1
Parent Survey
Alumni Survey
Industry Survey
G


CO Attainment (Direct) Calculation Flow Chart
A
Marks for
• Theory, Labs : Internal & end semester exams
• Viva, Seminar, Projects : Rubrics (all COs)
• CO-Question Matrix
• Threshold for Attempt (TAP =30%)
• Threshold for Marks (TAM=60%)
• Total No of Questions (TQ)
QN = 1
Is QN > TQ
Calculate marks weighted attainment average of COs if same CO appears for multiple questions
END
• Max Marks for a QN
• Marks obtained by each student for QN
• Total No of Students appeared for the exam (NST)
• Total No of Students attempted the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN


CO Attainment (Indirect) Calculation Flow Chart
B
• Course Exit Student Survey
• Threshold for Attempt (TAP = 30%)
• Max Marks on a scale of 5
• Threshold for Marks (TAM = 60%)
• Total No of Questions one for each CO (TQ)
QN = 1
Is QN > TQ
Calculate attainment average of COs if same CO appears for multiple questions
END
• Marks given by each student on a scale of 5, for QN
• Total No of Students appeared for survey (NST)
• Total No of Students answered the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN

8. Rubrics

Rubric is a tool that helps to make subjective measurements as objective, clear, and consistent as possible by defining the criteria on which performance should be judged.

A tool often shaped like a matrix, with criteria on one side and levels of achievement across the top used to score products or performances. Rubrics describe the characteristics of different levels of performance, often from exemplary to unacceptable. The criteria are ideally explicit, objective, and consistent with expectations for student performance.

Rubrics may be used by an individual or multiple raters to judge student work.
Rubrics are meaningful and useful when shared with students before their work is judged so they better understand the expectations for their performance.

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
1.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothetopic.	Collects a great deal of Informatio n all relates to thetopic.	2
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned teamrole.	2
		Share Equally	Always relies on others to do the work.	Rarely does the assigned work--often needremindi ng.	Usually does the assigned work--rarely needs reminding	Always does the assigned Work without having to be reminded	2
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking--rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		2.5

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
2.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothe topic.	Collects a great deal ofInformation on all relates to thetopic.	4
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	2
		Share Equally	Always relies on others to Do the work.	Rarely does the assigned work--often needs reminding.	Usually does the assigned work--rarely needs reminding	Always does the assigned Work without havingto be reminded	4
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking--rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		4

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
3.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothe topic.	Collects a great deal of Informatio n all relates to thetopic.	5
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	5
		Share Equally	Always relies	Rarely	Usually	Always	4
			on others to Do the work.	does the assigned work-- often needs reminding.	does the assigned work-- rarely needs reminding	does the assigned Work without having to be reminded	
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking-- rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	5
					Average		4.5

9. Accreditation Criteria

The assessment and evaluation process of accreditation of an engineering program is based on 10 broad criteria developed through a participatory process involving experts from reputed national-level technical institutions, industries, R&D organizations and professional bodies. Each criterion relates to a major feature of institutional activity and its effectiveness. The criteria have been formulated in terms of parameters, including quantitative measurements that have been designed for maximal objective assessment of each feature. An engineering programme to be accredited or re- accredited has to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the programme and seek to improve the standards and quality continually, and address deficiencies if any aspect falls short of the standards set by the accreditation criteria. During the full term of accreditation, the institutions are required to submit their annual self-assessment report to NBA.

Program Level Criteria

Criteria-1: Vision, Mission and Program Educational Objectives

Criteria-2: Programme Curriculum and Teaching – Learning Processes

Criteria-3: Course Outcomes and Programoutcomes

Criteria-4: Students' Performance

Criteria-5: FacultyInformation and Contributions

Criteria-6: Facilities and Technical Support

Criteria-7: Continuous Improvement

Institute Level Criteria

Criteria-8: First Year Academics

Criteria-9: Student Support Systems

Criteria-10: Governance, Institutional Support and Financial Resources

Bachelor of Technology
(B. Tech-CSE)

10. Program Structure

I YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR22A1001	Linear Algebra and Function Approximation	3	1	0	4	4	40	60	100
2	GR22A1003	Applied Physics	3	1	0	4	4	40	60	100
3	GR22A1006	English	2	0	0	2	2	40	60	100
4	GR22A1007	Programming for Problem Solving	2	1	0	3	3	40	60	100
5	GR22A1011	Graphics For Engineers	1	0	4	5	3	40	60	100
6	GR22A1013	Applied Physics Lab	0	0	3	3	1.5	40	60	100
7	GR22A1017	Programming for Problem Solving Lab	0	0	3	3	1.5	40	60	100
8	GR22A1016	English Language and Communication Skills Lab	0	0	2	2	1	40	60	100
Total			**11**	**3**	**12**	**26**	**20**	**320**	**480**	**800**
9	GR22A1022	Design Thinking	2	0	0	2	1	40	60	100

I YEAR II SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR22A1002	Differential Equations and Vector Calculus	3	1	0	4	4	40	60	100
2	GR22A1005	Engineering Chemistry	3	1	0	4	4	40	60	100
3	GR22A1008	Fundamenta ls of Electrical Engineering	2	0	0	2	2	40	60	100
4	GR22A1012	Data Structures	2	1	0	3	3	40	60	100
5	GR22A1015	Engineering Chemistry Lab	1	0	4	5	3	40	60	100
6	GR22A1019	Fundamenta ls of Electrical Engineering Lab	0	0	3	3	1.5	40	60	100
7	GR22A1020	Data Structures Lab	0	0	3	3	1.5	40	60	100
8	GR22A1021	Engineering Workshop	0	0	2	2	1	40	60	100
Total			**11**	**3**	**12**	**26**	**20**	**320**	**480**	**800**

II YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR22A2067	Digital Logic Design	3	0	0	3	3	40	60	100
2	GR22A2068	Java Programming	3	0	0	3	3	40	60	100
3	GR22A2005	Probability and Statistics	3	0	0	3	3	40	60	100
4	GR22A2069	Discrete Mathematics	2	1	0	3	3	40	60	100
5	GR22A2070	Database Management Systems	3	0	0	3	3	40	60	100
6	GR22A2071	ripting Languages Lab	0	0	4	4	2	40	60	100
7	GR22A2072	Object Oriented Programming in C++ Lab	0	0	3	3	1.5	40	60	100
8	GR22A2073	Database Management Systems Lab	0	0	3	3	1.5	40	60	100
Total			**14**	**1**	**10**	**25**	**20**	**320**	**480**	**800**
9	GR22A2002	Value Ethics and Gender Culture	2	0	0	2	2	40	60	100
10	GR22A2108	ffective Technical Communicat ion	2	0	0	2	2	40	60	100

II YEAR II SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR22A2073	omputer Organization	3	0	0	3	3	40	60	100
2	GR22A2074	Operating Systems	2	1	0	3	3	40	60	100
3	GR22A2075	Discrete Mathematics	2	1	0	3	3	40	60	100
4	GR22A2076	Full Stack Web Development	3	0	0	3	3	40	60	100
5	GR22A2077	Design and Analysis of Algorithms	3	0	0	3	3	40	60	100
6	GR22A2078	Full Stack Web Development Lab	0	0	3	3	1.5	40	60	100
7	GR22A2079	Operating Systems Lab	0	0	3	3	1.5	40	60	100
8	GR22A2080	Visual Programming using C# and .Net Lab	0	0	4	4	2	40	60	100
		Total	**13**	**2**	**10**	**25**	**20**	**320**	**480**	**800**
9	GR22A2001	Environmental Science	2	0	0	2	2	30	70	100
10	GR22A2109	Real-time Research Project/ Societal Related Project	0	0	4	4	2	50	-	50

11. Course Outcomes:

LINEAR ALGEBRA AND FUNCTION APPROXIMATION
B.TECH (CSE)
Course Code: GR22A1001

Course Outcomes: At the end of the course, the student will be able to

1. Work with the essential tools of vector and matrix algebra
2. Compute eigenvalues and vectors for engineering applications
3. Illustrate matrix decomposition techniques to determine the exact or approximate solutions of a linear algebraic system.
4. Develop the skill of finding multivariable function optima
5. Illustrate the concepts of function approximation with measurement of error

APPLIED PHYSICS
B.TECH (CSE)
Course Code: GR22A1003

Course Outcomes: At the end of the course, the student will be able to

1. Solve engineering problems involving quantum nature of radiation and matter waves.
2. Comprehend the characteristics of semiconductor devices such as transistors and diodes.
3. Familiarize with operation of optoelectronic devices and its applications.
4. Analyze the properties of Laser and its propagation in different types of opticalfibers.
5. Identify dielectric, magnetic and superconducting materials based on their properties for specific applications.

ENGLISH
B.TECH (CSE)
Course Code: GR22A1006

Course Outcomes: At the end of the course, the student will be able to

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Listen and respond appropriately.

PROGRAMMING FOR PROBLEM SOLVING
B.TECH (CSE)
Course Code: GR22A1007

Course Outcomes: At the end of the course, the student will be able to

1. To design algorithms and flowcharts for problem solving and illustrate the fundamentals of C language.
2. To identify and apply control structures and arrays to solve problems.
3. To discover the need for strings and functions in problem solving and apply it.
4. To analyze the need for pointers and structures in C and implement for solutions.
5. To interpret working with files, preprocessor directives and command line arguments in C.

GRAPHICS FOR ENGINEERS
B.TECH (CSE)23
Course Code: GR22A1010

Course Outcomes: At the end of the course, the student will be able to

1. Interpret industrial drawings and read working drawings.
2. Draw engineering objects like springs using AutoCAD.
3. Imagine and create multi-views of 2-d plane figures.
4. Construct and interpret multi-views of 3-d solid objects with proper dimensioning, scaling etc.
5. Draw and create pictorial views and model the industrial objects like gears and bearings with solid modelling commands available in AutoCAD tool.

APPLIED PHYSICS LAB
B.TECH (CSE)
Course Code: GR22A1013

Course Outcomes: At the end of the course, the student will be able to

1. Compare the behavior of p-n junction diode, Solar cells and LED.
2. Analyze the behavior of magnetic and electric fields with the help of graphs.
3. Determine the work function of a material through photoelectric effect.
4. Asses the characteristics of Lasers and infer the losses in optical fibers.
5. Estimate the time constant of RC circuit and resonance phenomenon in LCR circuit.

PROGRAMMING FOR PROBLEM SOLVING LAB
B.TECH (CSE)
Course Code: GR22A1017

Course Outcomes: At the end of the course, the student will be able to

1. Translate algorithms into a working program and analyse and debug the codes using basics of C language.
2. Develop programs by choosing appropriate control structures.
3. Select and apply the concept of arrays and strings for problem solving.
4. Demonstrate problem solving using modular programming and pointers.
5. Solve the problems using structures, files and pre-processor directives.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB
B.TECH (CSE)
Course Code: GR22A1015

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the role and importance of various forms of communication skills.
2. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professional responsibilities.
5. Evaluate and use a neutral and correct form of English.

DESIGN THINKING
B.TECH (CSE)
Course Code: GR22A1020

Course Outcomes: At the end of the course, the student will be able to

1. Students will be able to identify an Opportunity from a Problem
2. Students will be able to frame a Product/Service Idea
3. Students will be able to empathize with the customers
4. Students will be able to design and develop a Prototype
5. Students will be able to pitch their idea

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
B.TECH (CSE)
Course Code: GR22A1002

Course Outcomes: At the end of the course, the student will be able to

1. Classify the differential equations of first order and solve them analytically by suggested methods
2. Solve linear differential equations of higher order under various forcing functions
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics
4. Apply vector differential operators on scalar and vector fields and apply them to solve some field related problems
5. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces

ENGINEERING CHEMISTRY
B.TECH (CSE)
Course Code: GR22A1005

Course Outcomes: At the end of the course, the student will be able to

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.
3. Recognize various problems related to electrochemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in engineering.
4. Know the origin of different types of engineering materials used in modern technology and Interpret different problems involved in industrial utilization of water.
5. Understand the processing of fossil fuels for the effective utilization of chemical energy.

FUNDAMENTALS OF ELECTRICAL ENGINEERING
B.TECH (CSE)
Course Code: GR22A1008

Course Outcomes: At the end of the course, the student will be able to

1. Summarize Understand basic electric circuits.
2. Analyze electric circuits with suitable theorems.
3. Interpret the working principle of Electrical machines.
4. Solve single phase balanced sinusoidal systems.
5. Apply sensors for real time applications

DATA STRUCTURES
B.TECH (CSE)
Course Code: GR22A1012

Course Outcomes: At the end of the course, the student will be able to

1. Implement various sorting techniques and analyze the computational complexity of algorithms.
2. Analyze the basics of data structures and itstypes and translate to programs the operations on stack and queue and their applications.
3. Develop algorithms for various operations on linked lists and convert them to programs.
4. Interpret operations on non-linear data structure binary tree and BST.
5. Summarize the operations on graphs and apply graph traversals techniques and outline hashing techniques.

ENGINEERING CHEMISTRY LAB
B.TECH (CSE)
Course Code: GR22A1015

Course Outcomes: At the end of the course, the student will be able to

1. Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
2. Determination of parameters like hardness and chloride content in water, measurement of redox potentials and conductance.
3. Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.
4. Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.
5. Determination of physical properties like adsorption and viscosity.

FUNDAMENTALS OF ELECTRICAL ENGINEERING LAB
B.TECH (CSE)
Course Code: GR22A1019

Course Outcomes: At the end of the course, the student will be able to

1. Get an exposure to common electrical components and their ratings.
2. Get an exposure to basic electrical laws.
3. Understand the measurement and relation between the basic electrical parameters
4. Understand the response of different types of electrical circuits to different excitations.
5. Compare the basic characteristics of Electrical machines

DATA STRUCTURES LAB
B.TECH (CSE)
Course Code: **GR22A1020**

Course Outcomes: At the end of the course, the student will be able to

1. Construct executable C programs for sorting techniques.
2. Implement stack and queue data structures and their applications.
3. Interpret various linked list operations to produce executable codes.
4. Develop working procedure for operations on BST using DMA.
5. Demonstrate graph operations and hashing techniques.

ENGINEERING WORKSHOP
B.TECH (CSE)
Course Code: GR22A1021

Course Outcomes: At the end of the course, the student will be able to

1. Develop various trades applicable to industries / Manufacturing practices.
2. Create Hands on experience for common trades.
3. Improve to fabricate components with their own hands.
4. Develop practical knowledge on the dimensional accuracies and dimensional tolerances possible with various manufacturing processes.
5. To build the requirement of quality of work life on safety and organizational needs.

DIGITAL LOGIC DESIGN

B.TECH (CSE)
Course Code: GR22A2067

Course Outcomes: At the end of the course, the student will be able to

1. Apply knowledge of fundamental Boolean principles and manipulation to design Logic Circuits.
2. Apply various techniques of Boolean function simplification to create minimal expressions.
3. Create combinational circuits for a specified behavior with minimal specification.
4. Synthesize Sequential circuits with minimal states.
5. Realize combinational circuitry using Combinational PLDs and develop & test HDL models of Logic Circuits.

JAVA PROGRAMMING

B.TECH (CSE)
Course Code: GR22A2068

Course Outcomes: At the end of the course, the student will be able to

1. Identify the model of Object-Oriented Programming: Abstract data types, Encapsulation, Inheritance and Polymorphism
2. Summarize the fundamental features like Interfaces, Exceptions and Collections
3. Correlate the advantages of Multi-threading.
4. Design interactive programs using Applets, AWT and Swings
5. Develop real time applications using the features of Java.

PROBABILITY AND STATISTICS

B.TECH (CSE)
Course Code: GR22A2005

Course Outcomes: At the end of the course, the student will be able to

1. Compute and interpret descriptive statistics.
2. Make use of the properties of Binomial, Poisson, Normal and Exponential distributions to estimate the variability of occurrence
3. Analyze univariate and bivariate data using statistical modelling
4. Apply inferential statistics to suggest explanations for a situation or phenomenon arising in the case of large samples
5. Apply inferential statistics to suggest explanations for a situation or phenomenon arising in the case of small samples.

ECONOMICS AND ACCOUNTING FOR ENGINEERS

B.TECH (CSE)
Course Code: GR22A2004

Course Outcomes: At the end of the course, the student will be able to

1. Express a given logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given a problem, using deductive logic and prove the solution based on logical inference.
3. Classify a mathematical problem into its algebraic structure.
4. Evaluate Boolean functions and simplify expressions using the properties ofBoolean algebra.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

DATABASE MANAGEMENT SYSTEMSB.TECH (CSE)
Course Code: GR22A2069

Course Outcomes: At the end of the course, the student will be able to

1. Identify the role of Database System Applications and the design issues related.
2. Design the logical model for the applications and apply indexing techniques.
3. Construct a Database Schema, manipulate data using a SQL.
4. Apply the Schema Refinement techniques for a database design for optimized access.
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

JAVA PROGRAMMING LAB

B.TECH (CSE)
Course Code: GR22A2071

Course Outcomes: At the end of the course, the student will be able to

1. Analyze a problem, identify and define the computing requirements appropriate to its solution using object-oriented programming concepts.
2. Design the applications using Inheritance, Polymorphism and Synchronization concepts
3. Handle exceptions at Compile time and Run time
4. Solve the real-world problems using Java Collection framework.
5. Develop GUI applications using Applets, AWT and Swings

R PROGRAMMING LAB

B.TECH (CSE)
Course Code: GR22A2070

Course Outcomes: At the end of the course, the student will be able to

1. Work efficiently in R interactive environment and list arrays, vectors and other concepts
2. Develop and evaluate loop constructs available in R
3. Design logic for arithmetic operations and functions in R
4. Evaluate effectively the descriptive and predictive statistical methods using R.
5. Summarize different kinds of visualization techniques for plotting graphs.

EFFECTIVE TECHNICAL COMMUNICATION

B.TECH (CSE)
Course Code: GR22A2108

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate proficiency in producing well-structured technical documents adhering to standard writing conventions and industry-specific guidelines.
2. Develop critical analysis skills to assess and evaluate technical documents.
3. Develop a habit of lifelong learning in technical communication, recognizing its importance in their personal and professional growth.
4. Exhibit effective oral communication skills by delivering technical presentations with clarity, coherence, and appropriate use of visual aids.
5. Exemplify intercultural competence in technical communication.

DATABASE MANAGEMENT SYSTEMS LAB

B.TECH (CSE)
Course Code: GR22A2069

Course Outcomes: At the end of the course, the student will be able to

1. Construct the schema of the database and modify it.
2. Compile a query to obtain the aggregated result from the database.
3. Speculate the concepts of various database objects.
4. Compare the use of procedure and function in database.
5. Use triggers and packages to create applications in the database.

VALUE ETHICS AND GENDER CULTURE

B.TECH (CSE)
Course Code: GR22A2002

Course Outcomes: At the end of the course, the student will be able to

1. To enable the student to understand the core values that shapes the ethical behaviour. And Student will be able to realize the significance of ethical human conduct and self-development
2. Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.
3. The students will learn the rights and responsibilities as an employee and a team member.
4. Students will attain a finger grasp of how gender discrimination works in our society and how to counter it.
5. Students will develop a better understanding on issues related to gender and Empowering students to understand and respond to gender violence.

OPERATING SYSTEMS

B.TECH (CSE)
Course Code: GR22A2074

Course Outcomes: At the end of the course, the student will be able to

1. Explain different functions and types of operating system and implement various process management concepts for maximization of CPU throughput
2. Analyze synchronization problems and design a deadlock management scheme.
3. Optimize memory management for improved system performance.
4. Demonstrate disk management, implement disk scheduling and file system interface
5. Describe and frame protection and security policy for OS.

COMPUTER ORANIZATION

B.TECH (CSE)
Course Code: GR22A2073

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate knowledge of register organization of a basic computer system
2. Incorporate In-depth understanding of control unit organization and micro programmed control.
3. Understand the performance of central processing unit of a basic computer system.
4. Apply various algorithms to perform arithmetic operations and propose suitable hardware and appraise various methods of communications with I/O devices.
5. Analyze and emphasize various communication media in the basic computer system using design of various memory structures and Multiprocessor systems.

DISCRETE MATHEMATICS

B.TECH (CSE)
Course Code: GR22A2075

Course Outcomes: At the end of the course, the student will be able to

1. Use propositional and predicate logic in knowledge representation and truth verification.
2. Demonstrate the application of discrete structures in different fields of computer science.
3. Apply basic and advanced principles of counting to the real-world problems.
4. Able to formulate the problem and solve using recurrence relations and generating functions
5. Devise the given problem as a graph network and solve with techniques of graph theory.

DISCRETE MATHEMATICS

B.TECH (CSE)
Course Code: GR22A2075

Course Outcomes: At the end of the course, the student will be able to

1. Use propositional and predicate logic in knowledge representation and truth verification.
2. Demonstrate the application of discrete structures in different fields of computer science.
3. Apply basic and advanced principles of counting to the real-world problems.
4. Able to formulate the problem and solve using recurrence relations and generating functions
5. Devise the given problem as a graph network and solve with techniques of graph theory.

FULL STACK WEB DEVELOPMENT

B.TECH (CSE)
Course Code: GR22A2076

Course Outcomes: At the end of the course, the student will be able to

1. Enable participants to develop a complete web application from the scratch that includes Front-end, Back-end and Data-exchange technologies.
2. Attain the knowledge of web development basics, HTML, CSS and building interactive web pages using JavaScript & jQuery.
3. Design the applications using node.js and Angular.
4. Construct the real-world applications using PHP and MySQL.
5. Become an industry-ready engineer who can be readily deployed in a project.

DESIGN AND ANALYSIS OF ALGORITHMS

B.TECH (CSE)
Course Code: GR22A2077

Course Outcomes: At the end of the course, the student will be able to

1. Distinguish various performances of algorithms.
2. Illustrating Divide and Conquer Design Paradigm algorithms.
3. Examining various algorithms based on Dynamic programming paradigm.
4. Discriminate greedy approach and back tracking algorithms.
5. Demonstrate branch and bound problems and Distinguish problems related to various complexity classes.

FULL STACK WEB DEVELOPMENT LAB

B.TECH (CSE)
COURSE CODE: GR22A2078

Course Outcomes: At the end of the course, the student will be able to

1. To design a website
2. To implement client-side validation.
3. To develop the robust and scalable websites, backend APIs
4. To implement end-to-end applications.
5. To design web applications with database connectivity

OPERATING SYSTEMS LAB

B.TECH (CSE)
COURSE CODE: GR22A2079

Course Outcomes: At the end of the course, the student will be able to

1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem, and Dining philosophers' problem using semaphores.
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging techniques and page replacement policies, memory allocation techniques in memory management.
5. Implement disk scheduling techniques and file allocation strategies.

VISUAL PROGRAMMING USING C# AND .NET LAB
B.TECH (CSE)
COURSE CODE: GR22A2080

Course Outcomes: At the end of the course, the student will be able to

1. Create Event Driven Applications.
2. Develop asynchronous applications
3. Deploy Web services
4. Build database applications using ADO.NET
5. Understand the Language Integrated Query (Linq) library

ENVIRONMENTAL SCIENCE

B.TECH (CSE)
COURSE CODE: GR22A2001

Course Outcomes: At the end of the course, the student will be able to

1. Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems
2. Interpret the key components in safe guarding the environment
3. Evolve an individual vision of harmonious interaction with natural world.
4. Appraise the quality of environment in order to create a healthy atmosphere
5. Familiarize with the individual responsibilities towards green revolution

GR20

OUTCOME BASEDEDUCATION

ACCREDITATION

BACHELOR OF TECHNOLOGY

(COMPUTER SCIENCE AND ENGINEERING)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

GOKARAJU RANGARAJU

Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

GOKARAJU RANGARAJU

Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad

OUTCOME BASED EDUCATION
&
ACCREDITATION

BACHELOR OF TECHNOLOGY

(COMPUTER SCIENCE AND ENGINEERING)

Department of Computer Science and Engineering

GOKARAJU RANGARAJU
Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad

CONTENTS

Outcome Based Education and Accreditation

1. Introduction

"Outcomes Based Education" (OBE) of Engineering qualifications gives recognition to graduates for the knowledge, skills and attitudes/behaviors they have acquired upon just completion of a program and after 4 to 5 years of graduation. This system is student centered instruction that focuses on measuring student performance i.e. outcomes of the Program and at the same time enabling students to develop new skills that prepare them to stand out with their global counterparts..

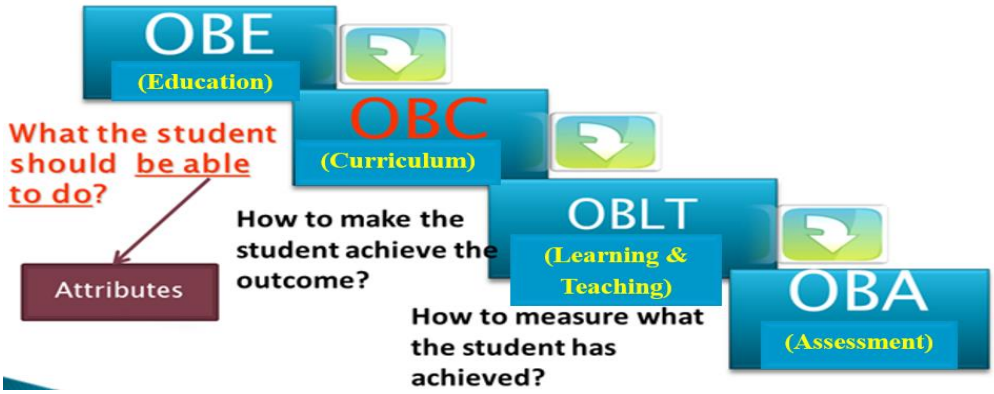
Outcome Based Accreditation (OBA) is an Assessment of the Performance of the Program/Institution as per the Accreditation Criteria defined in terms of Outcomes and other key Constituents.

Outcome Based Curriculum (OBC) is prepared keeping in mind that what the student should be able to do at end of the Program.

Outcome Based Learning &Teaching (OBLT) methods are developed to make the student achieve the Outcomes.

Outcome Based Assessments (OBA) methods are designed to measure what the student has achieved at end of the Program in terms of Knowledge, Skills, and Attitude/Behavior.

Key Constituents of OBE The Key Constituents of OBE are Vision, Mission, Program Educational Objectives (PEO), Program Outcomes (PO), Graduate Attributes (GA), Course Outcomes (CO), Assessments, Rubrics, Mapping, Evaluation andGrading.



Accreditation

It is a process of quality assurance and improvement, whereby a program in an approved Institution is critically appraised to verify that the Institution/program continues to meet and/or exceed the Norms and Standards prescribed by regulator from time to time. It is a kind of recognition which indicates that a program/Institution fulfills certain standards.

- It is a peer review process that assures the quality of post-secondary education students receive.
- Educational institutions or program volunteer to undergo this review periodically to determine if certain criteria are being met
- It is important to understand that accreditation is not a ranking system. It is simply assurance that a program or institution meets established quality standards.

There are two types of accreditation- Institution and Program.

- Institutional accreditation evaluates overall institutional quality. One form of institutional accreditation is accreditation of Colleges and Universities. (National Assessment & Accreditation Council-NAAC under UGC)
- Program accreditation examines specific program of study rather than institution as a whole. (National Board of Accreditation-NBA under AICTE)

Importance and Significance of Accreditation

- To make the institute/department/program aware of the weaknesses of the program offered by it and act on suggestions for improvement.
- To encourage the institute to move continuously towards the improvement of quality of its program, and the pursuit of excellence.
- To facilitate institutions for updating themselves in program curriculum, teaching and learning processes, faculty achievements students' skills/abilities/knowledge.
- To improve student enrollment both in terms of quality and quantity.
- To facilitate receiving of grants from Government regulatory bodies and institutions/agencies.
- To attain international recognition of accredited degrees awarded.
- To facilitate the mobility of graduated students and professionals.
- To enhance employability of graduates.
- To create sound and challenging academic environment in the Institution, and contributes to social and economic development of the country by producing high quality technical manpower.

2. Washington Accord

The Washington Accord Agreement recognizes that

"Accreditation of engineering ac academic programs is a key foundation for the practice of engineering at the professional level in each of the countries or territories covered by the Accord."

The Washington Accord was sign in 1989.It is an agreement between the bodies responsible for accrediting professional engineering degree programs in each of the signatory countries. It recognizes the substantial equivalency of programs accredited by those bodies and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. The Washington Accord covers professional engineering undergraduate degrees. Postgraduate-level programs are not covered by the Accord. The Washington Accord Agreement applies only to accreditations conducted by the signatories within their respective national or territorial boundaries.

Agreements covering qualifications in engineering

There are three agreements covering mutual recognition in respect of qualification in engineering:

The Washington Accord signed in 1989 was the first -it recognizes substantial equivalence in the accreditation of qualifications in professional engineering, normally of four years duration.

The Sydney Accord signed in 2001 and recognises substantial equivalence in the accreditation of qualifications in engineering technology, normally of three years duration.

The Dublin Accord signed in 2002 and recognises substantial equivalence in the accreditation of qualifications in technician engineering, normally of two years duration.

The Washington Accord pertains to engineering programs accredited by its signatories within their respective jurisdiction starting in 1989. There are 15 Signatories to the Washington Accord as on today. Signatories to the Washington Accord are organizations responsible for accrediting engineering programs in Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States (1989); Hong Kong (1995), South Africa (1999), Japan (2005), Singapore (2006),Korea, Chinese Taipei (2007), Malaysia (2009), Turkey (2011), Russia (2012). Signatories have full rights of participation in the Accord.

Washington Accord Agreement states:

- Accreditation criteria, policies and procedures of the signatories have been verified comparable
- Accreditation decisions made by one signatory are acceptable to the other signatories
- Recognition applies only to accreditations conducted within the signatory's national or territorial boundaries.
- Mutual recognition of accredited engineering programs
- Benchmarking standards for engineering education
- Graduate Attributes (GA) represent the generally agreed reference for accredited programs
- Bench marking accreditation policies and processes

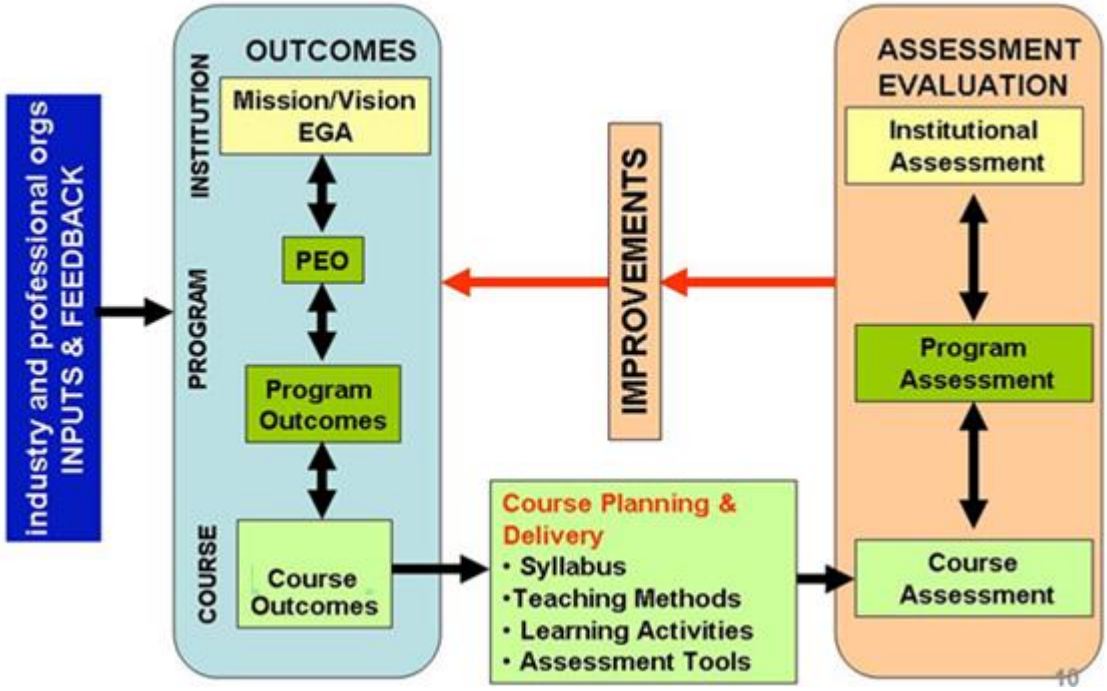
The Signatories will identify and encourage the implementation best practice for the academic preparation of engineers by mutual monitoring regular communication and sharing of information: accreditation criteria, systems, procedures, manuals, publications list of accredited programs; invitations to observe accreditation visits; and invitations to observe meetings of any boards.

"Getting into Washington Accord is like getting into the UN Security Council,"

Organizations holding provisional status have been identified as having qualification accreditation or recognition procedures that are potentially suitable for the purposes of the Accord; those organizations are further developing those procedures with the goal of achieving signatory status in due course; qualifications accredited or recognized by organizations holding provisional status are not recognized by the signatories:

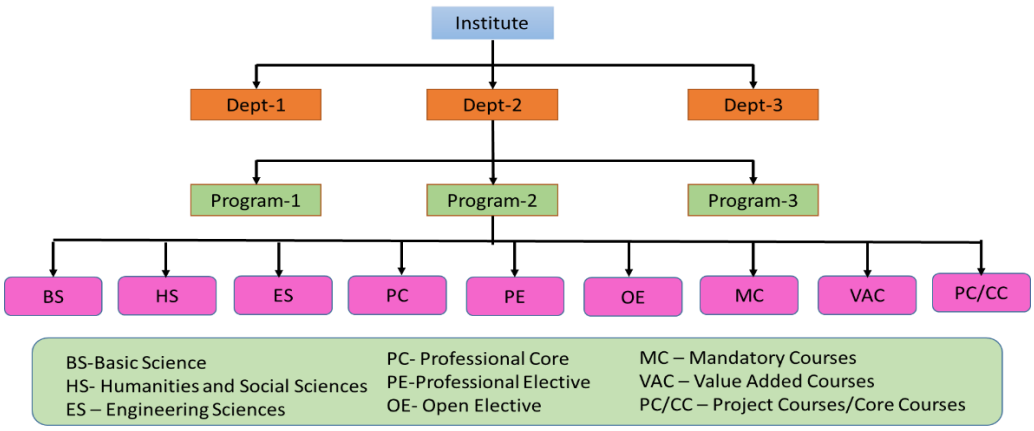
3. Outcome Based Education (OBE) Framework

The OBE Framework shown below presents a pictorial clarification of the hierarchical relationships among several different terminologies such as Vision, Mission, Program Educational Objectives, Program Outcomes, Course Outcomes etc. and also Assessment Plan.



Institute and Courses Relationship

An Institute may have several Departments such as Mechanical Engineering, Electrical & Electronics Engineering, Electronics& Communication Engineering, Computer Science Engineering, etc. Each Department may be conducting several Programs such as B.Tech in any Engineering, M.Tech in any Engineering, Diploma and Certificate programs. Each Program may have of several Courses such as shown inthe flow diagram below. Each course has a syllabus with itscontents.



4. Definitions

Vision and Mission

Vision

A vision statement is a mental big picture idea of what you want to accomplish orachieve. The vision statement should be concise and easy toremember.Because it is easy to remember, it is easy for everyone in the organization to focus on the vision. When people focus on the vision, their daily activities are automatically directed towards achieving the vision.

Mission

A statement of mission is a general statement of how you will achieve your vision

- There is a very close relationship between the vision andmission.
- The mission is an action statement that usually begins with the word “to”. Once again it is a verysimple and direct statement that is easy to understand andremember.
- Your mission statement should be simple. However, creating the statement is usually not easy. It may require several drafts. The statement needs to capture the very essence of what your business or organization will achieve and how you will achieveit.

Program Educational Objectives (PEOs)

Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Program Outcomes (POs)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

Course Outcomes (COs)

Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Assessment

Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.

Evaluation

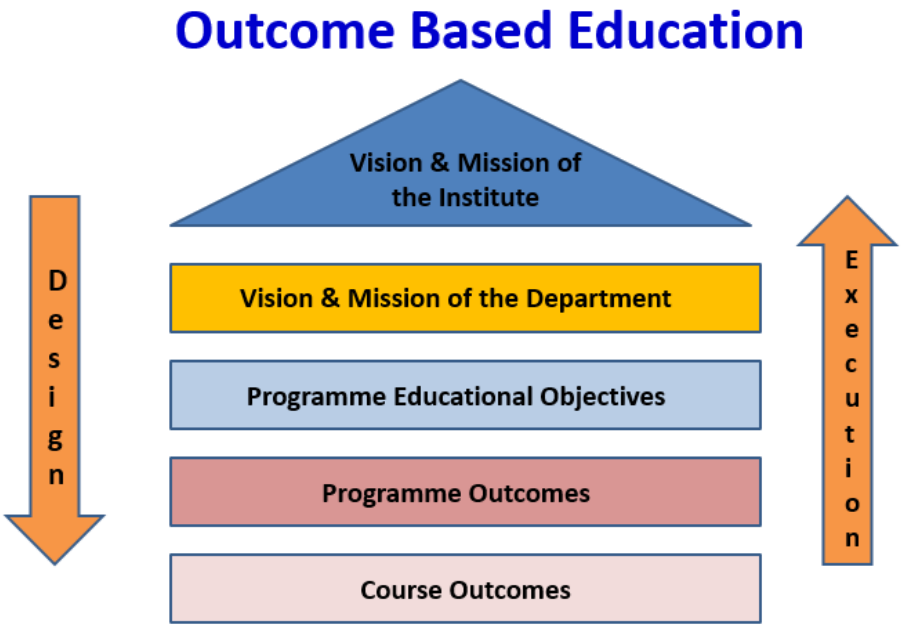
Evaluation is one or more processes, done by the evaluation team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program.

Mapping

Mapping is the process of representing, preferably in matrix form, the correlation among the parameters. It may be done for one to many, many to one, and many to many parameters.

Rubrics

Rubrics provide a powerful tool for assessment and grading of student work. They can also serve as a transparent and inspiring guide to learning. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students your expectations in the assessment, and what you consider important.



5. Vision, Mission, PEOs, POs, PSOs and COs

Institute Vision:

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Institute Mission:

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Vision and Mission of the Department:

Vision of the Department:

"To be a center of global excellence and to emerge as a valuable resource for industry and society".

Mission of the Department

1. To produce qualified and competent computer professionals with international standards.
2. To foster innovative and application oriented research capabilities of young minds for the progress of society.
3. To inculcate strong ethical values and professional behavior so as to adapt to the emerging changes in the field of computing technology.

Programme Educational Objectives

PEOs are the expected achievements of graduates in their career. They are expected to perform and achieve during the first few years after graduation. Every programme is to prepare graduates to accomplish after 3 to 5 years of graduation. These must be realistic and attainable which addresses needs of the stakeholders.

B. Tech (CSE)

PEO1: Graduates will be prepared for a successful career and related skills for industry to meet the needs of the nation and leading industries and also to excel in postgraduate programs.

PEO2: Graduates will continue to learn and apply the acquired knowledge to solve engineering problems and appreciation of the arts, humanities and social sciences.

PEO3: Graduates will have good and broad scientific and engineering cognition, so as to comprehend, analyze, design and create novel products and solutions for real-time applications.

PEO4: Graduates will understand professional and ethical responsibility, develop leadership, utilize membership opportunities, develop effective communication abilities, teamwork skills, multidisciplinary approach and life-long learning.

Program Outcomes (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behaviour that students acquire through the program. The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering graduate. These should be inline with the Graduate Attributes(GA) as defined by the Washington Accord:

- **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

- **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems:
    - That cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories and techniques;
    - That may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
    - That require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
    - Which need to be defined (modelled) within appropriate mathematical framework; and
    - That often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter.
- **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings..
- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

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

- **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required. These are the statements, which are specific to the particular program. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.

Program Outcomes (POs)

At the end of programme the graduates will be able to

PO1: Apply knowledge of mathematics, science, and engineering fundamentals to solve complex engineering problems.
PO2: Analyse, design and conduct experiments by using mathematics, core engineering and basic sciences.
PO3: Identify, design, formulate and the impact of engineering solutions to develop a viable solution in a global, economic, environmental, and societal context.
PO4: Use constructive research methodology to identify, contrive, and to solve the intricate issues in real life complex Problems.
PO5: Identify, Select and to apply modern software tools, and utilize resources to find solutions for complex engineering problems.
PO6: Apply expertise to experimental, statistical, computational methods and to assess societal, health, safety, legal and cultural issues relevant to the professional engineering practice.
PO7: Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
PO8: Apply professional and ethical responsibility with the norms of engineering.
PO9: Contribute as individual and able to work with any multi-disciplinary teams for achieving the targeted goal towards organizational growth.
PO10: Compile and communicate, the developed complex engineering process by creating effective documentation, presentation, and assessment report, and communicate the entire advancement to the next successive hierarchical level.
PO11: Converge the Engineering, knowledge and skill, to manage multi-disciplinary environmental projects within the permitted financial boundary and time.
PO12: Recognize and predict the future technological change, and adopt to focus on preparing and engaging in life-long learning.

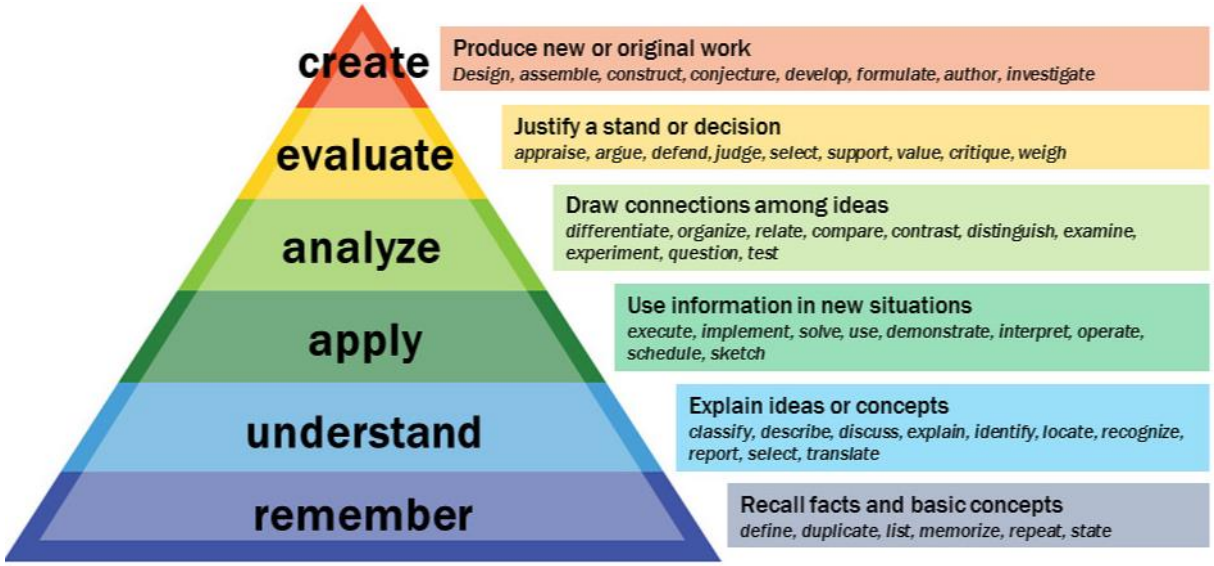
Program Specific Outcomes (PSOs):

PSO1: To foster industrial focused technical skills in Computer science and Engineering through valid added courses and soft skills amalgamate with academic, to create a futuristic equipped professional.

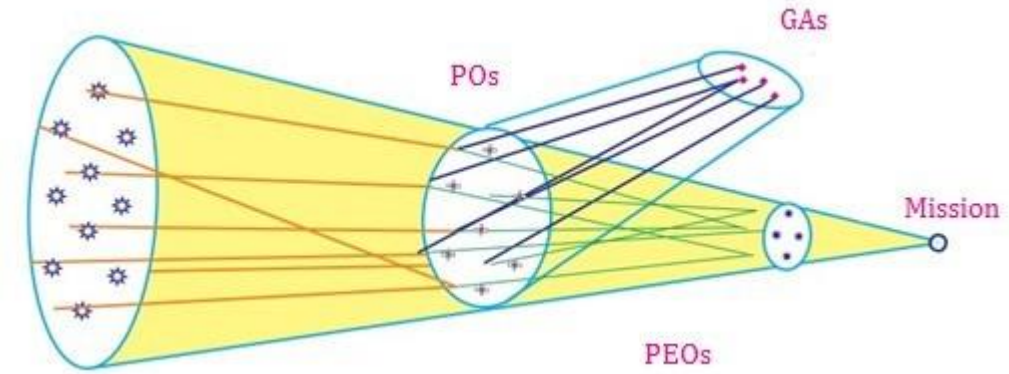
PSO2: Apply the acquired knowledge and skill, to deliver inventive solutions to social, economic and technological challenges, which leads to our nation's growth.

Course Outcomes (COs)

Course Outcomes describe what students are expected to know and be able to do at the time of completion of the course. These relate to the skills, knowledge, and behaviors/attitudes that the students / learners acquire as they progress through the course. These are specific and be measurable. For each course there would be 5 – 7 outcomes. These COs are written as per Blooms taxonomy



Relationship between PEOs, POs and COs



ProgramEducationalObjectives(PEOs)areassessedafewyears (3to5years)after Graduation.

Program Outcomes (POs) are assessed during and upon Graduation

Course Outcomes (COs) are assessed upon Course Completion.

6. Assessment Methods and Evaluation

Assessment

Assessment is one or more processes that identify, collect, use and prepare data to evaluate the attainment of student outcomes and program educational objectives. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods maybe used as part of an assessment process.

"Assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development."

Assessment Methods and Evaluation

Program Educational Objectives

PEOs (Program Educational Objectives) relate to the career and professional accomplishments of students after they graduate from the program. Consequently, assessment and evaluation of the objectives requires assessment tools that can be applied after graduation. The PEO's assessment process and methods are tabulated.

S.No.	Method	Assessment Tool	Description
1	Direct	Oral & Written Exams	Objective, subjective, theory, practical, seminar and viva evaluation
2		Projects	Mini & Major project evaluation
3	Indirect	Student Exit Survey	Passing out students

4		Alumni Survey	Old batches of the students
5		Employer Survey	Industries which recruit our students
6		Industry Survey	Leading industry in the domain of programme

The continuous process of assignments, direct and indirect assessments and evaluation will lead to the revision and refinement of the PEOs.

Program Outcomes

The attainment of POs may be assessed by direct and indirect methods. Direct methods of assessment are essentially accomplished by the direct examination or observation of students' knowledge or skills against measurable performance indicators. On the other hand, indirect methods of assessment are based on ascertaining opinion or self-report. Theresults of assessment of each PO for two to three assessment years shall be indicated as they play a vital role inimplementing the continuous improvement process of the program.

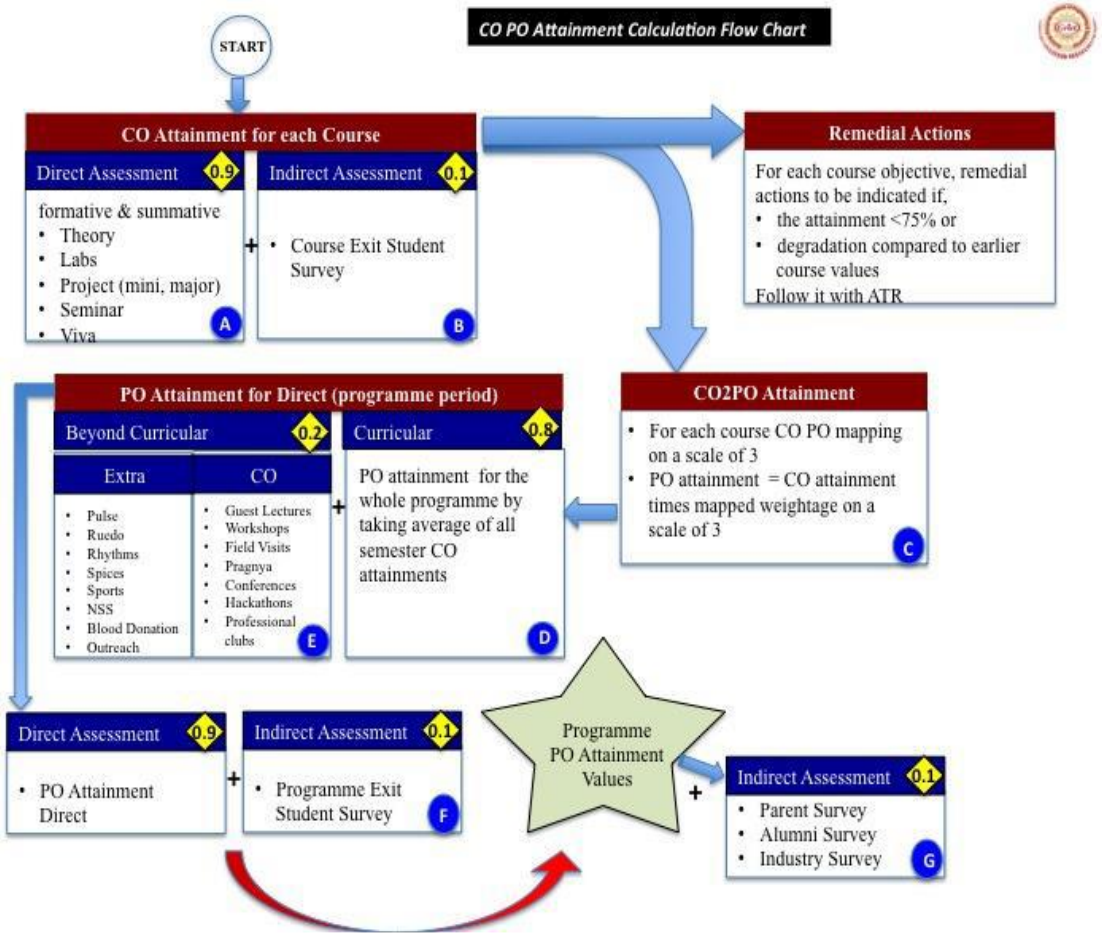
7. Mapping

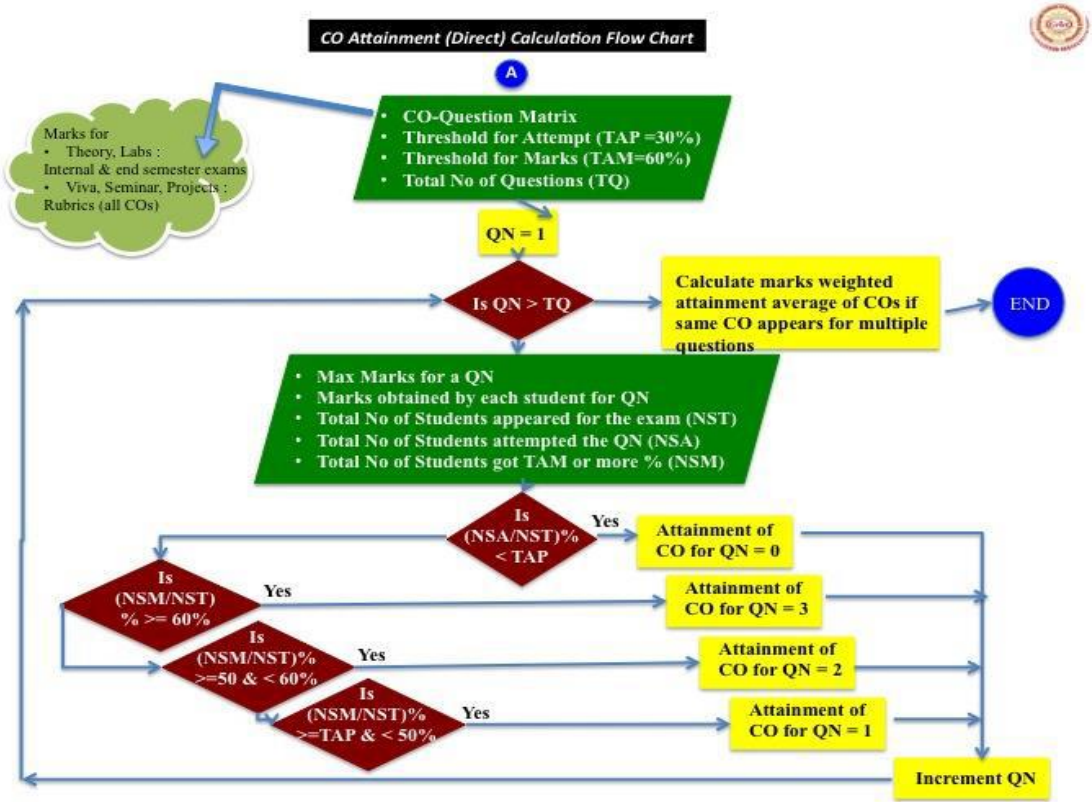
Program Articulation Matrix

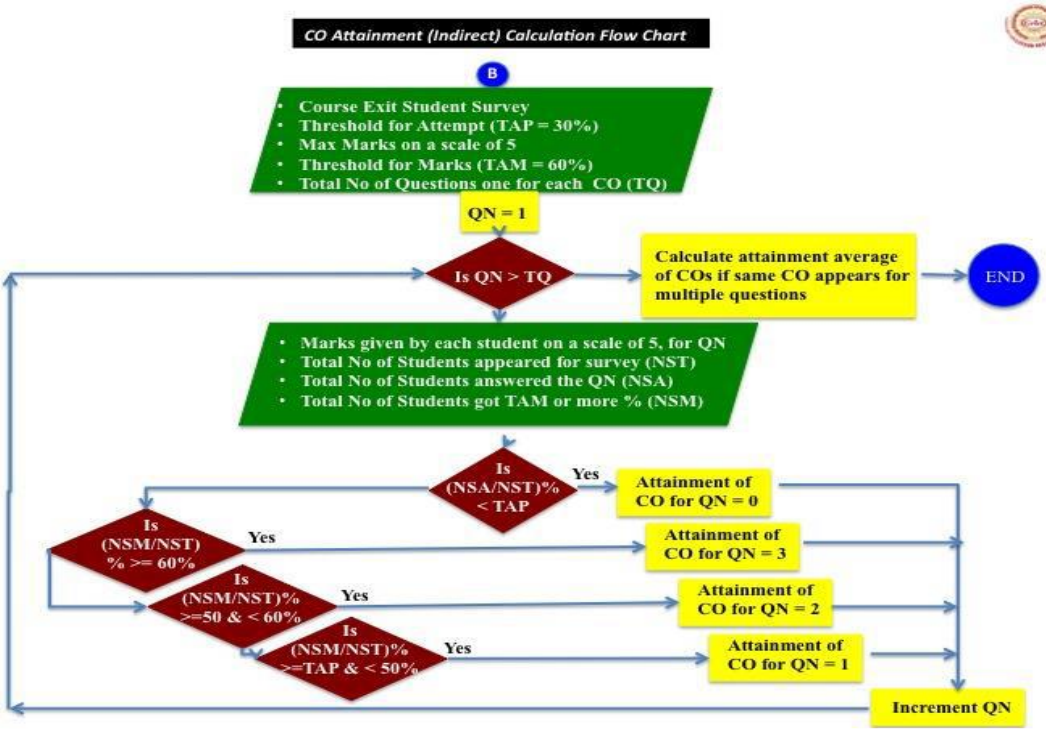
Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C101														
C202														
C303														
….														
….														
C4..														

Course Articulation Matrix

Course	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1															
CO2															
CO3															
CO4															
CO5															




CO Attainment (Direct) Calculation Flow Chart
A
Marks for
• Theory, Labs : Internal & end semester exams
• Viva, Seminar, Projects : Rubrics (all COs)
• CO-Question Matrix
• Threshold for Attempt (TAP =30%)
• Threshold for Marks (TAM=60%)
• Total No of Questions (TQ)
QN = 1
Is QN > TQ
Calculate marks weighted attainment average of COs if same CO appears for multiple questions
END
• Max Marks for a QN
• Marks obtained by each student for QN
• Total No of Students appeared for the exam (NST)
• Total No of Students attempted the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN


CO Attainment (Indirect) Calculation Flow Chart
B
• Course Exit Student Survey
• Threshold for Attempt (TAP = 30%)
• Max Marks on a scale of 5
• Threshold for Marks (TAM = 60%)
• Total No of Questions one for each CO (TQ)
QN = 1
Is QN > TQ
Calculate attainment average of COs if same CO appears for multiple questions
END
• Marks given by each student on a scale of 5, for QN
• Total No of Students appeared for survey (NST)
• Total No of Students answered the QN (NSA)
• Total No of Students got TAM or more % (NSM)
Is (NSA/NST)% < TAP
Yes
Attainment of CO for QN = 0
Is (NSM/NST) % >= 60%
Yes
Attainment of CO for QN = 3
Is (NSM/NST)% >=50 & < 60%
Yes
Attainment of CO for QN = 2
Is (NSM/NST)% >=TAP & < 50%
Yes
Attainment of CO for QN = 1
Increment QN

8. Rubrics

Rubric is a tool that helps to make subjective measurements as objective, clear, and consistent as possible by defining the criteria on which performance should be judged.

A tool often shaped like a matrix, with criteria on one side and levels of achievement across the top used to score products or performances. Rubrics describe the characteristics of different levels of performance, often from exemplary to unacceptable. The criteria are ideally explicit, objective, and consistent with expectations for student performance.

Rubrics may be used by an individual or multiple raters to judge student work.
Rubrics are meaningful and useful when shared with students before their work is judged so they better understand the expectations for their performance.

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
1.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothetopic.	Collects a great deal of Informatio n all relates to thetopic.	2
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned teamrole.	2
		Share Equally	Always relies on others to do the work.	Rarely does the assigned work-- often needremindi ng.	Usually does the assigned work-- rarely needs reminding	Always does the assigned Work without having to be reminded	2
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking-- rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		2.5

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
2.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothe topic.	Collects a great deal ofInformation on all relates to thetopic.	4
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	2
		Share Equally	Always relies on others to Do the work.	Rarely does the assigned work--often needs reminding.	Usually does the assigned work--rarely needs reminding	Always does the assigned Work without havingto be reminded	4
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking--rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	3
					Average		4

S. No.	Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
			1	2	3	4	
3.		Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information some relates to the topic	Collects some basic Information most relates tothe topic.	Collects a great deal of Informatio n all relates to thetopic.	5
		Fulfill team role's	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	5
		Share Equally	Always relies	Rarely	Usually	Always	4
			on others to Do the work.	does the assigned work-- often needs reminding.	does the assigned work-- rarely needs reminding	does the assigned Work without having to be reminded	
		Listen to other team mates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking-- rarely	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	5
					Average		4.5

9. Accreditation Criteria

The assessment and evaluation process of accreditation of an engineering program is based on 10 broad criteria developed through a participatory process involving experts from reputed national-level technical institutions, industries, R&D organizations and professional bodies. Each criterion relates to a major feature of institutional activity and its effectiveness. The criteria have been formulated in terms of parameters, including quantitative measurements that have been designed for maximal objective assessment of each feature. An engineering programme to be accredited or re- accredited has to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the programme and seek to improve the standards and quality continually, and address deficiencies if any aspect falls short of the standards set by the accreditation criteria. During the full term of accreditation, the institutions are required to submit their annual self-assessment report to NBA.

Program Level Criteria

Criteria-1: Vision, Mission and Program Educational Objectives

Criteria-2: Programme Curriculum and Teaching – Learning Processes

Criteria-3: Course Outcomes and Programoutcomes

Criteria-4: Students' Performance

Criteria-5: FacultyInformation and Contributions

Criteria-6: Facilities and Technical Support

Criteria-7: Continuous Improvement

Institute Level Criteria

Criteria-8: First Year Academics

Criteria-9: Student Support Systems

Criteria-10: Governance, Institutional Support and Financial Resources

Bachelor of Technology
(B. Tech-CSE)

10. Program Structure

III YEAR ISEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR20A3043	Computer Networks	3	0	0	3	3	30	70	100
2	GR20A3044	Data Warehousing and Data Mining	3	0	0	3	3	30	70	100
3	GR20A3045	Micro Controllers and Internet of Things	2	1	0	3	3	30	70	100
4		Open Elective-I	3	0	0	3	3	30	70	100
5		Professional Elective-I	3	0	0	3	3	30	70	100
6	GR20A3051	Data Warehousing and Data Mining Lab	0	0	3	3	1.5	30	70	100
7	GR20A3052	Web Technologies Lab	0	0	4	4	2	30	70	100
8	GR20A3053	Micro Controllers and Internet of Things Lab	0	0	3	3	1.5	30	70	100
Total			**14**	**1**	**10**	**25**	**20**	**240**	**560**	**800**

PROFESSIONAL ELECTIVE – I				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A3046	Artificial Intelligence
2	CSE	PE	GR20A3047	Principles of Programming Languages
3	CSE	PE	GR20A3048	IT Infrastructure Management
4	CSE	PE	GR20A3049	Graph Theory

OPEN ELECTIVE – I				
S.No	BOS	Group	Course Code	Course
1	CSE	OE	GR20A3050	Principles of E-Commerce

III YEAR IISEMESTER

S.NO.	Course Code	Course	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR20A3123	Machine Learning	2	1	0	3	3	30	70	100
2	GR20A3117	Formal Language and Automata Theory	3	0	0	3	3	30	70	100
3	GR20A3054	Software Engineering	3	0	0	3	3	30	70	100
4		Professional Elective-II	3	0	0	3	3	30	70	100
5		Open Elective-II	3	0	0	3	3	30	70	100
6	GR20A3122	Machine Learning Lab	0	0	3	3	1.5	30	70	100
7	GR20A4064	Unified Modeling Language Lab	0	0	3	3	1.5	30	70	100
8	GR20A3141	Mini Project with Seminar	0	0	6	6	2	30	70	100
Total			**14**	**1**	**12**	**27**	**20**	**240**	**560**	**800**
9	GR20A2003	Constitution of India	2	0	0	2	2	30	70	100

PROFESSIONAL ELECTIVE – II				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A3061	Data Science with R programming
2	CSE	PE	GR20A3118	Cloud Computing
3	CSE	PE	GR20A3119	Neural Networks and Deep Learning
4	CSE	PE	GR20A3120	Software Architecture

OPEN ELECTIVE – II				
S.No	BOS	Group	Course Code	Course
1	CSE	OE	GR20A3121	Business Analytics

IV YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR20A4047	Cryptography and Network Security	2	1	0	3	3	30	70	100
2	GR20A4048	Compiler Design	3	0	0	3	3	30	70	100
3		Professional Elective-III	3	0	0	3	3	30	70	100
4		Professional Elective-IV	3	0	0	3	3	30	70	100
5		Open Elective- III	3	0	0	3	3	30	70	100
6	GR20A4054	Cryptography and Network Security Lab	0	0	4	4	2	30	70	100
7	GR20A4055	Compiler Design lab	0	0	4	4	2	30	70	100
8	GR20A4129	Project Work-Phase I	0	0	12	12	6	30	70	100
Total			**14**	**1**	**20**	**35**	**25**	**240**	**560**	**800**

PROFESSIONAL ELECTIVE – III				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A4049	Network routing Algorithms
2	CSE	PE	GR20A4050	Image and Video Processing
3	CSE	PE	GR20A4051	Natural Language Processing
4	IT	PE	GR20A3128	Agile Methodologies

PROFESSIONAL ELECTIVE – IV				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A4052	Information Storage And Management
2	CSE	PE	GR20A4053	Multi Media Applications
3	CSE	PE	GR20A3131	Big Data Analytics
4	IT	PE	GR20A4058	Software Testing Methodologies

OPEN ELECTIVE – III				
S.No	BOS	Group	Course Code	Course
1	CSE	OE	GR20A3067	Augmented Reality and Virtual Reality

IV YEAR II SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR20A3140	Fundamentals of Management and Entrepreneurship	3	0	0	3	3	30	70	100
2		Professional Elective-V	3	0	0	3	3	30	70	100
3		Professional Elective-VI	3	0	0	3	3	30	70	100
4	GR20A4130	Project Work- Phase II	0	0	12	0	6	30	70	100
		Total	**9**	**0**	**12**	**21**	**15**	**120**	**280**	**400**

PROFESSIONAL ELECTIVE – V				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A4114	Real Time Operating Systems
2	CSE	PE	GR20A4115	Cyber security
3	CSE	PE	GR20A4116	Green Computing
4	IT	PE	GR20A4124	Design Patterns

PROFESSIONAL ELECTIVE – VI				
S.No	BOS	Group	Course Code	Course
1	CSE	PE	GR20A4067	Human Computer Interaction
2	IT	PE	GR20A3057	Computer Graphics
3	CSE	PE	GR20A4117	Data Analytics Using Open source tools
4	CSE	PE	GR20A4118	Software Product Development and Management

PROFESSIONAL ELECTIVES – 4 THREADS				
S. No.	Theory and Algorithms	Applications	Data Science and Machine Intelligence	Software and Technology
1	Graph Theory	Principles of Programming Languages	Artificial Intelligence	IT Infrastructure Management
2	Data Science with R Programming.	Cloud Computing	Neural Networks and Deep Learning	Software Architecture
3	Network Routing Algorithms	Image and Video Processing	Natural Language Processing	Agile Methodologies
4	Information Storage and management	Multi Media Applications	Big Data Analytics	Software Testing Methodologies
5	Real Time operating System	Cyber security	Green Computing	Design Patterns
6	Human Computer Interaction	Computer Graphics	Data Analytics Using Open source tools	Software Product Development and Management

OPEN ELECTIVES FOR GR20 REGULATIONS:		
Thread 1	**Thread 2**	**Offered By**
	1. Principles of E-Commerce	**CSE**
	2. Business Analytics	
	3. Augmented Reality & Virtual Reality	
	1.Internet of Things	**CSE (AIML)**
	2.Augmented Reality & Virtual Reality	
	3.Human Computer Interaction	
1.Soft Skills and Interpersonal Communication 2.Human Resource Development and Organizational Behaviour 3.Cyber Law and Ethics 4.Economic Policies in India	1. Augmented Reality & Virtual Reality	**CSE (DS)**
	2.Internet of Things	
	3.Human Computer Interaction	
	1. Artificial Intelligence	**IT**
	2. Human Computer Interaction	
	3. Data Science	
	1. Non-Conventional Energy Sources	**EEE**
	2. Machine Learning	
	3. Artificial Intelligence Techniques	
	1. Artificial Neural Networks	**ECE**
	2. Software Defined Radio and Cognitive Radio	
	3. Fundamentals of	

	MimoWireless Communications	
	1. Operations Research	**ME**
	2. Robotics	
	3. Mechatronic Systems	
	1. Engineering Materials for Sustainability	**CE**
	2. Geographic Information Systems and Science	
	3. Environmental Impact Assessment and Life Cycle Analyses	

11. Course Outcomes

COMPUTER NETWORKS

B.TECH (CSE)

Course Code: GR20A3043

Course Outcomes: At the end of the course, the student will be able to

1. Define basic terminologies of Computer Networks and to apply various networking configurations and transmission media to build a network for an organization.
2. Summarize error correction and detection techniques and MAC Protocols for specific networks.
3. Illustrate various routing algorithms and outline their applications.
4. Distinguish TCP and UDPprotocols.
5. Make use of various application layer protocols in Internet based Applications.

DATA WAREHOUSING AND DATA MINING

B.TECH (CSE)

Course Code: GR20A3044

Course Outcomes: At the end of the course, the student will be able to

1. Learn the concepts of database technology evolutionary path which has led to the need for data mining and itsapplications.
2. Design a data mart or data warehouse for anyorganization
3. Apply pre-processing statistical methods for any given rawdata.
4. Extract knowledge and implementation of data miningtechniques
5. Explore recent trends in data mining such as web mining, spatial-temporalmining.

MICROCONTROLLER AND INTERNET OF THINGS

B.TECH (CSE)

Course Code: GR20A3045

Course Outcomes: At the end of the course, the student will be able to

1. Explore to Microcontrollers.
2. Finalize with sensors, actuators and communication devices for IoT.
3. Introducing design aspects of IoT.
4. Apply python packages for IoT applications.
5. Use cloud integration for IoT applications.

PRINCIPLES OF E-COMMERCE
B.TECH(CSE)
Course Code: GR20A3050

Course Outcomes: At the end of the course, the student will be able to

1. Comprehend and identify the nature and types of e-commerce.
2. Distinguish all types of business models.
3. Choose and pick the suitable software, hardware and e-com tools for developing a better web application.
4. Implement a robust, safe and secured online payment system.
5. Interpret about the current e-commerce development and usage of effective internet and rearticulate about the online content and management.

ARTIFICIAL INTELLIGENCE
B.TECH (CSE)
Course Code: GR20A3046

Course Outcomes: At the end of the course, the student will be able to

1. Select an appropriate searching strategy for developing intelligent agents to find solution in optimized way using building blocks ofAI.
2. Apply prepositional and first order logic methods to resolve decisions for knowledge based agents.
3. Practice uncertain knowledge and reasoning handling using Bayesiannetworks
4. Analyze the working of temporal models, hidden markov models, decisiontrees.
5. Write AI programs and construct small robots capable of performing perception and movement based on techniques learnt in thecourse.

PRINCIPLES OF PROGRAMMING LANGUAGES
B.TECH (CSE)
Course Code: GR20A3047

Course Outcomes: At the end of the course, the student will be able to

1. Discuss the criteria for evaluating programming languages and language constructs including programming paradigms.
2. Describe formal methods of syntax.
3. Illustrate the data types and control structures in different programming languages
4. Construct abstract data types, concurrency and exceptions
5. Compare functional and imperative languages.

IT INFRASTRUCTURE MANAGEMENT
B.TECH (CSE)
Course Code: GR20A3048

Course Outcomes: At the end of the course, the student will be able to

1. Comprehend the design factors and challenges in IT Infrastructure Management
2. Recognise the service delivery and associated processes
3. Apprehend the storage and security management related to IT Infrastructure
4. Realise and apply the performance and tuning processes
5. Emphasis the process of IT infrastructure management from case studies

GRAPH THEORY
B.TECH (CSE)
Course Code: GR20A3049

Course Outcomes: At the end of the course, the student will be able to

1. Learn the fundamentals of graph theory
2. Determine cut-sets and cut-vertices
3. Represent a graph in matrix form
4. Understand planar graphs, dual graphs, coloring, covering and partitioning of graphs.
5. Solve graph related problems and write algorithms

DATA WAREHOUSING AND DATA MINING LAB
B.TECH (CSE)
Course Code: GR20A3051

Course Outcomes: At the end of the course, the student will be able to

1. Learn the concept of creating database tables in attribute relation file format(.arff).
2. Design a database tables in .arff format and insert, modify the data.
3. Apply pre-processing statistical methods for any given raw data.
4. Extract knowledge and implementation of various data mining techniques.
5. Implement data mining algorithms in real time problem solving using weka tool.

WEB TECHNOLOGIES LAB
B.TECH (CSE)
Course Code: GR20A3052

Course Outcomes: At the end of the course, the student will be able to

1. Develop interactive web sites through the DOM API and to change the CSS styles through java script
2. Build single-page web applications using AngularJS
3. Implement core technologies of modern Java web programming like servlets and JSP
4. Create web application using JSP
5. Develop JSP code without scriplets tag and access the database.

MICRO CONTROLLER AND INTERNET OF THINGS LAB
B.TECH (CSE)
Course Code: GR20A3053

Course Outcomes: At the end of the course, the student will be able to

1. Understand the different blocks involved in an IoT eco-system.
2. Understand interface techniques to connect different sensors to a micro controller.
3. Understand different communication protocols used in IoT.
4. Apply cloud environment for IoT.
5. Apply the concepts learnt to implement IoT projects

MACHINE LEARNING
B.TECH (CSE)
Course Code: GR20A3123

Course Outcomes: At the end of the course, the student will be able to

1. Explain the concepts and able to prepare the dataset for different Machine learning models..
2. Identify and Apply appropriate Supervised Learning models.
3. Design Neural Network models for the given data.
4. Perform Evaluation of Machine Learning algorithms and Model Selection.
5. Devise un-supervised and Reinforcement learning models .

FORMAL LANGUAGE AND AUTOMATA THEORY
B.TECH (CSE)
Course Code: GR20A3117

Course Outcomes: At the end of the course, the student will be able to

1. Design Finite Automata models.
2. Construct Regular Expressions and equivalent automata models.
3. Formulate Grammars for Formal languages.
4. Represent Normal Forms and Push Down Automata.
5. Experiment with Computational models.

SOFTWARE ENGINEERING
B.TECH (CSE)
Course Code: GR20A3054

Course Outcomes: At the end of the course, the student will be able to

1. Understand business requirements and choose a relevant Process model for a given software proposal
2. Analyze the requirements to prepare SRS
3. Estimate the Cost and Schedules of a Software Project.
4. Model various Functional and Object-Oriented design for a s/w project.
5. Develop various functional and structural test cases for a software module

DATA SCIENCE WITH R PROGRAMMING
B.TECH (CSE)
Course Code: GR20A3061

Course Outcomes: At the end of the course, the student will be able to

1. Use R environment, data structures, functions, to solve statistical problems
2. Analyse basic and descriptive statistical analysis methods using R
3. Apply data collection , preparation, visualization and feature engineering with R
4. Summarize data analysis and machine learning techniques with R
5. Implement R advanced features for real time business case studies

CLOUD COMPUTING

B.TECH (CSE)
Course Code: GR20A3118

Course Outcomes: At the end of the course, the student will be able to

1. Understand the features, advantages and challenges of cloud computing, compare their operation ,implementation and performance
2. Understand, Analyze and compare different types of clouds and cloud services.
3. Understanding and validating the financial and technological implications in selecting cloud computing paradigm for an organization.
4. Understand and Analyze the security challenges and risks involved in the cloud.
5. Create/Deploying of an application in cloud.

NEURAL NETWORKS AND DEEP LEARNING

B.TECH (CSE)
Course Code: GR20A3119

Course Outcomes: At the end of the course, the student will be able to

1. Understand the basic math required for neural network.
2. Explain working of artificial neural networks.
3. Categorize between supervised and unsupervised learning mechanisms.
4. Analyze the real world problem and identify required hyper parameters to be considered for a deep learning network.
5. Design optimized deep learning applications for small problems using algorithms learnt in the course.

SOFTWARE ARCHITECTURE

B.TECH (CSE)
Course Code: GR20A3120

Course Outcomes: At the end of the course, the student will be able to

1. Design and motivate software architecture for large scale software systems
2. Recognize major software architectural styles, design patterns, andframeworks
3. Describe a software architecture using various documentation approaches and architectural descriptionlanguages
4. Generate architectural alternatives for a problem and select amongthem
5. Use well-understood paradigms for designing new system

BUSINESS ANALYTICS

B.TECH (CSE)
Course Code: GR20A3121

Course Outcomes: At the end of the course, the student will be able to

1. Reproduce the fundamentals of data collection and data management.
2. Describe the importance of big data and to apply the data visualization.
3. Apply and interpret the basic inferences in statistical methods.
4. Practice the text analytics and forecasting analytics
5. Summarize and evaluate the purpose of business analytics using scenarios and applications.

MACHINE LEARNING LAB
B.TECH (CSE)
Course Code: GR20A3122

Course Outcomes: At the end of the course, the student will be able to

1. Illustrate the applications of Python Machine Learning Libraries.
2. Apply Dimensionality reduction methods for Machine Learning Tasks.
3. Design and analyze various supervised learningmechanisms.
4. Develop back propagation algorithm and Random Forest Ensemblemethod.
5. Design and analyze various unsupervised learningalgorithms.

UNIFIED MODELING LANGUAGE LAB
B.TECH (CSE)
Course Code: GR20A4064

Course Outcomes: At the end of the course, the student will be able to

1. An ability to learn analysis and design of a business process and system as a whole by using uml.
2. An ability to apply forward and reverse engineering of system using uml with a team effort.
3. An ability to distinguish the different uml diagrams.
4. An ability to design how to apply the UML to a number of common modeling techniques.
5. Show the role and function of each UML model in developing object oriented software.

CONSTITUTION OF INDIA
B.TECH (CSE)
Course Code: GR20A2003

Course Outcomes: At the end of the course, the student will be able to

1. Students will be able to know the importance of Constitution and Government
2. Students will be able to become Good Citizens and know their fundamental rights, duties and principles.
3. Students will learn about the role of PM, President, Council of Ministers etc and it will help students learn about Local Administration.
4. The Students understand the importance of Election Commission and the Students will become aware of how a Country and State are run in Democracy.
5. They will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

MINI PROJECT WITH SEMINAR
B.TECH (CSE)
Course Code: GR20A3141

Course Outcomes: At the end of the course, the student will be able to

1. Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.
2. Design Engineering Solution to the problem statement with systematic approach.
3. Analyse and develop an efficient solution for implementation of the project.
4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.
5. Demonstrate professionalism with ethics while preparing and presenting the project work.

CRYPTOGRAPHY AND NETWORK SECURITY
B.TECH (CSE)
Course Code: GR20A4047

Course Outcomes: At the end of the course, the student will be able to

1. Work and check the applications defined with confidentiality, integrity, and authentication.
2. Work with various public key and private key cryptographic algorithms.
3. Examine the issues and structure of Authentication Service and Electronic Mail Security.
4. Understand the IP Security Architecture, Web Security and Key Management techniques.
5. Understand intrusion and intrusion detection, Web security and firewalls

COMPILER DESIGN
B.TECH (CSE)
Course Code: GR20A4048

Course Outcomes: At the end of the course, the student will be able to

1. Understand the basic concepts of compiler design, and its different phases.
2. Understand the different types of parsing techniques and should be in a position to solve the problem.
3. Analyze the program and minimize the code by using optimizing techniques which helps in reducing the number of instructions in a program and also utilization of registers in an effective way.
4. Learn the process of translating a modern high-level language to executable code.
5. Construct new tools for compilation for small programming languages.

NETWORK ROUTING ALGORITHMS
B.TECH (CSE)
Course Code: GR20A4049

Course Outcomes: At the end of the course, the student will be able to

1. Acquire knowledge on network devices where and when they are used.
2. Comprehend various types of subnets and address formats.
3. Examine different dimensions of routing in different types of networks
4. Analyse different types of data delivery methods.
5. Apply various routing protocols in wireless network scenario

IMAGE AND VIDEO PROCESSING
B.TECH (CSE)
Course Code: GR20A4050

Course Outcomes: At the end of the course, the student will be able to

1. Describe the basic principles of Imaging.
2. Learn the knowledge of the images in transform domains and segmentation.
3. Apply image compression on images.
4. Understand and develop algorithms video processing.
5. Implement various video motion techniques.

NATURAL LANGUAGE PROCESSING
B.TECH (CSE)
Course Code: GR20A4051

Course Outcomes: At the end of the course, the student will be able to

1. Summarize the role of natural language processing in various applications and explain language modelling.
2. Apply word level analysis, syntactic analysis and semantic analysis on natural language processing.
3. Discuss discourse processing of text.
4. Illustrate the automation of natural language generation and machine translation of Indian languages.
5. Infer information retrieval systems and utilize lexical resources for processing natural language text.

AGILE METHODOLOGIES
B.TECH (CSE)
Course Code: GR20A3128

Course Outcomes: At the end of the course, the student will be able to

1. Realize the importance of interacting with business stakeholders in determining the requirements for a software system.
2. Perform iterative software development processes: how to plan them, how to execute them.
3. Develop techniques and tools for improving team collaboration and software quality.
4. Perform Software process improvement as an ongoing task for development teams.
5. Show how agile approaches can be scaled up to the enterprise level.

INFORMATION STORAGE AND MANAGEMENT
B.TECH (CSE)
Course Code: GR20A4052

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the knowledge on the components of storage infrastructure
2. Attain the ability to evaluate storage architectures including storage subsystems
3. Realise the business continuity, backup and recovery methods.
4. Appreciate the concepts of storage security and information security applied to virtual machine.
5. Apply the knowledge for storage infrastructure and acquire the knowledge on structure of cloud computing and its techniques

MULTIMEDIA APPLICATIONS
B.TECH (CSE)
Course Code: GR20A4053

Course Outcomes: At the end of the course, the student will be able to

1. Identify and categorize various file formats like text, audio and video and image models.
2. Implement Action Script features in Multimedia applications.
3. Implement multimedia animation movies using action scripts.
4. Implement multimedia audio, video and data compression Techniques.
5. Apply various networking protocols for multimedia applications.

BIG DATA ANALYTICS
B.TECH (CSE)
Course Code: GR20A3131

Course Outcomes: At the end of the course, the student will be able to

1. Understand the concepts of Big Data and navigation of the Hadoop Ecosystem.
2. Illustrate the HDFS Architecture and the coordination service of Hadoop.
3. Implement distributed processing Map Reduce Paradigm with YARN.
4. Analyze importing and exporting data from Hadoop using Sqoop, Flume and working with PIG.
5. Examine the data stores - Hive and HBase on Hadoop.

SOFTWARE TESTING METHODOLOGIES
B.TECH (CSE)
COURSE CODE: GR20A4058

Course Outcomes: At the end of the course, the student will be able to

1. Create a model for testing and criticize various consequences of bugs.
2. Apply Path testing Strategies to conduct as part of White Box Testing.
3. Apply various Data flow testing techniques for exploring Data Bugs and Domain Bugs.
4. Design test cases based on decision tables for a given logical construct.
5. Attribute graph matrices techniques for the simplification of graphs and simplify testing process.

AUGMENTED REALITY AND VIRTUAL REALITY
B.TECH (CSE)
COURSE CODE: GR20A3067

Course Outcomes: At the end of the course, the student will be able to

1. To summarize about augmented reality.
2. To choose AR devices for various applications.
3. To summarize about augmented reality.
4. To experiment with VR devices.
5. To apply AR & VR technology in various domains.

CRYPTOGRAPHY AND NETWORK SECURITY LAB
B.TECH (CSE)
COURSE CODE: GR20A4054

Course Outcomes: At the end of the course, the student will be able to

1. Use the concepts of different ciphers for encryption and decryption.
2. Implement symmetric encryption algorithms.
3. Examine asymmetric encryption algorithms.
4. Interpret hash algorithms and their functionalities.
5. Solve the problems on digital signatures and digital certificates.

COMPILER DESIGN LAB
B.TECH (CSE)
COURSE CODE: GR20A4055

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate different phases of compiler through programming language.
2. Define the role of lexical analyser and use of regular expressions.
3. Develop program for implementing parsing techniques.
4. Understand the working of LEX and YACC compiler and develop simple applications.
5. Design programs that execute faster by using code optimization techniques

PROJECT WORK - PHASE I
B.TECH (CSE)
Course Code: GR20A4129

Course Outcomes: At the end of the course, the student will be able to

1. Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.

2. Design Engineering Solution to the problem statement with systematic approach.

3. Analyse and develop an efficient solution for implementation of the project.

4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.

5. Demonstrate professionalism with ethics while preparing and presenting the project work.

FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP
B.TECH (CSE)
Course Code: GR20A3140

Course Outcomes: At the end of the course, the student will be able to

1. The students understand the significance of Management in their Profession.
2. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.
3. The students can explore the Management Practices in their domain area and understand, adopt motivational theories and leadership styles and apply controlling techniques at right time for better decision making.
4. The student will be exposed to the basic concepts of entrepreneurship and its development process.
5. The student will be able to evaluate business ideas and attain hands on experience in designing value proposition and he will acquire the ability of developing a business plan / model.

REAL TIME OPERATING SYSTEMS
B.TECH (CSE)
Course Code: GR20A4114

Course Outcomes: At the end of the course, the student will be able to

1. Understand the concepts of Operating system Principles, System Calls and Files.
2. Understand the concepts of Operating system Process, Communication and structures.
3. Understand the Network topologies and Distributed Operating system.
4. Understand the Real-time Languages, Models and Kernel Principles.
5. Understand the RTOS Domain Applications.

CYBER SECURITY
B.TECH (CSE)
Course Code: GR20A4115

Course Outcomes: At the end of the course, the student will be able to

1. Obtain firm understanding on basic terminology and concepts of cybercrimes.
2. Analyze different types of attacks.
3. Deal with the security challenges posed by mobile devices for develop encryption algorithm.
4. Implement the tools to handle security challenges.
5. Evaluate the associated challenges and the cost of cybercrimes in Organizations.

GREEN COMPUTING
B.TECH (CSE)
Course Code: GR20A4116

Course Outcomes: At the end of the course, the student will be able to

1. Recite the fundamentals of green computing practices.
2. Apply the modelling to reduce negative impact on the environment.
3. Utilize the energy saving practices for use in hardware.
4. Adopt the tools for reducing paper waste and carbon foot print.
5. Acquire knowledge for adopting green computing in different scenarios.

DESIGN PATTERNS
B.TECH (CSE)
Course Code: GR20A4124

Course Outcomes: At the end of the course, the student will be able to

1. The ability to learn different design patterns available, and to organize them and solving of Design Problems using Design Patterns, to understand and analyze how to select a Design Pattern, use them in real life examples.
2. To capability to analyze how Design patterns solve many of the day-to-day problems object-oriented designers face, and in many different ways. To understand the applications of design patterns by using a case study of designing a Document Editor.
3. The skill to learn different creational design patterns like Abstract Factory, Builder, Factory Method, Prototype, Singleton. To Learn these design patterns to help them understand existing object-oriented systems.
4. The ability to learn different structural design patterns like Adapter, Bridge, Composite, Decorator, Façade. Flyweight, and Proxy. To recognize how the Design patterns help one identify less-obvious abstractions and the objects that can capture them. For example,

objects that represent a process or algorithm dont occur in nature, yet they are a crucial part of flexible designs.

5. The ability to learn different behavioral design patterns like Chain of Responsibility Command, Interpreter, Iterator, Mediator, Observer, State, Strategy, Template Method, Visitor and To understand the impact the design patterns will have, how they are related to other work in design, and how you can get involved in finding and cataloging patterns.

HUMAN COMPUTER INTERACTION

B.TECH (CSE)

Course Code: GR20A4067

Course Outcomes: At the end of the course, the student will be able to

1. Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
2. Design how technologies can be to change people's attitudes and behavior.
3. Apply the difference between qualitative and quantitative data and analysis.
4. Extract the social Mechanisms that are used by people to communicate and collaborate.
5. Explore the user Experience design and analyze the factors involved in design.

COMPUTER GRAPHICS

B.TECH (CSE)

Course Code: GR20A3057

Course Outcomes: At the end of the course, the student will be able to

1. Outlining the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. Learn the basic principles of 3- dimensional computer graphics.
3. Determine to scan and convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Change from a world coordinates to device coordinates, clipping and projections.
5. Articulate the application of computer graphics concepts in the development of computer games, information visualization and business applications.

DATA ANALYTICS USING OPEN SOURCE TOOLS

B.TECH (CSE)

Course Code: GR20A4117

Course Outcomes: At the end of the course, the student will be able to

1. Describe and recall about graphics techniques in data analysis.
2. Experiment data using various data modeling techniques
3. Mine data using clusters and simulations
4. Summarize data using business intelligence and predictive analytics
5. Implement the Programming Environments with Data analytics

SOFTWARE PRODUCT DEVELOPMENT AND MANAGEMENT
B.TECH (CSE)
Course Code: GR20A4118

Course Outcomes: At the end of the course, the student will be able to

1. Recite the foundation of Software Product Development Methodology and planning.
2. Apply the product development architecture, design and testing.
3. Release the software with prior testing and training.
4. Marketing and selling the software with legal and management compliance.
5. Software product service is provided with monitoring and controlling.

PROJECT WORK - PHASE II
B.TECH (CSE)
Course Code: GR20A4130

Course Outcomes: At the end of the course, the student will be able to

1. Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.

2. Design Engineering Solution to the problem statement with systematic approach.

3. Analyse and develop an efficient solution for implementation of the project.

4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.

5. Demonstrate professionalism with ethics while preparing and presenting the project work.

SOFT SKILLS AND INTERPERSONAL COMMUNICATION
B.TECH (CSE)
Course Code: GR20A3136

Course Outcomes: At the end of the course, the student will be able to

1. Develop soft skills communication skills, leadership skills etc.
2. Implement goal setting techniques to build a promising career.
3. Design formal report and proposals with appropriate formal expressions.
4. Create healthy workplace environment by treating others with respect and dignity.
5. Evaluate the power of confidence building and self-esteem with examples.

HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
B.TECH (CSE)
Course Code: GR20A3137

Course Outcomes: At the end of the course, the student will be able to

1. To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organisational setting.
2. To Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.
3. To assess the group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations in the framework of organization and to familiarize the concepts, techniques and practices of human resource development in the current organizational view.

4. To impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
5. To report the current trends and applications in HRD and Balanced Scorecard to measures the performance and to develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.

CYBER LAW AND ETHICS
B.TECH (CSE)
Course Code: GR20A3138

Course Outcomes: At the end of the course, the student will be able to

1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students will be able understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. The student will be in position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

ECONOMIC POLICIES IN INDIA
B.TECH (CSE)
Course Code: GR20A3139

Course Outcomes: At the end of the course, the student will be able to

1. Familiarize with the nature of business environment and its components.
2. The students will be able to demonstrate and develop conceptual framework of business environment.
3. Understand the definition of ethics and the importance and role of ethical behaviour in the business world today.
4. Explain the effects of government policy on the economic environment.
5. Outline how an entity operates in a business environment.

OUTCOME BASED EDUCATION

&

ACCREDITATION

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

B.TECH-GR18

GOKARAJU RANGARAJU

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Accreditation by NAAC with 'A' Grade

(Autonomous Institute under JNTU Hyderabad)

CONTENTS

Introduction to Outcome Based Education and Accreditation

"**Outcome Based Education" (OBE)** of Engineering qualifications gives recognition to graduates for the knowledge, skills and attitudes/behaviours they have acquired upon just completion of a programme and after 4 to 5 years of graduation. This system focuses on the Objectives and Outcomes of the Programme and requires evidence of measurement and attainment of Objectives and Outcomes.

Outcome Based Accreditation (OBA) is an Assessment of the Performance of the Program/Institution as per the Accreditation Criteria defined in terms of Objectives, Outcomes and other key Constituents.

Outcome Based Curriculum (OBC) is prepared keeping in mind that what the student should be able to do at end of the Programme.

Outcome Based Learning & Teaching (OBLT) methods are developed to make the student achieve the Outcomes.

Outcome Based Assessments (OBA) methods are designed to measure what the student has achieved at end of the Programme in terms of Knowledge, Skills, and Attitude/Behavior.

Key Constituents of OBE The Key Constituents of OBE are Vision, Mission, Programme Educational Objectives (PEO), Programme Outcomes (PO), Graduate Attributes (GA), Course Objectives (COB), Course Outcomes (CO), Assessments, Rubrics, Mapping, Evaluation and Grading.

Accreditation

It is an Assessment of the Performance of the Program/Institution as per the Accreditation Criteria.

It is an assurance that a Program or Institution meets established quality standards.

Accreditation assures quality.

It is a peer review process that assures the quality of post secondary education students receive.

Educational institutions or program volunteer to undergo this review periodically to determine if certain criteria are being met.

It is important to understand that accreditation is not a ranking system. It is simply assurance that a program or institution meets established quality standards.

There are two types of accreditation- Institution and Program.

Institutional accreditation evaluates overall institutional quality. One form of institutional accreditation is accreditation of Colleges and Universities. (National Assessment & Accreditation Council-NAAC under UGC)

Program accreditation examines specific program of study rather than institution as a whole. (National Board of Accreditation-NBA under AICTE)

Importance and Significance of Accreditation

*To make the institute/department/program aware of the weaknesses of the program offered by it and act on suggestions for improvement.

*To encourage the institute to move continuously towards the improvement of quality of its program, and the pursuit of excellence.

*To facilitate institutions for updating themselves in program curriculum, teaching and learning processes, faculty achievements, students' skills/abilities/knowledge.

*To excel among stakeholders. (Students, faculty, alumni, employers, industries, government, regulators, management, etc.)

*To facilitate receiving of grants from Government regulatory bodies and institutions/agencies.

*To attain international recognition of accredited degrees awarded.

*To facilitate the mobility of graduated students and professionals.

Quality Assurance through Accreditation

Achieving Excellence through Accreditation

“Quality Costs Money, Quality Brings Money”

Quote by Dr. V. V. Rao

ROLE OF WASHINGTON ACCORD ON ACCREDITATION

Washington Accord

The Washington Accord Agreement recognizes that

"Accreditation of engineering academic programs is a key foundation for the practice of engineering at the professional level in each of the countries or territories covered by the Accord."

The Washingtosn Accord was signed in 1989. It is an agreement between the bodies responsible for accrediting professional engineering degree programs in each of the signatory countries. It recognizes the substantial equivalency of programs accredited by those bodies, and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. The Washington Accord covers professional engineering undergraduate degrees. Postgraduate-level programs are not covered by the Accord.

The Washington Accord Agreement applies only to accreditations conducted by the signatories within their respective national or territorial boundaries.

Agreements covering qualifications in engineering

There are three agreements covering mutual recognition in respect of qualifications in engineering:

The Washington Accord signed in 1989 was the first - it recognises substantial equivalence in the accreditation of qualifications in professional engineering, normally of four years duration.

The Sydney Accord signed in 2001 and recognises substantial equivalence in the accreditation of qualifications in engineering technology, normally of three years duration.

The Dublin Accord signed in 2002 and recognises substantial equivalence in the accreditation of qualifications in technician engineering, normally of two years duration.

The Washington Accord pertains to engineering programs accredited by its signatories within their respective jurisdiction starting in 1989. There are 15 Signatories to the Washington Accord as on today. Signatories to the Washington Accord are organizations responsible for accrediting engineering programs in Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States (1989); Hong Kong (1995), South Africa(1999), Japan (2005), Singapore (2006), Korea, Chinese Taipei (2007), Malaysia (2009), Turkey (2011), Russia (2012). Signatories have full rights of participation in the Accord.

Washington Accord Agreement states:

- Accreditation criteria, policies and procedures of the signatories have been verified comparable
- Accreditation decisions made by one signatory are acceptable to the other signatories
- Recognition applies only to accreditations conducted within the signatory's national or territorial boundaries

Mutual recognition of accredited engineering programs
Benchmarking standards for engineering education
Graduate Attributes (GA) represent the generally agreed reference for accredited programs
Benchmarking accreditation policies and processes

The Signatories will identify and encourage the implementation of best practice for the academic preparation of engineers

–by mutual monitoring

–regular communication and sharing of information:
-accreditation criteria, systems, procedures, manuals, publications

- lists of accredited programs;

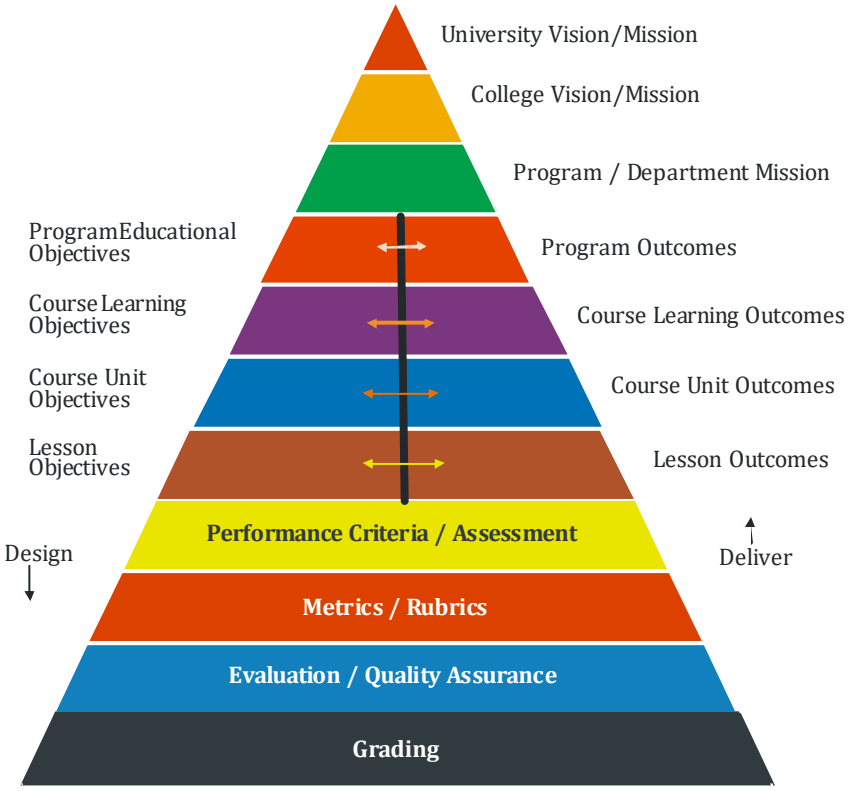
–invitations to observe accreditation visits; and invitations to observe meetings of any boards .

"Getting into Washington Accord is like getting into the UN Security Council,"

Organisations holding provisional status have been identified as having qualification accreditation or recognition procedures that are potentially suitable for the purposes of the Accord; those organisations are further developing those procedures with the goal of achieving signatory status in due course; qualifications accredited or recognised by organisations holding provisional status are not recognised by the signatories:

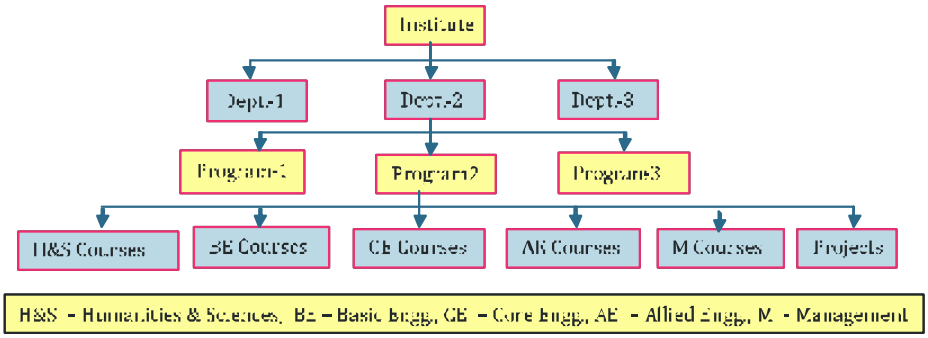
Outcome Based Education (OBE) Pyramid

The OBE Pyramid shown below presents a pictorial clarification of the hierarchical relationships among several different terminology such as “vision”, “



Institute and Courses Relationship

An Institute may have several Departments such as Mechanical Engineering, Electrical & Electronics Engineering, Electronics & Communication Engineering, Computer Science Engineering, etc.. Each Department may be conducting several Programs such as B.Tech. in any Engineering, M.Tech. in any Engineering, Diploma and Certificate programs. Each Program may have of several Courses such as shown in the flow diagram below. Each Course has a Syllabus with its contents.



Definitions

Vision

A vision statement is a mental big picture idea of what you want to accomplish or achieve.

The vision statement should be concise and easy to remember.

Because it is easy to remember, it is easy for everyone in the organization to focus on the vision.

When people focus on the vision, their daily activities are automatically directed towards achieving the vision.

University Vision

To enable, nurture and produce employable professional graduates from the JNTUH affiliated college system useful to Society.

Institute Vision

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicentre of creative solutions.

Program (CSE) Vision

To become a leading centre of higher learning, building upon the culture and the values of universal science and contemporary education.

Mission

A statement of mission is a general statement of how you will achieve your vision.

There is a very close relationship between the vision and mission.

The mission is an action statement that usually begins with the word “to”.

Once again it is a very simple and direct statement that is easy to understand and remember.

Your mission statement should be simple. However, creating the statement is usually not easy. It may require several drafts. The statement needs to capture the very essence of what your business or organization will achieve and how you will achieve it.

University Mission

To promote a healthy and enabling teaching-learning culture wherein adequate quality of delivery mechanisms are ensured in the JNTUH affiliated college system and to channelize the energies of the youth in constructive activities.

Vision

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Mission and Vision of the Department

Vision of the Department

To be a center of global excellence and to emerge as a valuable resource for industry and society.

Mission of the Department

1. To produce qualified and competent computer professionals with international standards.
2. To foster innovative and application oriented research capabilities of young minds for the progress of society.
3. To inculcate strong ethical values and professional behavior so as to adapt to the emerging changes in the field of computing technology.

PEOs, POs, GAs, Cobs and Cos

Approaches to Accreditation

1. Input-Output Based Education

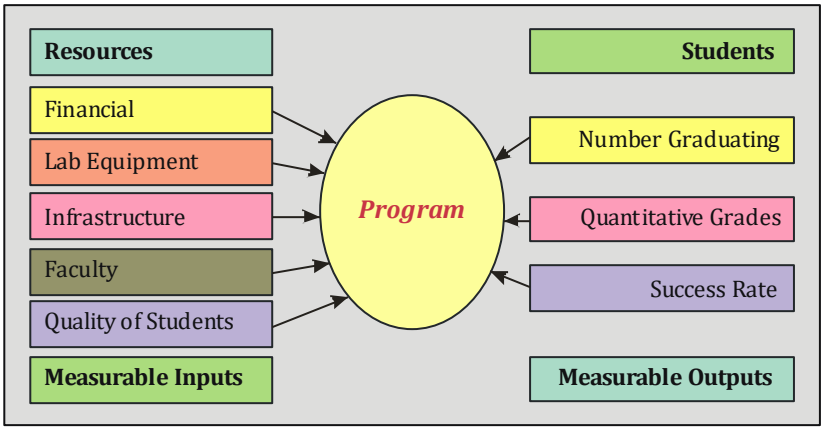
The Input-Output Based Education Model requires strict adherence to a core curriculum. This model often involves direct prescriptions of curriculum and faculty composition. It is teacher centric. It focuses on Inputs.

This model has several advantages

1. It makes the accrediting process uniform and potentially fair,
2. Criteria are unambiguous and often numeric,
3. Relatively easy to maintain
4. The key to success lies in adherence to clear unambiguous rules.

This model also has several serious drawbacks

1. It is difficult to establish and update, it often leads to vigorous debates over what the "core" requirements should be.
2. Lack of innovation and creativity in the curriculum
3. Does not encourage continuous improvement in curriculum
4. Assessment of Knowledge only



2. Outcome Based Education

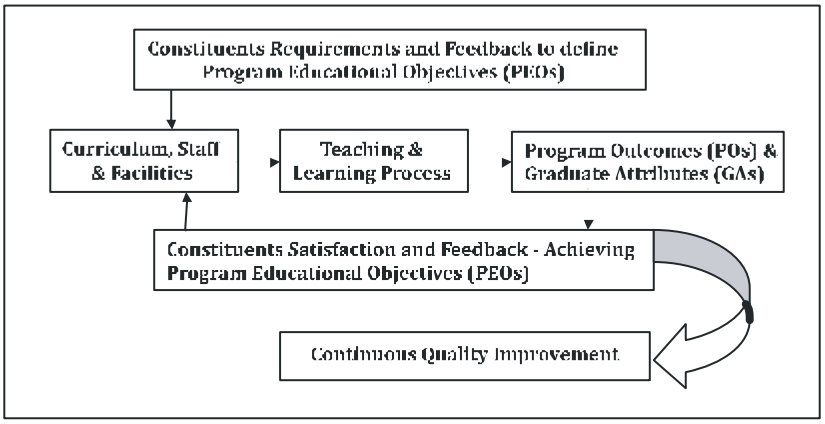
The Outcomes-Based Model prescribes a "small" core curriculum and other basic requirements. It defines the basic parameters for the outcomes of the program. It does focus on the more specific outcomes and objectives declared by the program. The Outcomes-Based Model requires the measurement of outcomes, looking for evidence that these measurements have been used to foster a quality improvement process. It is student centric. It focuses on Outcomes.

This model has several advantages

* Balance between various components of Curriculum
* Assessment of Knowledge, Skills and Attitudes of graduate
* Provides for significant diversity in outcomes and objectives.
* Focuses on the objectives and outcomes of the program
* Encourages continuous improvement in curriculum

This model also has several serious drawbacks

* Puts significant responsibility in the hands of the program leaders - and therefore significant risk; some programs may try to achieve outcomes that are unattainable.
* Requires evidence of measurement and attainment of objectives and outcomes
* Too much data may be collected and analyzed periodically
* Disagreements and ambiguity about assessment and assessment tools tend to plague the process.
* The process of evaluating outcomes requires a high level of sophistication, as these can sometimes be difficult to measure and assess.
* Complaints on inconsistent evaluations may follow. Strong disagreements may arise about methodology and about the extent to which data need to be collected and analyzed.
* Extra burden on faculty, students and educational institutions.
* Additional preparation, homework, and continuing education time spent by students, parents and faculty in supporting learning.



Programme Educational Objectives (PEOs)

Programme educational objectives are broad statements that describe what graduates are expected to attain within a few (3 to 5) years of graduation. Programme educational objectives are based on the needs of the program's constituencies and goals. PEOs should be consistent with the mission of the Program and the Institution.

PEOs are evolved / prepared in consultation with program's constituencies (Students, Faculty, Parents, Alumni, Industry, Management, Professional Bodies, Data on future, Data on trends in development in the profession, etc.

Programme Educational Objectives of CSE

Describe the Programme Educational Objectives (PEOs) (2)

(List and articulate the programme educational objectives of the programme under accreditation)

This programme is meant to prepare our students to professionally thrive and to lead. During their progression:

PEO 1: Graduates will be prepared for a successful career in Computer Science discipline and related industry to meet the needs of the nation and leading industries and also to excel in postgraduate programs.

PEO 2: Graduates will continue to learn and apply the acquired knowledge to solve engineering problems and appreciation of the arts, humanities and social sciences.

PEO 3: Graduates will have good and broad scientific and engineering knowledgebase so as to comprehend, analyze, design and create novel products and solutions for real-time applications.

PEO 4: Graduates will understand professional and ethical responsibility, develop leadership, utilize membership opportunities, develop effective communication skills , teamwork skills, multidisciplinary approach and life-long learning required for a successful professional career.

Programme Outcomes (POs)

Programme Outcome / Programme Educational Outcomes / Student Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. Outcomes are narrower statements and these relate to the skills, knowledge, and behaviours/attitudes that students acquire as they progress through the program. They must reflect all the Graduate Attributes at the end of the course.

Engineering programs must demonstrate that their students attain the following outcomes:

Program Outcomes of CSE

a) Ability to apply knowledge of mathematics, science, and engineering.

b) Ability to design and conduct experiments, as well as to analyze and interpret data.

c) Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) Ability to function on multi-disciplinary teams.

e) Ability to identify , formulates, and solve engineering problems

f) Understanding of professional and ethical responsibility.

g) Ability to communicate effectively.

h) Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

i) Recognition of the need for, and an ability to engage in life-long learning.

j) Knowledge of contemporary issues.

k) Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.

l) Ability to create and or use Computer Science and Engineering related software tools, to get employment and succeed in higher studies.

Program Specific Outcomes:

PSO 1: To foster industrial focused technical skills in Computer Science and Engineering through value added courses and soft skills amalgamate with academic to create a futuristic equipped professional.

PSO 2: Apply the acquired knowledge and skill, to deliver inventive solutions to social, economic and technological challenges, which leads to our nation's growth.

SMART OBJECTIVES AND OUTCOMES

Objectives / Outcomes are the building blocks or steps towards achieving a program's goals. Objectives / Outcomes are specific and concise statements that state who will make what change, by how much, where and by when.

When writing Objectives and Outcomes, keep them SMART

SMART work objectives / outcomes are:

Specific - Is it clear and well defined

Measurable - Know if it is obtainable and how far away completion is

Achievable - Agreement with all the stakeholders what it should be

Realistic - Within the availability of resources, knowledge and time

Timely - Enough time to achieve it, is there a time limit

Difference between Objectives and Outcomes

Objectives are intended results or consequences of instruction, curricula, programs, or activities. Outcomes are achieved results or consequences of what was learned; i.e., evidence that learning took place. Objectives are focused on specific types of performances that students are expected to demonstrate at the end of instruction. Objectives are often written more in terms of teaching intentions and typically indicate the subject content that the teacher(s) intends to cover. It is

teacher-centred. Learning outcomes, on the other hand, are more student/learner-centred and describe what it is that the learner should learn.

Objectives are derived from the mission statement and provide a focus for general performance expectations for graduates of the institution or program regardless of the graduates' major areas of study. Objectives direct the development of the student attributes (outcomes) needed to achieve the objectives. They facilitate the direction of educational strategies needed to instill in students the attributes (outcomes) needed to achieve the objectives.

Graduate Attributes (GAs)

Graduate Attributes form a set of individually assessable programme outcomes that are the components indicative of the Graduate's potential to acquire competence to practice at the appropriate level. The GAs are the attributes expected of a graduate of an accredited programme. The Graduate Attributes of the NBA are as following:

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

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

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

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

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

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

Course / Subject Objectives (CObs)

Course / Subject Objectives are statements that describe what students are expected to attain in terms of specific knowledge, skills, and attitudes after completing the course/subject. Course / Subject Objectives are based on the syllabus content of the course/subject. These are teacher-centred.

Course / Subject Outcomes (COs)

Course / Subject Outcomes describe what students are expected to know and be able to do at the time of completion of the course/subject. These relate to the skills, knowledge, and

behaviours/attitudes that the students / learners acquire as they progress through the course/subject. These are specific and be measurable. These are student/learner-centred.

In summary, Course Outcomes (COs) are

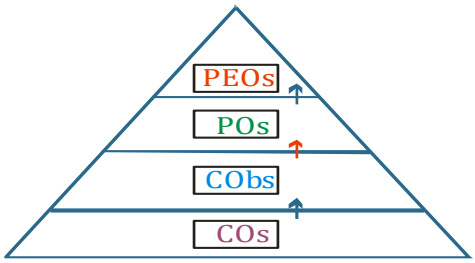
* Student-focused, not teacher-focused
* Aligned between course, program, and institutional levels
* Stated in terms of knowledge, skills, attitude or ability that students will acquire.
* Expressed in terms of measurable and/or observable behaviors
* Needed to reflect the objectives, outcomes and mission of the academic program
* Focused on abilities central to the discipline
* Focused on aspects of learning that will endure students new modes of thinking
* Limited to manageable number (say, 3-6) being accomplished within a semester
* To begin with an action verb (e.g., write, install, solve, and apply Blooms Taxonomy).

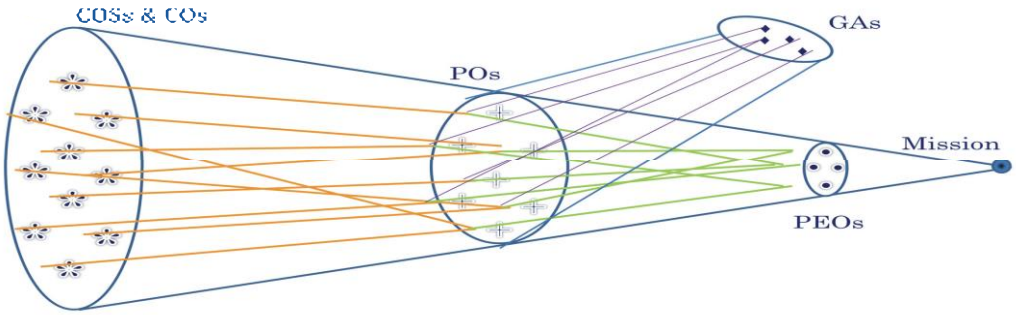
Course Objectives Vs Course Outcomes

The following table summarizes the difference between course objectives and course outcomes.

Course Objectives	Course Outcomes
Describe what a faculty needs to teach and a plan for delivery.	Describe what students should Demonstrate and show upon the completion of a course.
At the end of the course, students will understand and know the concepts of the topics covered.	At the end of the course, students will be able to do, demonstrate, choose, design, ... the topics covered.

Relationship between PEOs, POs and Cos





Program Educational Objectives (PEOs) are assessed a few years (3 to 5 years) after Graduation.

Program Outcomes (POs) are assessed during and upon Graduation.

Course Outcomes (COs) are assessed upon Course Completion.

Assessment Methods

Assessment

Assessment is one or more processes that identify, collect, use and prepare data to evaluate the attainment of student outcomes and program educational objectives. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the objective or outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

"Assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development."

Assessment Methods and Tools

Following are some possible Program-level (P) and Course-level (C) Assessment Methods and Tools. These Methods and Tools are used to assess Program Educational Objectives (PEOs), Program Outcomes (POs) and Course Outcomes (COs) :

1. Exit surveys, exit interviews (P)
2. Alumni surveys and interviews (P)
3. Employer surveys and interviews (P)
4. Job offers, starting salaries (relative to national benchmarks) (P)
5. Entry Level surveys (P)
6. Performance in co-op and internship assignments and in problem-based learning situations (P,C)
7. Assignments, reports, and tests in the capstone (team/group) design course (P,C)
8. Competitive testse.g., GRE, GMAT, etc., (P,C)
9. Student surveys, individual and focus group interviews (P,C)
10. Peer evaluations, self-evaluations (P,C)
11. Student portfolios (P,C)

12. Behavioral observation and verbal protocol analysis (analyzing transcripts of student interviews or working sessions to extract patterns of problem-solving, thinking, or communication) (P,C)
13. Written tests or test items clearly linked to learning objectives (C)
14. Written project reports (C)
15. Oral presentations (live or on videotape) (C)
16. Research proposals, student-formulated problems (C)
17. Abstracts, executive summaries, papers (C)
18. Letters, memos (C)
19. Written critiques of documents or oral presentations (C)
20. Classroom assessment techniques (C)

Choose some of the above assessment methods at program-level (P) and course-level (C) most suitable to your Course. Some of the assessments you might have already completed and some you may be planning. For Ist, IInd&IIIrd year B.Tech Courses choose mostly from course-level (C) assessment methods. For IVth year B.Tech Courses choose from both program-level (P) and course-level (C) assessment methods.

Direct Measures

Direct measures provide for the direct examination or observation of student knowledge or skills against measurable learning outcomes

Indirect Measures

Indirect measures are those that ascertain the opinion or self-report of the extent or value of learning experiences.

Written Surveys and Questionnaires

Asking individuals to share their perceptions about the program (e.g., their own or others' skills/attitudes/behavior, or program/course qualities and attributes)

Most common indirect measure

-Usually locally developed but also some national surveys that allow for comparisons

(e.g., National Survey of Student Engagement, Educational Benchmarking,)

Exit and other Interviews

Asking individuals to share their perceptions about the program (e g their own skills/attitudes, skills and attitudes of others, or program qualities) in a face-to-face dialog with an interviewer

-Generally indirect measure

-Interview could be crafted to include elements of direct measures

Standardized Exams

Subject-specific examinations, generally group administered mostly multiple choice "objective" tests, usually purchased from a private vendor

-Direct measure of student learning

- Provide ability to make comparisons with other programs

-Need to be confident that it is relevant to the program for which it is used

Locally developed exams

Objective (includes true-false, fill-in-the blank, matching, and multiple choice question) and/or subjective (open-ended require students to write) tests designed by faculty of the program

-Most common at classroom level

-Direct measure of student learning

-Can be specific to performance indicators for the learning outcomes

-Can be difficult to get faculty agreement on questions related to outcomes

Focus Groups

Group discussions conducted by a trained moderator with participants to identify trends/patterns in perceptions

-Indirect method that can provide valuable information about student perceptions and experiences

-Can be used to provide insights about student responses on other assessments

-Results cannot be generalized to entire cohort

Archival Records

Biographical, academic, or other file data available from the college or other agencies and institutions

-Identify data already available (data audit)

-Generally direct measure

-Build upon data collection efforts that have already occurred

-Constitutes non intrusive measurement not non-measurement, requiring additional time or effort from students or other groups

Portfolios

Collections of student work which is archived and rated for level of attainment using scoring rubrics. The design of a portfolio is dependent upon how the scoring results are going to be used.

-Direct measure of student learning

-Possible to measure more than one learning outcome at one time (e.g., writing and use of technology)

-Course management systems often support portfolio development

Simulations (Competency-Based Measure)

A person's abilities are measured in a situation that approximates a “real world” world setting

-Direct measure of student learning

-Need well defined outcomes with appropriate tasks

-Can be designed for individuals and groups of Students

Performance Appraisals

Systematic measurement of the demonstration of acquired skills through direct observation

-Provides a direct measure of students' abilities to apply what has been learned

-Internships and co-op experiences provide a good setting for data collection

-Need to be focused data collection process

-Those who are in a position to make judgment

-Well constructed instrument for data collection

External Examiner

Using an expert in the field from outside the program (usually from a similar program at another institution) to conduct, evaluate, or supplement assessment of your students

-Generally a direct measure of student learning (if they assess against specific competencies)

-Outsiders can "see" attributes to which insiders have grown accustomed

-Evaluators may have skills, knowledge, or resources not otherwise available

Oral Exams

An assessment of student knowledge levels through a face-to-face dialogue face to between the student and examiner usually faculty

-Direct measure of student learning

-Content and style can be geared to specific learning outcomes and characteristics of the program, curriculum, etc.

-May not be allowed by institution who have concerns about pressure on students

Behavioral Observations

Measuring the frequency, duration, relationships, etc. of student actions, usually in a natural setting with non-interactive methods (e.g., formal or informal observations in a classroom).

-Direct measure of student behavior

-Observations are most often made be an individual and can be augmented by audio or videotape.

-Requires experienced observers

Rubrics and Mapping

Rubric is a tool that helps to make subjective measurements as objective, clear, and consistent as possible by defining the criteria on which performance should be judged.

A tool often shaped like a matrix, with criteria on one side and levels of achievement across the top used to score products or performances. Rubrics describe the characteristics of different levels of performance, often from exemplary to unacceptable. The criteria are ideally explicit, objective, and consistent with expectations for student performance.

Rubrics may be used by an individual or multiple raters to judge student work.

Rubrics are meaningful and useful when shared with students before their work is judged so they better understand the expectations for their performance.

EXAMPLE OF RUBRIC

OBJECTIVE: Work effectively with others

STUDENT OUTCOME: Ability to function in a multi-disciplinary team

S.No. Student Name	Performance Criteria	Unsatisfactory	Developing	Satisfactory	Exemplary	Score
		1	2	3	4	
1.	Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information or some relates	Collects some basic information all relates to the topic.	Collects a great deal of information all relates to the topic.	3
	Fulfill team role's duty	Does not perform any duties of assigned team	Performs very little duties.	Performs nearly all duties	Performs all duties of assigned team role.	3
	Share Equally	Always relies on others to do the work.	Rarely does the assigned work-often needs reminding.	Usually does the assigned work-rarely needs reminding.	Always does the assigned work without having to be reminded.	4
	Listen to other team mates	Is always talking-never allows anyone else to speak.	Usually doing most of the talking-rarely allows others to speak.	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	4
					Average score	3.5
2.					Average score	

Mapping

Mapping is the process of representing preferably in matrix form, the correlation among the parameters such as PEOs, POs, COs, etc.. It may be done for one to many, many to one, and many to many parameters.

Course Outcomes (COs)-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark "X")

Program Educational Objectives (PEOs)-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark "X")

Evaluation

Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program educational objectives and student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement. Evaluation gives value judgment. It is a statement about quality.

Grading

It is a process of evaluating students, ranking them, and distributing each student's value across a scale. Typically, grading is done at the course level. Grades can be numeric or descriptive or both.

Grading is focused on strengths and weaknesses in each individual student's learning for use by each student.

Accreditation Criteria

The assessment and evaluation process of accreditation of an engineering programme is based on broad Criteria and specific Criteria. An engineering programme to be accredited or re-accredited has to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the programme and seek to improve the standards and quality continually, and address deficiencies if any aspect falls short of the standards set by the accreditation criteria. During the full term of accreditation, the institutions are required to submit their annual self-assessment report to NBA.

Criteria-1.	Vision, Mission and Programme Educational Objectives
Criteria-2.	Programme Outcomes
Criteria-3.	Programme Curriculum
Criteria-4.	Students' Performance
Criteria-5.	Faculty Contributions
Criteria-6.	Facilities and Technical Support

Criteria-7. Academic Support Units and Teaching-Learning Process

Criteria-8. Governance, Institutional Support and Financial Resources

Criteria-9. Continuous Improvement

Criteria-10. Program Specific Criteria

Program Specific Criteria(PSC)

In addition to the Program General Criteria (1 to 9), each program must satisfy a set of criteria specific to the program, known as Program Specific Criteria (10). The Program Specific Criteria deal with the requirements for engineering practice particular to the related sub-discipline. The stipulation in the Program Specific Criteria chiefly concern curricular issues and qualifications of faculty. In the case where there is more than one set of Program Specific Criteria, a program must satisfy every set of criteria.

Program Specific Criteria for CSE

ELECTRICAL, COMPUTER, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Institute of Electrical and Electronics Engineers

Cooperating Society for Computer Engineering Programs: CSAB

These program criteria apply to engineering programs that include electrical, electronic, computer, or similar modifiers in their titles.

Curriculum The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.

The curriculum must include probability and statistics, including applications appropriate to the program name; mathematics through differential and integral calculus; sciences (defined as biological, chemical, or physical science); and engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.

The curriculum for programs containing the modifier “electrical” in the title must include advanced mathematics, such as differential equations, linear algebra, complex variables, and discrete mathematics.

I YEAR I SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A1001	Linear Algebra and Differential Calculus	3	1	0	4	4	30	70	100
2	GR18A1003	Applied Physics	3	1	0	4	4	30	70	100
3	GR18A1007	Programming for Problem Solving	3	1	0	4	4	30	70	100
6	GR18A1010	Engineering Graphics	1	0	4	5	3	30	70	100
4	GR18A1011	Applied Physics Lab	0	0	3	3	1.5	30	70	100
5	GR18A1015	Programming for Problem Solving Lab	0	0	3		1.5	30	70	100
		Induction Programme					-			
Total			**10**	**3**	**10**	**20**	**18**	**180**	**420**	**600**

-

I YEAR II SEMSTER

S.NO.	Course Codes	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A1002	Differential Equations and Vector Calculus	3	1	0	4	4	30	70	100
2	GR18A1005	Chemistry	3	1	0	4	4	30	70	100
3	GR18A1008	Basic Electrical Engineering	3	0	0	3	3	30	70	100
4	GR18A1006	English	2	0	0	2	2	30	70	100
5	GR18A1013	Engineering Chemistry Lab	0	0	3	3	1.5	30	70	100
6	GR18A1016	Basic Electrical Engineering Lab	0	0	2	2	1	30	70	100
7	GR18A1014	English Language and Communication Skills Lab	0	0	2	2	1	30	70	100
8	GR18A1017	Engineering Workshop	1	0	3	4	2.5	30	70	100
Total			**12**	**2**	**10**	**24**	**19**	**240**	**560**	**800**

II YEAR I SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					

1	GR18A2065	Digital Logic Design	3	0	0	3	3	30	70	100
2	GR18A2066	Data Structures	3	0	0	3	3	30	70	100
3	GR18A2005	Probability and Statistics	3	0	0	3	3	30	70	100
4	GR18A2067	Discrete Mathematics	3	1	0	4	4	30	70	100
5	GR18A2068	Database Management Systems	3	0	0	3	3	30	70	100
6	GR18A2069	Open Source Lab	0	0	4	4	2	30	70	100
7	GR18A2070	Digital Logic Design Lab	0	0	3	3	1.5	30	70	100
8	GR18A2071	Data Structures Lab	0	0	3	3	1.5	30	70	100
9	GR18A2072	Database Management Systems Lab	0	0	3	3	1.5	30	70	100
Total			**15**	**1**	**13**	**29**	**22.5**	**270**	**630**	**900**
10	GR18A2002	Value Ethics and Gender Culture	2	0	0	2	2	30	70	100

II YEAR II SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A2073	Computer Organization	3	0	0	3	3	30	70	100
2	GR18A2004	Economics & Accounting for Engineers	3	0	0	3	3	30	70	100
3	GR18A2074	Operating Systems	3	0	0	3	3	30	70	100
4	GR18A2075	Java Programming	3	0	0	3	3	30	70	100
5	GR18A2076	Design and Analysis of Algorithms	3	0	0	3	3	30	70	100
6	GR18A2077	Scripting Languages Lab	0	0	3	3	1.5	30	70	100
7	GR18A2078	Operating Systems Lab	0	0	3	3	1.5	30	70	100
8	GR18A2079	Java Programming Lab	0	0	3	3	1.5	30	70	100
Total			**15**	**0**	**09**	**27**	**19.5**	**240**	**560**	**800**
9	GR18A2001	Environmental Science	2	0	0	2	2	30	70	100
10	GR18A2083	Design Thinking	2	0	0	2	1	30	70	100

III YEAR I SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A3043	Object Oriented Software Engineering	3	0	0	3	3	30	70	100
2	GR18A3044	Computer Networks	3	0	0	3	3	30	70	100
3	GR18A3045	Formal Languages Automata Theory	3	0	0	3	3	30	70	100
4	GR18A3046	Web Technologies	3	0	0	3	3	30	70	100

5	GR18A304	Micro Controller and Internet of Things	3	0	0	3	3	30	70	100
6		Professional Elective I	3	0	0	3	3	30	70	100
7	GR18A3052	Object Oriented Software Engineering Lab	0	0	3	3	1.5	30	70	100
8	GR18A3053	Computer Networks and Web Technologies Lab	0	0	3	3	1.5	30	70	100
9	GR18A3054	Micro Controller and Internet of Things Lab	0	0	2	2	1	30	70	100
Total			**18**	**0**	**08**	**26**	**22**	**270**	**630**	**900**

PROFESSINAL ELECTIVE - 1		
S. No.	**Course Code**	**COURSE**
1.	GR18A3048	Graph Theory
2.	GR18A3049	Principles of Programming Languages
3.	GR18A3050	Artificial Intelligence
4.	GR18A3051	Software Testing Methodologies

III YEAR II SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A3099	Data Warehousing and Data Mining	3	0	0	3	3	30	70	100
2	GR18A3100	Compiler Design	3	0	0	3	3	30	70	100
3	GR18A3115	Fundamentals of Management and Entrepreneurship	3	0	0	3	3	30	70	100
4		Professional Elective II	3	0	0	3	3	30	70	100
5		Open Elective I	3	0	0	3	3	30	70	100
6	GR18A3105	Data Warehousing and Data Mining Lab	0	0	2	2	1	30	70	100
7	GR18A3106	Compiler Design Lab	0	0	2	2	1	30	70	100
8	GR18A3116	Mini Project with Seminar	0	0	6	6	3	30	70	100
		Summer Internship	-	-	-		-			
Total			**18**	**0**	**10**	**25**	**20**	**240**	**560**	**800**
9	GR18A2003	Constitution of India	2	0	0	2	2	30	70	100

PROFESSINAL ELECTIVE - 2		
S. No.	**Course Code**	**COURSE**
1.	GR18A3101	Advanced Algorithms
2.	GR18A3102	Cloud Computing
3.	GR18A3103	Neural Networks and Deep Learning
4.	GR18A3104	Software Architecture

IV YEAR I SEMESTER

S.NO.	Course	COURSE	Hours	Total	Total	Int	Ext	Marks

	Code		L	T	P	Hours	Credits			
1	GR18A4043	Cryptography & Network Security	3	0	0	3	3	30	70	100
2	GR18A4044	Machine Learning	3	0	0	3	3	30	70	100
3		Professional Elective III	3	0	0	3	3	30	70	100
4		Professional Elective IV	3	0	0	3	3	30	70	100
5		Open Elective II	3	0	0	3	3	30	70	100
6	GR18A4053	Cryptography & Network Security Lab	0	0	3	3	1.5	30	70	100
7	GR18A4054	Machine Learning Lab	0	0	3	3	1.5	30	70	100
8	GR18A4061	Main Project (Phase I)	0	0	12	12	6	30	70	100
Total			**15**	**0**	**18**	**33**	**24**	**240**	**560**	**800**

PROFESSINAL ELECTIVE - 3		
S. No.	**Course Code**	**COURSE**
1.	GR18A4045	Parallel and Distributed Algorithms
2.	GR18A3112	Image and Video Processing
3.	GR18A4047	Natural Language Processing
4.	GR18A4048	Agile Software Process

PROFESSINAL ELECTIVE - 4		
S. No.	**Course Code**	**COURSE**
1.	GR18A4055	Information Storage and Retrieval
2.	GR18A4050	Multi Media Applications
3.	GR18A4051	Data Science
4.	GR18A4052	Software Project Management

IV YEAR II SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1		Professional Elective V	3	0	0	3	3	30	70	100
2		Professional Elective VI	3	0	0	3	3	30	70	100
3		Open Elective III	3	0	0	3	3	30	70	100
4	GR18A4108	Main Project (Phase II)	0	0	12	12	6	30	70	100
Total			**9**	**0**	**12**	**21**	**15**	**120**	**280**	**400**

PROFESSINAL ELECTIVE - 5		
S. No.	**Course Code**	**COURSE**
1.	GR18A4096	Real Time Operating Systems
2.	GR18A4097	Cyber Security

3.	GR18A4059	Soft Computing
4.	GR18A4098	Design Patterns

PROFESSINAL ELECTIVE - 6		
S. No.	**Course Code**	**COURSE**
1.	GR18A4099	Human Computer Interaction
2.	GR18A3060	Computer Graphics
3.	GR18A4100	Big Data Analytics
4.	GR18A4101	Software Measurements and Metrics

PROFESSIONAL ELECTIVES – 4 THREADS

S. No.	Thread 1 Theory and Algorithms	Thread 2 Applications	Thread 3 Data Science and Machine Intelligence	Thread 4 Software and Technology
1	Graph Theory	Principles of Programming Languages	Artificial Intelligence	Software Testing Methodologies
2	Advanced Algorithms	Cloud Computing	Neural Networks and Deep Learning	Software Architecture
3	Parallel and Distributed Algorithms	Image& Video Processing	Natural Language Processing	Agile Software Process
4	Information Retrieval Systems	Multi Media Applications	Data Science	Software Project Management
5	Real Time Operating System	Cyber Security	Soft Computing	Design Patterns
6	Human Computer Interaction	Computer Graphics	Big Data Analytics	Software Measurements and Metrics

OPEN ELECTIVES – 2 THREADS

S. No.	THREAD 1	THREAD 2
1	Soft Skills and Interpersonal Communication	CSE: 1. E-Commerce 2. Database Management Systems 3. Java Programming
2	Human Resource Development and Organizational Behavior	IT: 1. Multimedia and Application Development 2. Web Programming 3. Operating Systems
3	Cyber Law and Ethics	EEE: 1.Embedded Systems 2. Control Systems 3. Artificial Intelligence Techniques
4	History of Science	ECE: 1. Principles of Satellite Communications 2. Scientific Computing 3. Wavelets
5	Introduction to Art and Aesthetics	ME: 1.Operations Research 2. Automobile Engineering 3. Robotics
6	Economic Policies in India	CE: 1. Green Building Technology 2.Building Materials and Construction Planning 3. Introduction to Fluid Mechanics

LINEAR ALGEBRA AND DIFFERENTIAL CALCULUS
Course code: GR18A1001

After learning the contents of this paper the student must be able to

- Compute the rank of a matrix to determine the existence of solutions of a linear algebraic system
- Determine the eigenvalues and eigenvectors of a square matrix which arise in several engineering applications
- Determine approximate solution of over determined systems using the pseudo inverse
- Apply the definite integral for various computational problems in geometry and Evaluate some improper integrals using special functions
- Develop the skill of determining optimal values of multivariable functions using classical methods

APPLIED PHYSICS

Course Code: GR18A1003

At the completion of this course, students will be able to:

- Outline the development of quantum mechanics and solve Schrodinger equation for simple potentials.
- Demonstrate the operation mechanism of electronic devices such as transistors and diodes.
- Explain the development and applications of optoelectronic devices.
- Analyze the properties of Laser and its propagation in optical fibers.
- Evaluate the properties of dielectric and magnetic materials for various applications.

PROGRAMMING FOR PROBLEM SOLVING

Course Code: GR18A1007

The Student will learn:

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.

ENGINEERINGGRAPHICS

Course Code: GR18A1010

- Familiarize with BIS standards and conventions used in engineering graphics.
- Draw various engineering curves e.g ellipse, parabola, cycloids and involutes etc and construct various reduced scales e.g plain, diagonal and vernier scales
- Differentiate between first angle and third angle methods of projection and distinguish parallel and perspective projection.
- Visualize different views like elevation and plan for a given line, plane figures or solid objects.
- Apply drafting techniques and use 2D software e.g AutoCAD to sketch 2D plane figures.

APPLIED PHYSICS LAB

Course Code: GR18A1011

At the completion of this course, students will be able to:

- Compare the behavior of p-n junction diode, Solar cells and LED.
- Analyze the behavior of magnetic and electric fields with the help of graphs.
- Determine the work function of a material through photoelectric effect.
- Asses the characteristics of Lasers and infer the losses in optical fibers.
- Estimate the time constant of RC circuit and resonance phenomenon in LCR circuit.

PROGRAMMING FOR PROBLEM SOLVING LAB
Course Code: GR18A1015

The students will learn the following:

- Formulate the algorithms for simple problems and translate given algorithms to a working and correct program.
- Correct syntax errors as reported by the compilers
- Identify and correct logical errors encountered during execution
- Represent and manipulate data with arrays, strings and structures and use pointers of different types
- Create, read and write to and from simple text and binary files and modularize the code with functions so that they can be reused

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
Course Code : GR18A1002

To provide the student with

- Classify the differential equations of first order and solve them analytically by suggested methods
- Solve linear differential equations of higher order under various forcing functions
- Evaluate double and triple integrals and apply them to some problems in geometry and mechanics
- Perform vector differential operations on scalar and vector fields and apply them to solve some field related problems
- Apply classical vector integral theorems for fast computation of work done around closed curves and flux across closed surfaces

CHEMISTRY
Course Code: GR18A1005

Students should be able to

- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.
- Recognize various problems related to electro chemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in Engineering.
- Know the origin of different types of engineering materials used in modern technology and Interpret different problems involved in industrial utilization of water.
- Understand the processing of fossil fuels for the effective utilization of chemical energy.

BASIC ELECTRICAL ENGINEERING
Course Code: GR18A1008

- To understand and analyze basic electric circuits with suitable theorems.
- To solve 1-phase and 3-phase balanced sinusoidal systems.

- To interpret the working principle of Electrical machines.
- To appraise the applications of Induction motors and synchronous generators used in Industries.
- To identify the components of Low Voltage Electrical Installations.

ENGLISH
Course Code: GR18A1006

Students should be able to

- Use English Language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently in various contexts and different cultures.
- Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
- Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.

ENGINEERING CHEMISTRY LAB
Course code: GR18A1013

- Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- Determination of parameters like hardness and chloride content in water.
- Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.
- Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.
- Determination of physical properties like adsorption and viscosity.

BASIC ELECTRICAL ENGINEERING LAB
Course Code: GR18A1016

- Get an exposure to common electrical components and their ratings.
- Get an exposure to basic electrical laws.
- Understand the measurement, calculation and relation between the basic electrical parameters
- Understand the response of different types of electrical circuits to different excitations.
- Compare the basic characteristics of Electrical machines

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB
Course code: GR18A1014

- Interpret the role and importance of various forms of communication skills.
- Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.

- Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
- Recognise the need to work in teams with appropriate ethical, social and professional responsibilities.
- Evaluate and use a neutral and correct form of English.

ENGINEERING WORKSHOP
Course Code: GR18A1017

- Develop various trades applicable to industries / Manufacturing practices.
- Create Hands on experience for common trades.
- Improve to fabricate components with their own hands.
- Develop practical knowledge on the dimensional accuracies and dimensional tolerances possible with various manufacturing processes
- To build the requirement of quality of work life on safety and organizational needs.

DIGITAL LOGIC DESIGN
Course Code: GR18A2065

At the end of the course, the student will be able to

- Apply knowledge of fundamental Boolean principles and manipulation to design Logic Circuits.
- Apply various techniques of Boolean function simplification to create minimal expressions.
- Create combinational circuits for a specified behavior with minimal specification.
- Synthesize Sequential circuits with minimal states.
- Realize combinational circuitry using Combinational PLDs and develop & test HDL models of Logic Circuits.

DATA STRUCTURES
Course Code: GR18A2066

Upon the successful completion of the course the students will be able to

- Implement searching techniques for a given problem.
- Write pseudo code for various sorting techniques.
- Implement various linear data structures and determine the time complexity.
- Understand the non-linear data structures like trees, graphs.
- Choose appropriate data structures to represent data items in real world problems

PROBABILITY AND STATISTICS
Course Code: GR18A2005

- Estimate the chance of occurrence of various uncertain events in different random experiments with strong basics of probability.
- Compute and interpret descriptive statistics.

- Evaluate random processes which occur in engineering applications governed by the Binomial, Poisson, Multinomial, Exponential, Normal and Gamma distributions.
- Forecast the models using Regression Analysis.
- Apply Inferential Statistics to make predictions or judgments about the population from which the sample data is drawn.

DISCRETE MATHEMATICS
Course Code: GR18A2067

At the end of the course, the student will be able to

- For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.
- For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.
- For a given a mathematical problem, classify its algebraic structure..
- Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
- Develop the given problem as graph networks and solve with techniques of graph theory.

DATABASE MANAGEMENT SYSTEMS
Course Code: GR18A2068

- Identify the role of Database System Applications and the design issues related.
- Design the logical model for the applications and apply indexing techniques.
- Construct a Database Schema, Manipulate data using a SQL.
- Can apply the Schema Refinement techniques for a database design for optimized access.
- For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

OPEN SOURCELAB
Course Code: GR18A2069

At the end of the course, student will be able to

- Install open source packages
- Understand Kernel Configuration of Linux
- Use GUI programs with Open CV
- Develop the programs for PERL, LISP
- Use LATEX

DIGITAL LOGIC DESIGN LAB
Course Code: GR18A2070

At the end of the course, student will be able to

- Identify the logic gates to solve the real world problems.
- Validate and check the various combinational circuits like adders, comparators, multiplexers and checkers.
- Verify various sequential circuits like flip flops, registers, counters. Translate the Boolean expressions using hardware description language.

- Implement the sequential and combinational circuits over hardware description language.
- Analyze and synthesize logic circuits. Design any Boolean function using universal gates such as NAND and NOR.

DATA STRUCTURES LAB

Course Code: GR18A2071

After completion of course student will be able to:

- Analyze run-time execution of various sorting ,searching methods.
- Apply the knowledge of various Linked lists in real time problems.
- To choose appropriate data structure as applied to specified problem definition
- Understand the applications of Stacks and Queues.
- To handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: GR18A2072

At the end of the course, the student will be able to

- Construct the schema of the database and modify it.
- Compile a query to obtain the aggregated result from the database.
- Speculate the concepts of various database objects.
- Compare the use of procedure and function in database.
- Use triggers and packages to create applications in the database.

VALUE ETHICS AND GENDER CULTURE

CourseCode:GR18A2002

- To enable the student to understand the core values that shapes the ethical behaviour.
- Student will be able to realize the significance of ethical human conduct and self-development
- Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.
- Students will attain a finger grasp of how gender discrimination works in our society and how to counter it.
- Students will develop a better understanding on issues related to gender and Empowering students to understand and respond to gender violence.

COMPUTER ORGANIZATION

Course Code: GR18A2073

At the end of the course, the student will be able to

- Demonstrate knowledge of register organization of a basic computer system
- Incorporate In-depth understanding of control unit organization and micro programmed control.
- Understand the performance of central processing unit of a basic computer system.
- Apply various algorithms to perform arithmetic operations and propose suitable hardware for them.
- Analyze and emphasize various communication media in the basic computer system using design of various memory structures and Multiprocessor systems

ECONOMICS AND ACCOUNTING FOR ENGINEERS

Course Code: GR18A2004

After studying this course, students will be in a position to:

- Analyze the economic environment and forecast demand of products through demand forecasting techniques.
- Plan the production levels in tune with maximum utilization of organizational resources and with maximum profitability and list out various costs associated with production and able to compute breakeven point.
- Outline the different types markets and competition, forms of business organization and methods of pricing.
- Analyze the profitability of various projects using capital budgeting techniques
- Prepare the financial statements.

OPERATING SYSTEMS

Course Code: GR18A2074

At the end of the course, the student will be able to

- Explain functions, structures of operating system
- Determine various process management concepts including scheduling and synchronization.
- Demonstrate the concepts of memory management and I/O systems.
- Solve issues related to file system interface and implementation of disk management.
- Classify protection and security mechanisms

JAVA PROGRAMMING

Course Code: GR18A2075

Upon the successful completion of the course, the student will be able:

- Write java programs and differentiate between object-oriented programming and procedure-oriented programming.
- Apply object-oriented programming features for solving a given problem.
- Incorporate exception handling mechanism.
- Implement Use java standard API library to write complex programs.
- Develop interactive programs using applet and swing.

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: GR18A2076

At the end of the course, the student will be able to:

- Express algorithms in a language independent manner (as pseudo codes).
- Applying various searching and sorting algorithms for different applications.
- Illustrating various techniques like greedy and dynamic approach in solving problems.
- Explain different backtracking applications and can also solve problems using fundamental graph algorithms.

- Differentiate between deterministic and non-deterministic problems.

SCRIPTING LANGUAGES LAB
Course Code: GR18A2077

At the end of the course student will be able to:

- Evaluate the process of executing a PHP-based script on a web server
- Design, debug and run complete web applications using PHP and MYSQL
- Adequately use Python programming in selection, functions, modules, aggregated data (arrays, lists, etc.)
- Develop substantial Python scripts by appropriate reusing previously created scripts.
- Ability to develop Python scripts for using databases.

OPERATING SYSTEMS LAB
Course Code: GR18A2078

At the end of the course, the student will be able to

- Evaluate the performance of different types of CPU scheduling algorithms
- Implement producer-consumer problem, reader-writers problem, Dining philosophers problem using semaphore
- Implement MVT, MFT, paging techniques and page replacement policies, memory allocation techniques in memory management and types of fragmentation that encounter in such techniques.
- Simulate Banker's algorithm for deadlock avoidance
- Implement file allocation strategies, file organization techniques and disk scheduling techniques.

JAVA PROGRAMMING LAB

Course Code: GR18A2079

Upon the successful completion of the course, the student will be able to:

- Implement object-oriented programming concepts.
- Analyze a problem, identify and define the computing requirements appropriate to its solution.
- Explore the java standard API library to write complex programs.
- Implement and manage multithreading.
- Develop graphical user interface in Java programs

ENVIRONMENTAL SCIENCE
Course Code : GR18A2001

Based on this course, the Engineering graduate will

- Understand the harmonious co-existence in between nature and human being
- Recognize various problems related to environment degradation.
- Develop relevant research questions for environmental investigation.
- Generate ideas and solutions to solve environmental problems due to soil, air and water pollution.
- Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.

DESIGN THINKING
Course Code : GR18A2001

Based on this course, the Engineering graduate will

- Study a problem from problem perspectives.
- Learn how to frame the design challenge properly.
- Ideate, prototype and Iterate solutions.
- Learn from the overall design process how to create value as entrepreneurs.
- Students will be equipped with all the skills in the design mindset.

OBJECT ORIENTED SOFTWARE ENGINEERING
Course Code : GR18A3043

At the end of this course student will be able to

- Apply software development life cycle to provide Object-Oriented solutions for Real-World Problems.
- Identify domain objects, their properties and relationships among them.
- Design solutions for the Real-World Problems.
- Identify types of testing techniques to test object oriented system.
- Implement design solutions for user requirements.

COMPUTER NETWORKS
Course Code : GR18A3044

At the end of this course student will be able to

- Define basic terminologies of Computer Networks and to apply various networking configurations and transmission media to build a network for an organization.
- Develop error correction and detection techniques and MAC Protocols for specific networks.
- Develop various routing algorithms and give solutions to various transmission problems.
- Apply the application of TCP or UDP protocols.
- Develop some protocols at Application Layer and to deal with security problems related to Web Applications.

FORMAL LANGUAGES AND AUTOMATA THEORY
Course Code : GR18A3045

At the end of this course student will be able to

- Design Finite Automata models.
- Construct Regular Expressions and equivalent automata models.
- Formulate Grammars for Formal languages.
- Represent Normal Forms and Push Down Automata.
- Experiment with Computational models.

WEB TECHNOLOGIES
Course Code : GR18A3046

At the end of this course student will be able to

- Make interactive web sites through the DOM API and to change the CSS styles through java script
- Build single-page web applications using Angular JS
- Understand Core technologies of modern Java web programming like servlets and JSP
- Create web application using JSP
- Write JSP code without scriptlets tag and access the database.

MICRO CONTROLLER AND INTERNET OF THINGS
CourseCode:GR18A3047

At the end of this course student will be able to

- Use AVR Controllers.
- Explore architecture of ATMEGA 328 controllers for programming.
- Explore programming the sensor devices.
- Develop IoT Projects.
- Explore python web application framework for cloud IoT services.

GRAPH THEORY
CourseCode:GR18A3048

At the end of this course student will be able to

- Learn the fundamentals of graph theory
- Determine cut-sets and cut-vertices
- Represent a graph in matrix form
- Understand planar graphs, dual graphs, coloring, covering and partitioning of graphs.
- Solve graph related problems and write algorithms

PRINCIPLES OF PROGRAMMING LANGUAGES
CourseCode:GR18A3049

At the end of this course student will be able to

- Discuss the criteria for evaluating programming languages and language constructs including programming paradigms.
- Describe formal methods of syntax.
- Illustrate the data types and control structures in different programming languages
- Construct abstract data types, concurrency and exceptions
- Compare functional and imperative languages.

ARTIFICIAL INTELLIGENCE
CourseCode:GR18A3050

At the end of this course student will be able to

- Select an appropriate searching strategy for developing intelligent agents to find solution in optimized way using building blocks of AI.
- Apply prepositional and first order logic methods to resolve decisions for knowledge based agents.
- Practice uncertain knowledge and reasoning handling using Bayesian networks
- Analyze the working of temporal models, hidden markov models, decision trees.
- Write AI programs and construct small robots capable of performing perception and movement based on techniques learnt in the course.

SOFTWARE TESTING METHODOLOGIES
CourseCode:GR18A3051

At the end of this course student will be able to

- Create a model for testing and criticize various consequences of bugs.
- Apply a path testing technique for a given software.
- Apply various Data flow testing techniques for exploring Data Bugs and Domain Bugs.

- Design test cases based on decision tables for a given logical construct.
- Attribute graph matrices techniques for the simplification of graphs and simplify testing process.

OBJECT ORIENTED SOFTWARE ENGINEERING LAB
CourseCode:GR18A3052

At the end of this course student will be able to

- Analyze and identify requirements for real time problems.
- Design and implement various software design models.
- Use modern engineering tools for specification, design and implementation.
- Provide appropriate solutions for the real time problems using object oriented software engineering methodology.
- Design test cases for various real time problems

COMPUTER NETWORKS AND WEB TECHNOLOGIES LAB
CourseCode:GR18A3053

At the end of this course student will be able to

- Ability to understand the encryption and decryption concepts in Linux environment
- Ability to apply appropriate algorithm for the finding of shortest route.
- Ability to configure the routing table.
- To build single-page web applications using Angular JS
- To create web application using JSP

MICRO CONTROLLER AND INTERNET OF THINGS LAB
CourseCode:GR18A3054

At the end of this course student will be able to

- Develop the programs for controlling DC Motor using Arduino/ Raspberry Pi.
- Develop the programs on Arduino using sensors.
- Develop the programs using communication devices.
- Implement IoT programs using Raspberry Pi.
- Explore IoT Projects using Arduino /Raspberry Pi.

DATAWAREHOUSING AND DATA MINING
CourseCode:GR18A3099

At the end of this course student will be able to

- Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications.
- Design a data mart or data warehouse for any organization
- Apply pre-processing statistical methods for any given raw data.
- Extract knowledge and implementation of data mining techniques
- Explore recent trends in data mining such as web mining, spatial-temporal mining.

COMPILER DESIGN
CourseCode:GR18A3100

At the end of this course student will be able to

- Understand the basic concepts of compiler design, and its different phases.
- Understand the different types of parsing techniques and should be in a position to solve the problem.

- Analyze the program and minimize the code by using optimizing techniques which helps in reducing the number of instructions in a program and also utilization of registers in an effective way.
- Learn the process of translating a modern high-level language to executable code.
- Construct new tools for compilation for small programming languages.

FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP
CourseCode:GR18A3115

At the end of this course student will be able to

- The students understand the significance of Management in their Profession.
- The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.
- To know and adopt motivational theories and leadership styles and apply controlling techniques at right time for better decision making.
- The student will be exposed to the basic concepts of entrepreneurship and its development process.
- The student will acquire the ability of developing a business plan / model.

ADVANCED ALGORITHMS
CourseCode:GR18A3101

At the end of this course student will be able to

- Learn various sorting and graph implementation.
- Find the connected components in a graph and compute the path.
- Identify algorithm design technique and perform matrix operations.
- Analyze the Modulo representation and Discrete fourier transformation.
- Distinguish the NP-hard, NP-complete problems and understand randomized

CLOUD COMPUTING
CourseCode:GR18A3102

At the end of this course student will be able to

- Understand the features, advantages and challenges of cloud computing, compare their operation ,implementation and performance
- Understand, Analyze and compare different types of clouds and cloud services.
- Understanding and validating the financial and technological implications in selecting cloud computing paradigm for an organization.
- Understand and Analyze the security challenges and risks involved in the cloud.
- Create/Deploying of an application in cloud.

NEURAL NETWORKS AND DEEP LEARNING
CourseCode:GR18A3103

At the end of this course student will be able to

- Understand the basic math required for neural network.
- Explain working of artificial neural networks.
- Categorize between supervised and unsupervised learning mechanisms.
- Analyze the real world problem and identify required hyper parameters to be considered for a deep learning network.
- Design optimized deep learning applications for small problems using algorithms learnt in the course.

SOFTWARE ARCHITECTURE

CourseCode:GR18A3104

At the end of this course student will be able to

- Design and motivate software architecture for large scale software systems
- Recognize major software architectural styles, design patterns, and frameworks
- Describe a software architecture using various documentation approaches and architectural description languages
- Generate architectural alternatives for a problem and select among them.
- Use well-understood paradigms for designing new system

PRINCIPLES OF E-COMMERCE
CourseCode:GR18A3129

At the end of this course student will be able to

- Comprehend and identify the nature and types of e-commerce.
- Distinguish all types of business models.
- Choose and pick the suitable software, hardware and e-com tools for developing a better web application.
- Implement a robust, safe and secured online payment system.
- Interpret about the current e-commerce development and usage of effective internet and re articulate about the online content and management.

SOFT SKILLS AND INTERPERSONAL SKILLS
CourseCode: GR18A3117

At the end of this course student will be able to

- Develop soft skills communication skills, leadership skills etc.
- Implement goal setting techniques to build a promising career.
- Design formal report and proposals with appropriate formal expressions.
- Analyse their own experiences of leading and participating in teams with suitable examples.
- Describe team dynamics and exchange ideas about the elements of positive teamwork.
- Create healthy workplace environment by treating others with respect and dignity.
- Evaluate the power of confidence building and self-esteem with examples.

HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
Coursecode: GR18A3118

At the end of this course student will be able to

- To familiarize the concepts, techniques and practices of human resource development in the current organizational view and to impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
- Develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.
- To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organisational setting.
- To Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.
- To assess the group behavior in organizations, including communication, leadership,

power and politics, conflict, and negotiations in the frame work of organization.

DATA WAREHOUSING AND DATA MINING LAB
CourseCode:GR18A3105

At the end of this course student will be able to

- Learn the concept of creating database tables in attribute relation file format(.arff).
- Design a database tables in .arff format and insert, modify the data.
- Apply pre-processing statistical methods for any given raw data.
- Extract knowledge and implementation of various data mining techniques.
- Implement data mining algorithms in real time problem solving using weka tool.

COMPILER DESIGN LAB
CourseCode:GR18A3106

At the end of this course student will be able to

- Demonstrate different phases of compiler through programming language.
- Define the role of lexical analyser and use of regular expressions.
- Develop program for implementing parsing techniques.
- Understand the working of lex and yacc compiler and develop simple applications.
- Design programs that execute faster by using code optimization techniques.

CONSTITUTION OF INDIA
CourseCode:GR18A2003

At the end of this course student will be able to

- Students will be able to know the importance of Constitution and Government
- Students will be able to become Good Citizens and know their fundamental rights, duties and principles.
- Students will learn about the role of PM, President, Council of Ministers and Local Administration.
- The Students understand the importance of Election Commission.
- They will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

CRYPTOGRAPHY AND NETWORK SECURITY
CourseCode:GR18A4043

At the end of this course student will be able to

- Work and check the applications defined with confidentiality, integrity, and Authentication.
- Work with various public key and private key cryptographic algorithms.
- Examine the issues and structure of Authentication Service and Electronic Mail Security.
- Understand the IP Security Architecture, Web Security and Key Management techniques.
- Understand intrusion and intrusion detection, Web security and firewalls.

MACHINE LEARNING
CourseCode:GR18A4044

At the end of this course student will be able to

- Explain the concepts and able to Compare different machine learning models.

- Apply Supervised Learning models
- Design Neural Network models for the given data.
- Devise un-supervised model with optimized features.
- Perform Evaluation of Machine Learning algorithms and Model Selection

PARALLEL AND DISTRIBUTED ALGORITHMS
CourseCode:GR18A4045

At the end of this course student will be able to

- Explain the range of requirements that modern parallel/distributed systems have to address.
- Articulate design tradeoffs inherent in large scale parallel and distributed system design.
- Describe how the resources in a parallel and distributed system are managed by software.
- Justify the presence of concurrency within the framework of a parallel and distributed system.
- Demonstrate the potential runtime problems arising from the concurrent operation of many (possibly a dynamic number of) tasks in a parallel and distributed system.

IMAGE AND VIDEO PROCESSING
CourseCode:GR18A3112

At the end of the course, the students will be able to

- Describe the basic principles of Imaging.
- Learn the knowledge of the images in transform domains and segmentation.
- Apply Image compression on images.
- Understand and develop algorithms video processing.
- Implement various video motion techniques.

NATURAL LANGUAGE PROCESSING
CourseCode:GR18A4047

At the end of this course student will be able to

- Summarize the role of natural language processing in various applications and explain language modeling
- Apply word level analysis, syntactic analysis and semantic analysis on natural language processing.
- Discuss discourse processing of text.
- Illustrate the automation of natural language generation and machine translation of Indian languages.
- Infer information retrieval systems and utilize lexical resources for processing natural language text

AGILE SOFTWARE PROCESS
CourseCode:GR18A4048

At the end of this course student will be able to

- Realize the importance of interacting with business stakeholders in determining the requirements for a software system
- Perform iterative software development processes: how to plan them, how to execute them.
- Point out the impact of social aspects on software development success.

- Develop techniques and tools for improving team collaboration and software quality.
- Show how agile approaches can be scaled up to the enterprise level.

INFORMATION STORAGE AND RETRIEVAL
CourseCode:GR18A4055

At the end of this course student will be able to

- Distinguish IRS capabilities and to demonstrate the use of cataloguing and indexing.
- Illustrate the data structures used in IRS and study the accuracy for various clustering and indexing
- Differentiate software text search algorithms and hardware text search systems
- Use search techniques and information visualization technologies
- Construct multimedia retrieval systems

MULTIMEDIA APPLICATIONS
CourseCode:GR18A4050

At the end of this course student will be able to

- Identify and categorize various file formats like text ,audio and video and image models
- Implement Action Script features in Multimedia applications
- Implement multimedia animation movies using action scripts
- Implement multimedia audio, video and data compression techniques.
- Apply various networking protocols for multimedia applications

DATA SCIENCE
CourseCode:GR18A4051

At the end of this course student will be able to

- Examine Data Science process and its applications.
- Interpret how data is collected, stored and managed from multiple sources.
- Apply various Machine Learning algorithms for real time problems.
- Practice different data visualization techniques.
- Summarize the recent trends and ethics of data science.

SOFTWARE PROJECT MANAGEMENT
CourseCode:GR18A4052

At the end of this course student will be able to

- To take responsibility of project team and project organization
- Apply problem solving skills, core IT concepts, best practices and standards to information technologies
- Work with high level and low level Displays of mobile and storing data by using record management system
- Design, implement and deploy mobile applications using an appropriate software development environment with database
- Understands how different management and development practices affect software and process quality

CYBER LAW AND ETHICS
CourseCode:GR18A3119

At the end of this course student will be able to

- Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- Students locate and apply case law and common law to current legal dilemmas in the technology field.
- Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
- Students will be able understand cybercrime and ethical practices.
- The student will be able to know and learn web technologies and related issues.
- The student will be in position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc.
- Overview of cybercrime and framework.

CRYPTOGRAPHY AND NETWORK SECURITY LAB
CourseCode:GR18A4053

At the end of this course student will be able to

- Use the concepts of different ciphers for encryption and decryption.
- Implement symmetric encryption algorithms.
- Examine asymmetric encryption algorithms.
- Interpret hash algorithms and their functionalities.
- Solve the problems on digital signatures and digital certificates.

MACHINE LEARNING LAB
CourseCode:GR18A4054

At the end of this course student will be able to

- Illustrate various basic features of python or R-Tool.
- Implement Python script for simple problems and apply pandas for creation of databases.
- Design and analyze various supervised learning mechanisms.
- Design and analyze various unsupervised learning algorithms.
- Illustrate back propagation algorithm and Random Forest Ensemble method

REAL TIME OPERATING SYSTEMS
CourseCode:GR18A4096

At the end of this course student will be able to

- Understand the concepts of Operating system Principles, System Calls and Files.
- Understand the concepts of Operating system Process, Communication and structures.
- Understand the Network topologies and Distributed Operating system.
- Understand the Real-time Languages, Models and Kernel Principles.
- Understand the RTOS Domain Applications.

CYBER SECURITY
CourseCode:GR18A4097

At the end of the course, the student will be able to

- Obtain firm understanding on basic terminology and concepts of cybercrimes and security.
- Analyze the plans of attacks.

- Deal with the security challenges posed by mobile devices.
- Implement the tools to handle security challenges.
- Evaluate the associated challenges and the cost of cybercrimes in Organizations.

SOFT COMPUTING
CourseCode:GR18A4059

At the end of this course student will be able to

- Apply all the Soft Computing Techniques to solve real world problems
- Identify the problems, where Supervised and (Neural Networks) Unsupervised Learning Techniques can be applied
- To know how to evaluate the Fitness function in Genetic Algorithm
- Apply Genetic Algorithm to design New Algorithms/Protocols in any domain
- Differentiate between Fuzzy Model w.r.t Probabilistic Model and Apply Fuzzy Inference Techniques to solve problems in different domain

DESIGN PATTERNS
CourseCode:GR18A4098

At the end of the course, the students will be able to

- Identify categories of design patterns.
- Identify the appropriate design patterns to solve object oriented design problems.
- Develop design solutions using creational patterns.
- Apply structural patterns to solve design problems.
- Construct design solutions by using behavioral patterns.

HUMAN COMPUTER INTERACTION
CourseCode:GR18A4099

At the end of this course student will be able to

- Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
- Design how technologies can be to change people's attitudes and behavior.
- Apply the difference between qualitative and quantitative data and analysis.
- Extract the social Mechanisms that are used by people to communicate and collaborate.
- Explore the user Experience design and analyze the factors involved in design

COMPUTER GRAPHICS
CourseCode:GR18A3060

At the end of this course student will be able to

- To list the basic concepts used in computer graphics.
- To implement various algorithms to draw line, circle, scan and convert the basic geometrical primitives.
- Understand the basics of different algorithms for drawing 2D primitives such as transformations, area filling and clipping.
- To describe the importance of viewing and projections.
- To define the fundamentals of animation, virtual reality and its related technologies

BIG DATA ANALYTICS
CourseCode:GR18A4100

At the end of this course student will be able to

- Apply the Big Data Analytic techniques for Business Applications

- List the capabilities of Hadoop and HDFS
- Describe the use of Map Reduce
- Examine Job Execution in Hadoop Environment
- Explore data stores on Hadoop

SOFTWARE MEASUREMENTS AND METRICS
CourseCode:GR18A4101

At the end of this course student will be able to

- Identify and apply various software metrics, which determines the quality level of software.
- Compare and Pick out the right reliability model for evaluating the software.
- Develop correct and robust software products.
- Evaluate the reliability of any given software product.
- Design new metrics and reliability models for evaluating the quality level of the software based on the requirement

ECONOMIC POLICIES IN INDIA
CourseCode:GR18A3122

At the end of this course student will be able to

- Familiarize with the nature of business environment and its components.
- The students will be able to demonstrate and develop conceptual framework of business environment.
- Understand the definition of ethics and the importance and role of ethical behavior in the business world today.
- Explain the effects of government policy on the economic environment.
- Outline how an entity operates in a business environment.