Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Computer Engineering Groups

Program Code : CO/CM/CW — **With Effect From Academic Year: 2017 - 18**

Duration of Program : 6 Semesters — **Duration : 16 Weeks**

Semester : Fifth — **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory						Practical						
				L	T	P		Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total	
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	Environmental Studies	EST	22447	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Operating Systems	OSY	22516	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Advanced Java Programming	AJP	22517	3	1	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
4	Software Testing	STE	22518	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Elective (Any One)																				
4	Client Side Scripting Language	CSS	22519	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
	Advanced Computer Network	ACN	22520	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
	Advanced Dabase Management Systems	ADM	22521	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
5	Industrial Training	ITR	22049	-	-	6	6	--	--	--	--	--	--	--	75#	30	75~	30	150	60	150
6	Capstone Project Planning	CPP	22050	-	-	2	2	--	--	--	--	--	--	--	25@	10	25~	10	50	20	50
			Total	**15**	**1**	**16**	**32**	--	**350**	--	**150**	--	**500**	--	**200**	--	**200**	--	**400**	--	**900**

Student Contact Hours Per Week: **32 Hrs.** Medium of Instruction: **English**

Theory and practical periods of 60 minutes each. Total Marks : **900**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**
- **Evalution of Industrial Training and its reports is to done during this semester. Credit of Industrial Training will not affect the framing of time table.**

Program Name : **All Branches of Diploma in Engineering and Technology.**

Program Code : **CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/ MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC**

Semester : **Fourth**

Course Title : **Capstone Project – Planning**

Course Code : **22050**

1. RATIONALE

According to the requirement of National Board of Accreditation (NBA), 'learning to learn' is an important Graduate Attribute (GA No.11). It is required to develop this skill in the students so that they continue to acquire on their own new knowledge and skills from different 'on the job experiences' during their career in industry. An educational 'project' just does that and may be defined as ***'a purposeful student activity, planned, designed and performed by a student or group of students to solve/ complete the identified problem/task, which require students to integrate the various skills acquired over a period to accomplish higher level cognitive and affective domain outcomes and sometimes the psychomotor domain outcomes as well'***. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

a) Initiative, confidence and ability to tackle new problems
b) Spirit of enquiry
c) Creativity and innovativeness
d) Planning and decision making skills
e) Ability to work in a team and to lead a team
f) Ability of self directed learning which is required for lifelong learning
g) Persistence (habit of not giving up quickly and trying different solutions in case of momentary failures, till success is achieved)
h) Resourcefulness
i) Habit of keeping proper records of events and to present a formal comprehensive report of their work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Plan innovative/creative solutions independently and/or collaboratively to integrate various competencies acquired during the semesters to solve/complete the identified problems/task/shortcomings faced by industry/user related to the concerned occupation.**

3. COURSE OUTCOMES (COs)

The following could be some of the major course outcomes depending upon the nature of the projects undertaken. However, in case of some projects few of the following course outcomes may not be applicable.

a) Write the problem/task specification in existing systems related to the occupation.
b) Select, collect and use required information/knowledge to solve the problem/complete the task.
c) Logically choose relevant possible solution(s).
d) Consider the ethical issues related to the project (if there are any).
e) Assess the impact of the project on society (if there is any).
f) Prepare 'project proposals' with action plan and time duration scientifically before beginning of project.

g) Communicate effectively and confidently as a member and leader of team.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical				
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	2	2	--	--	--	--	--	--	--	25@	10	25~	10	50	20

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. Capstones Project

One of the dictionary meaning is the 'crown' or the stone placed on top of the building structure like 'kalash on top of Temples and Mosques' or 'Cross on top of churches'. Capstone projects are culminating experiences in which students synthesize the competencies acquired over whole programme. In some cases they also integrate cross-disciplinary knowledge. Thus Capstone projects prepare students for entry into a career and can be described as a 'rite of passage' or 'minimal threshold' through which participants change their status from student to graduate. A capstone project therefore should serve as a synthesis — reflection and integration — to bridge the real-world preparatory experience to real life. Thus capstone project should have emphasis on integration, experiential learning, and real-world problem solving and hence these projects are very important for students. To develop the highly essential industry oriented skills and competencies in the students, the capstone projects are offered in the last two semesters to serve for following purposes:

a) Integrate the competencies acquired by the students in the previous and current semesters.
b) Provide opportunities for interdisciplinary work in tackling problems likely to be faced by them in industry which are exciting and challenging.

6. Capstone Project Planning

Students are supposed to find out a suitable project and prepare a detailed plan in fifth semester so that it can be executed smoothly in sixth semester. The main characteristic of any project whether small or big is that it requires simultaneous application of various types of skills in the different domains of learning. Moreover, project normally do not have a predefined single solution, in other words for the same problem different students may come up with different but acceptable solutions. Further, in the process of arriving at a particular solution, the student must be required to make a number of decisions after scrutiny of the information s/he has accumulated from experiments, analysis, survey and other sources.

The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. A detailed project report is to be prepared as project progresses, which has to be submitted after the project is over. For self assessment and reflection students have to also prepare a portfolio of learning.

During the guidance and supervision of the project work, teachers' should ensure that students acquire following ***learning outcomes*** (depending upon the nature of the project work some of these learning outcomes may not be applicable):

a) Show the attitude of enquiry.
b) Identify the problems in the area related to their programme.
c) Identify the information suggesting the cause of the problem and possible solutions.
d) Assess the feasibility of different solutions and the financial implications.

e) Collect relevant data from different sources (books/internet/market/suppliers/experts etc. through surveys/interviews).
f) Prepare required drawings and detailed plan for execution of the work.
g) Work persistently and participate effectively in group work to achieve the targets.
h) Work independently for the individual responsibility undertaken.
i) Ask for help from others including guide, when required.
j) Prepare portfolio to reflect *(chintan-manan)* on experiences during project work.
k) Prepare seminar presentations to present findings/features of the project.
l) Confidently answer the questions asked about the project.
m) Acknowledge the help rendered by others in success of the project.

If students are able to acquire these *learning outcomes*, then they would be able to acquire the COs as discussed in section 3.

7. Scopes of Projects

Scope of the project work should be decided based on following criteria:

a) Relation to diploma programme curriculum: When students intend to select topics for the project work they need to choose a project which relates well to their curriculum (It may be beyond curriculum, but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.

b) Abilities possessed by the group of students: Projects should be chosen so that it can be completed mainly using students' problem solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are more complex and challenging. Teachers should guide students to choose challenging projects according to the students' ability.

c) Resources Available: Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:

i. Time available
ii. Raw Material/Components required
iii. Manufacturing/Fabrication equipment and tools required
iv. Testing/Measuring equipment and instruments required
v. Access to Journals (Library/Digital)
vi. Expertise for theoretical guidance (available in polytechnic, nearby institutes or nearby industries)
vii. Expertise and technology required for fabrication (if required)
viii. Software required.

An important aspect to be considered is to decide who will choose a project. The best practice is that teacher should guide students about the above factors to be considered for choosing the project and based on these factors students should do the ground work and identify the possible projects and teachers should work as only facilitator and Guide in final selection of the project title and its scope.

d) Suggested Type of Capstone Projects

In general, the projects that the students can take up could be of the following types;

i. Feasibility studies.
ii. Design projects
iii. Market surveys about raw material, components or finished products.
iv. Prototype (design, make, test and evaluate).
v. Advanced experimental work requiring the development of existing equipment to be used and developed.
vi. Field works: This could include surveys, using equipment, charting data and information from visual observation.

vii. Comparative Studies: Theoretical study of two systems/mechanisms/ processes in detail and comparing them on the basis of cost/energy conservation/impact on environment/technology used etc.
viii. Application of Emerging technology: Theoretical study of some emerging technology and feasibility of its application in some real life situation in detail.
ix. Fabrication of some equipment/machine etc.
x. Construction of some structure.
xi. Development of software or use of software for solving some broad-based problem.

8. GUIDELINES FOR UNDERTAKING A PROJECT

The selection of the *Capstone Project title* must have emphasis to the Elective courses/ Elective Group taken for the study and exam for 5th and 6th semester. The students will then work on the identified problem/task through a rigorous process of understanding and analyzing the problem, conducting a literature search, deriving, discussing (monitored by the guide every fortnight) and designing the ***Semester V 'Project Proposal'*** with the following ***sub-titles***:

a) Rationale (one page)
b) Introduction
c) Literature Survey
d) Problem Definition
e) Proposed Methodology of solving Identified problem
f) In-case some prototype has to be fabricated then its tentative design and procedure for making it should be part of the proposal.
g) Resources and consumables required.
h) Action Plan (sequential list of activities with probable dates of completion)

As soon as the 'Project Proposal' is approved by the teacher, the student will begin to maintain a dated ***'Project Logbook'*** for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This *'project logbook'* should be got signed by the teacher at regular intervals for progressive assessment to match the project proposal. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the 'Project Report' at the end of the semester by him/her.

9. PORTFOLIO FOR SELF-DIRECTED LEARNING

To ensure that students acquire these outcomes, students should also be guided to prepare a **'Portfolio',** so that they may reflect on their weaknesses/mistakes and learn from them. ***Students should also be encouraged to discuss with their guide and record not only technical problems but also problems related to group work, planning, execution, leadership in the team etc., so that students can also identify their weaknesses in affective domain and take remedial actions to overcome the same.*** If they wish, the students can also show their portfolio to their teachers (whom they trust) for obtaining teachers' comments on their reflection for pointing out their mistakes so that they can improve their performance.

'Portfolio' is the record of the reflection (thinking or *chintan-manan*) on experiences to which students undergo during the different stages of the project. In a portfolio, students record their critical experiences and reflect (think or do *chintan-manan*) on them in writing. This process of reflecting on the experiences make them learn from their mistakes and build on their strengths. To help students in reflection, a Portfolio format with reflective prompts (simple thought provoking questions) for different stages of the project is given as annexure B.

12.1 Purposes of Portfolio Preparation

Reflection by self is important since group work is so complex that it is difficult for teachers to appreciate the real problems amongst the students. In a portfolio, prompts (simple thought provoking questions) are given to trigger reflection on different aspects of project work. Prompts help the students to ask questions from themselves regarding different aspects of the project work and interpersonal relationships. Process of answering these questions forces students to think about behavioral problems and possible remedies/solution to deal with those problems. Portfolio preparation therefore helps in reflection on building the strengths and elimination of the weaknesses of the students pertaining to following qualities which the industry also need.

a) Plan properly for execution of given work.
b) Take appropriate decisions.
c) Arrange resources.
d) Work as member and leader of team.
e) Communicate properly.
f) Resolve the conflicts.
g) Manage the time well.
h) Have concern for ethical, societal and environmental issues.
i) Learn-to-learn from experiences.

It may be seen that these qualities are not directly related with the theoretical subject knowledge and can be developed only through real life experiences. Project work is one such type of experience where opportunity is available to develop all these qualities.

However, even during project work, emphasis of most of the students and teachers remains on development of the technical knowledge and skills while development of above qualities is neglected. Students can develop these qualities if they reflect (do thinking or *Chintan-Manan*) on their experiences from the point of view of these qualities and find out their own weaknesses and strengths. Because if somebody wants to improve his/her abilities then first step for that person is to have self awareness about his/her weaknesses and strengths.

Though portfolio preparation requires considerable time, it is essential, if we want to learn from the experiences and develop these qualities. Writing down reflections helps in better reflection as it is well known that when a person starts writing something he/she becomes more cautious about his/her view and evaluate those views before writing. Thus process of writing improves the quality of reflection or thinking. Moreover, if reflections on different stages of work are written down, over a period of time a large amount of reflection can be generated, and if this reflection is looked back, it may help in identifying some pattern of behaviour in individual which may be improved or rectified latter on as per requirement.

12.2 Guidelines for Portfolio Preparation and assessment

The main purpose of portfolio preparation is learning based on self-assessment and ***portfolio is not to be used for assessment in traditional sense.***

a) Each student has to prepare his/her portfolio separately. However, he/she can discuss with the group members about certain issues on which he/she wants to write in the portfolio.
b) For fifth semester and sixth semester, there will be only one portfolio but it will have two separate parts, first part for project planning (having two sections A and B) second part for project execution. (having two sections C and D)
c) Whatever is written inside the ***portfolio is never to be used for assessment***, because if teachers start giving marks based on whatever is written in the portfolio, then students would hesitate in true self-assessment and would not openly describe their own mistakes or shortcomings.

d) Some marks are allocated for portfolio, these marks are to be given based on how sincerely portfolio has been prepared and not based on what strengths and weaknesses of the students are mentioned in the portfolio.
e) Portfolio has to be returned back to the students after assessing it (assessment is only to see that whether portfolio is completed properly or not) by teachers. Because student is the real owner of the portfolio.
f) Students mainly learn during portfolio preparation, but they can further learn if they read it after a gap. And hence they are supposed to keep the portfolios with them even after completion of the diploma because it is record of their own experiences (it is like diary some people write about their personal experiences), because they can read it again after some time and can revise their learning (about their own qualities)

Even after completion of Diploma programme, students can continue to prepare portfolio related to different experiences in their professional and personal life and by refereeing back to old portfolios after a gap of some years, they can learn that how their personality has evolved over the years. They can also see a pattern of behaviour in their own personality which may be source of their weaknesses or strengths and they can take remedial measures based on this study of their portfolios.

Note

Since some sections of the portfolio are related with interpersonal relationships and student may find it difficult to write these experiences in English. Language should not be the barrier in reflection and hence students should be allowed to prepare the portfolio in their preferred language such as *Marathi* or *Hindi if they find it difficult to write in English.*

The amount and type of mistakes identified by students would not affect the marks received by the students. The total 7 Marks allocated for portfolio (4 marks for PA and 3 for ESE) are only for proper completion of the portfolio.

10. PROJECT REPORT

At the end of fifth Semester, the student will prepare a Semester V 'Project Report' with the following sub-titles:

- Certificate (in the Format given in this document as annexure A)
- Acknowledgements
- Abstract (in one paragraph not more than 150 words)
- Content Page
- Chapter-1 Introduction and background of the Industry or User based Problem
- Chapter-2 Literature Survey for Problem Identification and Specification,
- Chapter-3 Proposed Detailed Methodology of solving the identified problem with action plan
- References and Bibliography

Note: The report should contain relevant diagrams and figures, charts.

11. ASSESSMENT OF CAPSTONE PROJECT – PLANNING

Like other courses, assessment of Project work also has two components, first is progressive assessment, while another is end of the term assessment. The mentor faculty will undertake the progressive assessment to develop the COs in the students. They can give oral informal feedback about their performance and their interpersonal behaviour while guiding them on their project work every week. The following characteristics/ qualities informally or formally should be considered during different phases of the project work which will be assessed thrice as discussed in sub-section.

(A) Initial Phase

i. **Definition of the Problem**
   a) Accuracy or specificity

b) Appropriateness with reference to desired course outcomes.

ii. **Methodology of Conduction the Project**
   a) Appropriateness
   b) Flexibility
   c) Clarity

iii. **General Behaviour**
   a) Initiative
   b) Resourcefulness
   c) Reasoning ability
   d) Imagination/creativity
   e) Self-reliance

(B) Intermediate Phase

i. **Performance of Student**
   a) Ability to follow correct procedure
   b) Manipulative skills
   c) Ability to collect relevant information
   d) Ability to observe, record & interpret
   e) Ingenuity in the use of material and equipment
   f) Target achievement

ii. **General Behaviour**
   a) Persistence
   b) Interest
   c) Commitment
   d) Confidence
   e) Problem solving ability
   f) Decision making ability
   g) Initiative to act
   h) Team spirit.
   i) Sharing of material etc.
   j) Participation in discussion
   k) Completion of individual responsibilities

(C) Final Phase

i. **Quality of Product**
   a) Dimensions
   b) Shape
   c) Tolerance limits
   d) Cost effectiveness
   e) Marketability
   f) Modernity

ii. **Quality of Report**
   a) Clarity in presentation and organization
   b) Styles and language
   c) Quality of diagrams, drawings and graphs
   d) Accuracy of conclusion drawn
   e) Citing of cross references
   f) Suggestion for further research/project work

iii. **Quality of presentation**
   a) Understanding of concepts, design, methodology, results, implications etc
   b) Communication skills
   c) Ability to draw conclusions and generalization

12. PROGRESSIVE ASSESSMENT (PA) GUIDELINES

15 Marks are allocated for the formal progressive assessment. However, following points need consideration during the three times of formal progressive assessment of the students at the end of 4th, 12th and 14th week.

a) ***Fortnightly monitoring*** by the mentoring teachers is necessary and marks given progressively (even the gradual chapter preparation) so that that students will not copy earlier reports or get things done or reports from the market. The ***students should not be awarded marks*** if they have not done on their own.

b) For progressive assessment at the end of 14th week, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the capstone project work they have to carry out in future).

c) Although marks for *portfolio preparation* is to be given at the end of 14th week, students should be asked to bring their partly prepared portfolio (relevant sections prepared) also during their assessment at the end of 4th week and 12th week.

d) Marks for portfolio preparation should be based only on proper preparation of portfolio by writing answers to most of the prompts (self-questions to students) in the portfolio. These marks should not be based on the mistakes indicated by students in their working (while answering the prompts) and corrective actions taken by them.

e) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)

f) ***Originality of the report*** (written in own words) would be given more importance rather than use of glossy paper or multi-colour printing.

12.1 Progressive Assessment (PA) Criteria

Allocation Criteria of the ***25 marks*** are for the Progressive Assessment (PA).

S. No.	Criteria	Marks
	First Progressive Assessment at the end of 4th week	
1	**Problem Identification/Project Title** (Innovation /Utility of the Project for industry/ User/Academia) marks to be also given based on (i) Accuracy or specificity of the scope and (ii) Appropriateness of the work with reference to desired course outcomes.	02
2	**Industrial Survey and Literature Review**: marks to be given based on extent/volume and quality of the survey of Industry / Society / Institutes/Literature/Internet for Problem Identification and possible solutions	02
3	**General Behaviour**: initiative, resourcefulness, reasoning ability, imagination/creativity, self-reliance to be assessed **Note:** Oral feedback on general behaviour may also be given whenever relevant/ required during day to day guidance and supervision. **Only written feed-back/suggestions**	**00**
	Second Progressive Assessment at the end of 12th week	
4	**Project Proposal**: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester	**03**

S. No.	Criteria	Marks
5	**Execution of Plan in fifth semester** (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	02
6	**Log book** (for work done in fifth semester, detailed and regular entry would be basis of marks)	02
7	**General Behaviour** (persistence, interest, confidence, problem solving ability, decision making ability, initiative to act, team spirit, sharing of material etc., participation in discussions, completion of individual responsibilities, leadership) **Note:** Oral feedback on general behaviour should also be given whenever relevant/ required during day to day guidance and supervision. **Only written feed-back./suggestions**	00
	Third Progressive Assessment at the end of 14th week	
8	**Portfolio for Self learning and reflection** (marks based on amount of reflection and completion of the portfolio for work done in fifth semester)	**04**
9	**Final Report writing including documentation**. (marks based on: clarity in presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work) Report has to be prepared for work done in fifth semester and planning for sixth semester work.	**06**
10	**Presentation** (presentation skills including communication skills to be assessed by observing quality of presentations and asking questions during presentation and viva/voce) Report has to be prepared for work done in fifth semester and plan for sixth semester.	**02**
11	**Defence** (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	**02**
	Total	**25**

13. END-SEMESTER-EXAMINATION (ESE) ASSESSENT GUIDELINES

The ***remaining 25 marks*** are for the end semester examination (ESE). And marks would be given according to following criteria. Moreover, the suggested evaluation scheme can be changed slightly by the external faculty according to nature of problem / project following University guidelines..

a) For each project, the one or two students from the concerned group of students should be asked to present the power point presentation before the external and internal (for about 10 minutes) and then external should ask the questions from each member of the group separately to ascertain the contribution made by each student.

b) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks commensurate with their efforts.)

c) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).

d) Originality of the report (written in own words, even if there are grammatical and spelling mistakes) would be given more importance rather than quality of printing and use of glossy paper (and preparing report by copy pasting from other reports).

Note: It is very common that people are not able to complete the project in time despite best of their efforts. (Please recall that how many times people are able to complete in time, personal projects such as building own house or professional projects such as developing the lab in the institute). So if students have put in enough genuine efforts but could not complete the project in time then we should consider it sympathetically and they should be given marks based on their efforts and they should get more marks as compared to students who have got their projects completed by taking major help from others/market.

13.1 End-Semester-Examination (ESE) Assessment Criteria.

Allocation Criteria of the ***25 marks*** are for the end-semester-examination (ESE)

S. No.	Description	Marks
1	**Problem Identification/Project Title** (innovation /utility of the project for industry/ user/academia) marks to be also given based on (i) accuracy or specificity of the scope and (ii) appropriateness of the work with reference to desired course outcomes.	**02**
2	**Industrial Survey and Literature Review** (marks to be given based on extent/volume and quality of the survey of industry / society / institutes/literature/internet for problem identification and possible solutions)	**02**
3	**Project Proposal**: Marks to be given also based on appropriateness, flexibility, detail and clarity in methods/planning. (In case of working models, detailed design and planning of fabrication/assembly of the prototype has to be also assessed). This proposal should include whole project including work to be done in sixth semester.	**02**
4	**Execution of Plan in fifth semester** (Since project is to be fully completed in sixth semester, the part of the project which is planned to be completed in fifth semester is only to be evaluated: marks to be also given based on ability to collect relevant information, ability to follow correct procedure, manipulative skills, ability to observe, record & interpret, ingenuity in the use of material and equipment, target achievement) In case of working models, quality of workman ship (including accuracy in dimensions, shape, tolerance limits), appropriateness of raw materials/components/ technology being used, functioning of the prototype, cost effectiveness, marketability, modernity etc. has to be also assessed.	**02**
5	**Log book** (for work during fifth semester, marks to be given based on detailed and regular entry	**03**
6	**Portfolio for Self learning and reflection** (for work during fifth semester) Marks based on amount of reflection and completion of portfolio.	**03**
7	**Project Report including Documentation** (for work during fifth semester and planning for sixth semester) (marks based on: clarity in	**04**

S. No.	Description	Marks
	presentation and organization; styles and language; quality of diagrams, drawings and graphs; accuracy of conclusion drawn; citing of cross references; suggestion for further research/project work)	
8	**Presentation** (presentation skills including communication skills to be assessed by observing the quality of presentations and asking questions during presentation and viva/voce) Presentation should be based on work done in fifth semester and planning for sixth semester.	**03**
9	**Defence** (ability to defend the methods/materials used and technical knowledge, and involvement of individual to be assessed by asking questions during presentation and viva/voce)	**04**
	Total	**25**

14. SPECIAL TEACHING STRETAGIES (If any)

a) Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator

b) Teachers should guide students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.

c) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.

d) Teachers should motivate students to maintain log book and prepare portfolio. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.

e) Teachers should also encourage students to openly discuss their weaknesses and shortcomings in portfolio and teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them and their marks would not be affected by revealing their mistakes. Marks related to portfolio are awarded based only on the sincerity with which it is prepared and not based on strengths and weaknesses of students.

f) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.

g) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

Annexure A

CERTIFICATE

This is to certify that Mr./Ms.....

From .....College having Enrolment No: .....

has completed ***Report on the Problem Definition/ Semester V Project Report/ Final Project Report*** having title .....

individually/ in a group consisting of..... persons under the guidance of the Faculty Guide.

.....
The mentor from the industry for the project
Name: .....
Telephone:.....

Annexure B

Portfolio for Self Directed Learning for Major Project Work

Name of Student:.....

Semester:.....Programme/Branch:.....

Roll Number:.....

Title of the Project:.....

Name and Designation of Project Guide:.....

Name of Polytechnic:.....

Part A: Selecting the Project and Team (Answers to the following questions to be included in 'Portfolio' as Reflection related to formation of group and finalization of project topic).

Note: This section has to be prepared just after the finalization of the Project topic and formation of the Project Team .

1. How many alternatives we thought before finalizing the project topic?
2. Did we consider all the technical fields related to branch of our diploma programme?
3. Why we found present project topic as most appropriate?
4. Whether all the group members agreed on the present project topic? If not? What were the reasons of their disagreements?
5. Whether the procedure followed in assessing alternatives and finalizing the project topic was correct? If not, discuss the reasons.
6. What were the limitations in other alternatives of project topic?
7. How we formed our team?
8. Whether we faced any problem in forming the team? If yes, then what was the problem and how was it resolved?

9. Am I the leader of our project team? If yes, then why was I chosen? If not, why I could not become the project team leader?
10. Do I feel that present team leader is the best choice available in the group? If yes, then why? If not, then why?
11. According to me who should be the leader of the team and why?
12. Can we achieve the targets set in the project work within the time and cost limits?
13. What are my significant good/ bad sharable experiences while working with my team which provoked me to think? What I learned from these experiences?
14. Any other reflection which I would like to write about formation of team and finalization of project title, if any?

Part B: Reflection related to project planning (Answers to the following questions to be included in 'Portfolio' as reflection on planning)

Note: This section has to be prepared just after the finalization of the 'Project Proposal'.

1. Which activities are having maximum risk and uncertainty in our project plan?
2. What are most important activities in our project plan?
3. Is work distribution is equal for all project group members? If not? What are the reasons? How we can improve work distribution?
4. Is it possible to complete the project in given time? If not what are the reasons for it? How can we ensure that project is completed within time.
5. What extra precaution and care should be taken in executing the activities of high risk and uncertainty? If possible, how such risks and uncertainties can be reduced?
6. Can we reduce the total cost associated with the project? If yes, then describe the ways?
7. For which activities of our project plan, arrangement of resources is not easy and convenient?
8. Did we make enough provisions of extra time/expenditure etc. to carry out such activities?
9. Did we make enough provisions for time delays in our project activity? In which activities there are more chances of delay?
10. In our project schedule, which are the days of more expenditure? What provisions we have made for availability and management of cash?
11. Any other reflection which I would like to write about project planning?

Teacher Evaluation Sheet (ESE)
for
Capstone Project Planning

Name of Student: .....

Name of Programme..... **Semester:** .....

Course Title and Code:.....

Title of the Capstone Project: .....

A. POs addressed by the Capstone Project (Mention only those predominant POs)

a) .....
b) .....
c) .....
d) .....

B. COs addressed by the Capstone Project (Mention only those predominant POs)

a) .....
b) .....
c) .....
d) .....

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT

a) **Unit Outcomes (Cognitive Domain)**

i. .....
ii. .....
iii. .....
iv. .....

b) **Practical Outcomes (in Psychomotor Domain)**

i. .....
ii. .....
iii. .....
.....
iv. .....
.....

c) **Affective Domain Outcomes**

i. .....
ii. .....
iii. .....
iv. .....

D. SUGGESTED RUBRIC FOR ASSESSMENT OF CAPSTONE PROJECT

(please tick below the appropriate rating i.e. poor, average etc., for each characteristic to be assessed and give marks in the respective cell according to performance of student)

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
First Progressive Assessment (at the end of 4th week)							

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
1	**Problem/Task Identification (Project Title)**	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	i. Take care of more than three POs ii. Scope of problem/task very clear	02	
2	**Literature Survey /Industrial Survey**	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest	02	
Second Progressive Assessment (at the end of 12th week)							
3	**Project proposal**	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)	02	
4	**Execution of Plan in fifth semester (please write by hand about students performance in appropriate column)**					02	
5	**Log Book**	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week	03	
Third progressive Assessment at the end of 14th week							
6	Portfolio Preparation	Answer to only few of the 'questions from self' (prompts)	Answer to only about 50% of the 'questions from self'	Answer to most of the 'questions from self' (prompts) written. Some	Answer to nearly all the 'questions from self' (prompts) written in detail	03	

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent	Max. Marks	marks obtained
		written. Answers are not in much detail	(prompts) written. Answers are not in much detail	answers are not in much detail			
7	**Final Report Preparation**	Very short, poor quality sketches, Details about methods, material, precaution and conclusions omitted, some details are wrong Nearly sufficient and correct details about methods, material, precautions and conclusion. but clarity is not there in presentation, not enough graphic description.	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables, charts and sketches	**04**	
8	**Presentation**	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented	**03**	
9	**Defense**	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly	**04**	
					Total marks	**25**	

Any Other Comment:

.....

.....

Name and designation of the Faculty Member.....**Signature**.....

.....

Program Name : **Diploma in Civil Engineering/ Computer Engineering / Information Technology /Automobile Engineering/ Fashion & Clothing Technology / Electrical Engineering Group / Electronics Engineering Group**

Program Code : **CE/CR/CS/CO/CM/CW/IF/AE/DC/EE/EP/EU/DE/EJ/ET/EN/ EX/EQ/IE/IS/IC**

Semester : **Fifth**

Course Title : **Environmental Studies**

Course Code : **22447**

1. RATIONALE

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution pose major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental aspects, which shall provide an insight into various environment related issues. Environmental studies are an interdisciplinary academic field that integrates physical, chemical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental system & gives an insight into solutions of environmental problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Diagnose and manage environment related issues**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Develop Public awareness about environment
b. Select alternative energy resources for Engineering Practice
c. Conserve Ecosystem and Biodiversity
d. Apply techniques to reduce Environmental Pollution
e. Manage social issues and Environmental Ethics as lifelong learning

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory						Practical							
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	

(#) Online Theory Examination.

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

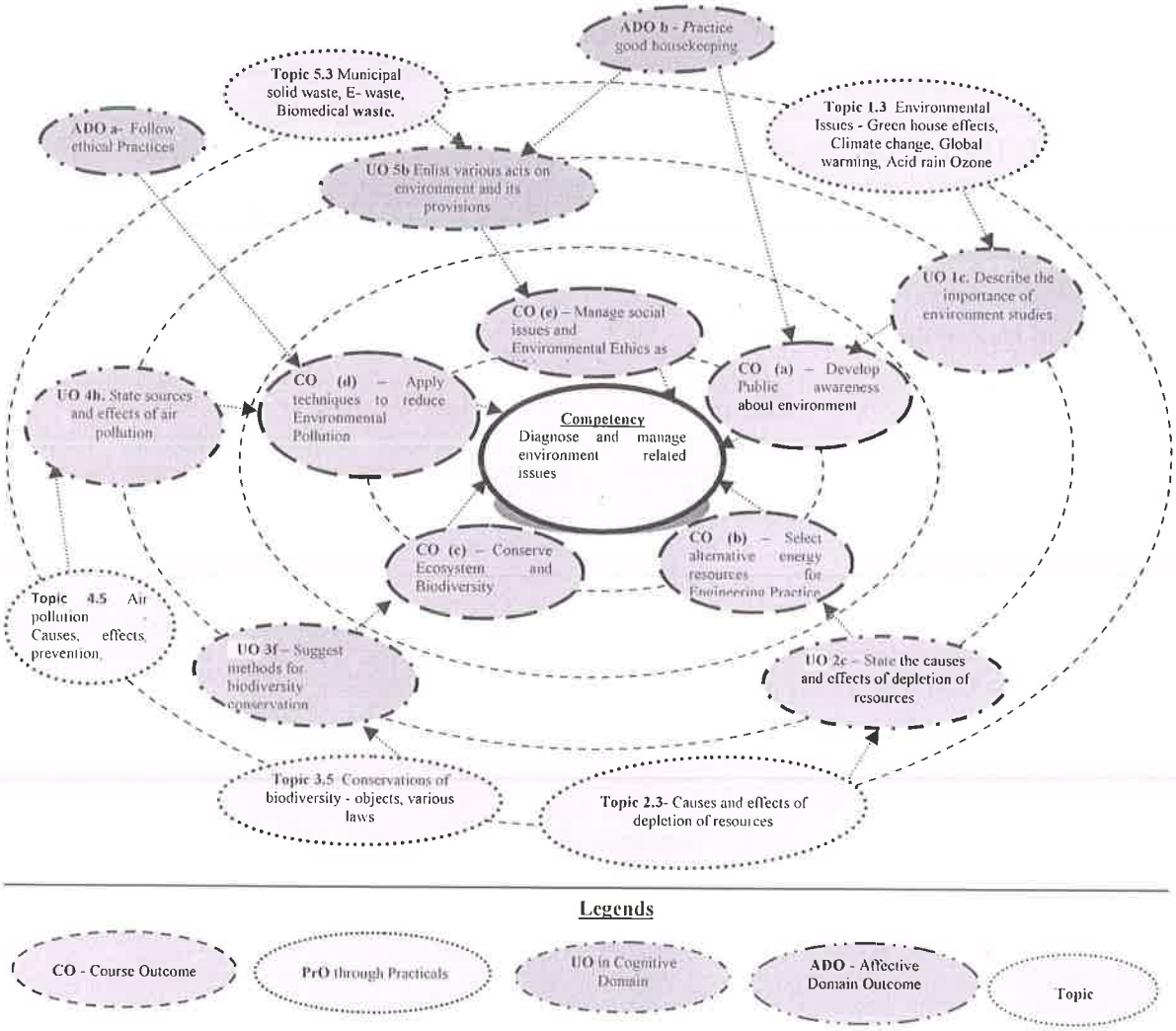

Figure 1 - Course Map

6. SUGGESTED EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	NIL		
	Total		

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	NIL	
Total		

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	NIL	-

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Environment	1a. Discuss the scope of Environment. 1b. Describe various types of environment 1c. Describe the importance of environment studies. 1d. Discuss about the need of public awareness about environment. 1e. Describe various environmental issues.	1.1 Definitions, need of environmental studies. 1.2 Segments of environment- Atmosphere, Hydrosphere Lithosphere, Biosphere. 1.3 Environmental Issues - Green house effects, Climate change, Global warming, Acid rain Ozone layer depletion, Nuclear accidents. 1.4 Concept of 4R (Reduce, Reuse, Recycle and Recover), 1.5 Public awareness about environment.
Unit– II Energy Resources	2a. List various natural resources. 2b. Describe Renewable, Nonrenewable and Cyclic resources. 2c. State the causes and effects of depletion of resources. 2d. State advantages and disadvantages of forms of energy. 2e. Select appropriate solutions of efficient use of energy. 2f. State the impacts of overuse of natural resources.	2.1 Natural Resources - Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources. 2.2 Renewable, Non-renewable and Cyclic Resources. 2.3 Causes and effects of depletion of resources. 2.4 Energy forms (Conventional and non-conventional). 2.5 Present global energy use and future demands. 2.6 Energy conservation. 2.7 Over use of natural resources and its impacts on environment.
Unit- III Ecosystem and Biodiversity	3a. State the aspects and division of ecosystem. 3b. State the general characteristics and function of ecosystem. 3c. List levels of biodiversity. 3d. Enlist the endangered species. 3e. Describe value of biodiversity. 3f. Suggest methods for biodiversity conservation.	3.1 Ecosystem - Definition , Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem. 3.2 Biodiversity - Definitions, Levels, Value and loss of biodiversity. 3.3 Biodiversity assessment initiatives in India. 3.4 Threats and Hotspots of biodiversity. 3.5 Conservations of biodiversity - objects, various laws.
Unit– IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation.	4.1 Definition of pollution, types- Natural & Artificial (Man- made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives , preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to prevent air pollution. 4j. State sources and effects of noise pollution. 4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation(domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects, prevention, Ambient air quality standards. 4.6 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.
Unit-V Social Issues and Environmental Education	5a. Elaborate article (48-A) and (51-A (g)) 5b. Enlist various acts on environment and its provisions. 5c. State the roles and responsibilities of CPCB. 5d. Define sustainable development, and EIA. 5e. Describe rain water harvesting and groundwater recharge. 5f. Differentiate between formal and non formal education.	5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts, CPCB and MPCB norms and responsibilities, The role of NGOs. 5.2 Concept of sustainable development, EIA and environmental morality. 5.3 Management Measures - Rain Water harvesting, Ground water recharge, Green Belt Development, Use of Renewable energy, water shed management, interlinking of rivers. 5.4 Role of information technology in environment and human health.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Environment	06	4	6	-	10
II	Energy Resources	10	4	8	-	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Ecosystem and Biodiversity	08	4	4	4	12
IV	Environmental Pollution	16	8	8	4	20
V	Social Issues and Environmental Education	08	4	4	4	12
	Total	**48**	**24**	**30**	**16**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Plant and adopt a tree in your nearby locality/Polytechnic campus and prepare report about its growth and survival after six months with photos.
b. Organize seminar on air pollutants of relevant MIDC area/vehicle
c. Organize poster exhibition about global warming and ozone depletion.
d. Visit a nearest water purification/effluent treatment plant.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Use proper equivalent analogy to explain different concepts.
g. Use Flash/Animations to explain various topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so

that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a report on visit to PUC Center.
b. Visit a near by RO plant and prepare detail technical report.
c. Prepare report on Household water filtration unit
d. Prepare a list of polluted natural resources which are responsible for pollution and collect information on how to manage them .
e. **Collection of Data from Hospital: Collect** everyday information on percentage of solid hazardous and toxic waste for two month
f. **Visit of Municipal Effluent Treatment Plant:** Visit effluent treatment plant and prepare report on waste management.
g. **Visit of Water Treatment Plant:** Visit water treatment plant and prepare report on various units of water treatment and its management.
h. **Preparation of report**: Prepare the chart of solid waste management showing effects on environment.
i. **And any other relevant topic related to course**

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic Environmental Sciences	Michael Allaby	Routledge Publication, 2nd Edition, 2000, ISBN: 0-415-21176-X
2	Environmental Science	Y. K. Singh	New Age International Publishers, 2006, ISBN: 81-224-2330-2
3	Environmental Studies	Erach Bharucha	University Grants Commission, New Delhi
4	Environmental Studies	Rajagopalan	Third Edition, Oxford University Press, USA, ISBN: 9780199459759, 0199459754
5	A text book of Environmental Science	Arvind Kumar	APH Publishing New Delhi
6	A text book of Environmental Studies	Shashi Chawla	Tata Mc Graw-Hill New Delhi

14. SOFTWARE/LEARNING WEBSITES

a. www.eco-prayer.org
b. www.teriin.org
c. www.cpcb.nic.in

d. www.indiaenvironmentportal.org.in
e. www.whatis.techtarget.com
f. www.sustainabledevelopment.un.org
g. www.conserve-energy-future.com

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Fifth**

Course Title : **Operating System**

Course Code : **22516**

1. RATIONALE

An Operating System is basically a system program that controls the execution of application programs and acts as an interface between applications and the computer hardware. It manages the computer system resources to be used in an efficient manner. This course enables to learn internal functioning of operating system and will help in identifying appropriate Operating System for given applications/task. This course is also a prerequisite for the group of courses included in 'Cloud Infrastructure Maintenance' Elective group.

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- **Manage operations of Operating System.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Install operating system and configure it.
b. Use operating system tools to perform various functions.
c. Execute process commands for performing process management operations.
d. Apply scheduling algorithms to calculate turnaround time and average waiting time.
e. Calculate efficiency of different memory management techniques.
f. Apply file management techniques.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

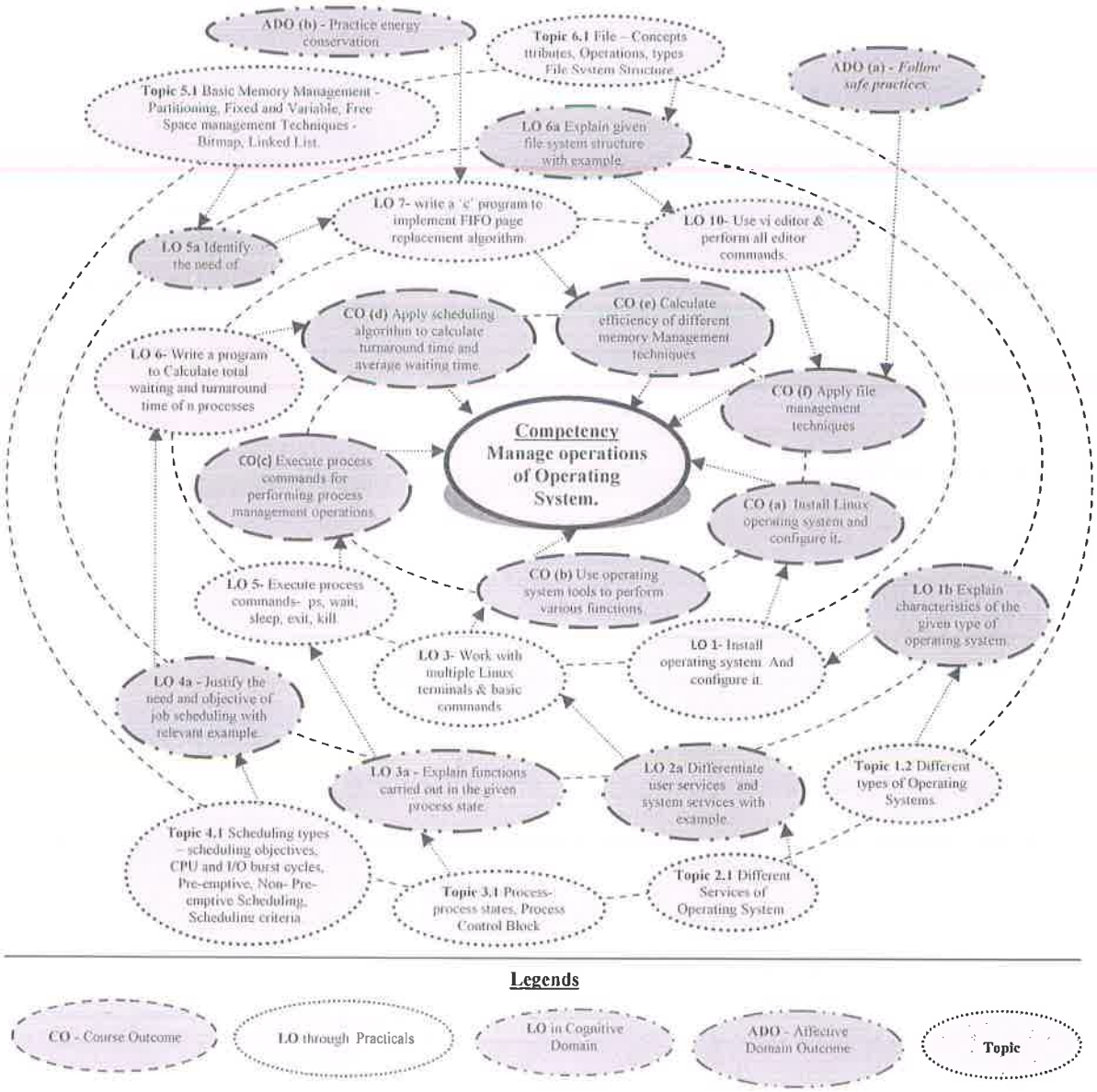

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Practical Outcomes (PrOs	Unit No.	Approx. Hrs. Required
1.	Install and configure Linux (or alike) operating system.	I	02*
2.	Execute general purpose commands date, time, cal, clear, banner, tty, script, man.	I	02*
3.	Work with multiple linux terminals and basic commands: who, who am I, login, passwd, su, pwd.	II	02*
4.	a) Use Operating services(Editor, GUI, File handling.)	II	02*

Sr. No.	Practical Outcomes (PrOs	Unit No.	Approx. Hrs. Required
	b) Run commands to start, stop, and restart the specified service in Linux.		
5.	Execute process commands- ps, wait, sleep, exit, kill.	III	02*
6.	Write a program to calculate total waiting and turnaround time of n processes with First Come First Serve CPU scheduling algorithm.	IV	02
7.	Write a 'C' program to implement FIFO page replacement algorithm.	V	02
8.	Execute file and directory manipulation commands – ls, rm, mv, cp, join, split, cat (file saving and redirection operator), head, tail, touch,	VI	02*
9.	Execute file and directory manipulation commands – diff, comm., pr, chmod, mkdir, rmdir, cd, pwd, dir, cmp. (Use wild card character).	VI	02*
10.	Execute text processing tr, wc, cut, paste, spell, sort, grep, more.	VI	02*
11.	Use vi editor and perform all editor commands.	VI	04*
12.	Write and execute Shell Script by using following Control statements features- "if" statement	VI	02*
13.	Write and execute Shell Script by using following Control statements features- "for" statement, exit, break, continue	VI	02*
14.	Write Shell script to find out whether - Given file exists?	VI	02
15.	Write Shell script to find out whether - File has read, write, and execute permissions?	VI	02*
	Total		**32**

Note

i. *In the above listed example wherever **Linux** as operating system is mentioned, it could be replaced with other alike operating systems such as **Ubuntu, CentOs** or any other OS.*

ii. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

iii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
a.	Installation/configuration of operating system	25
b.	Correctness of Executing various commands	25
c.	Writing and executing programs to get desired output	20
d.	Debugging the program	15
e.	Submit journal report in time	15
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.

c. Demonstrate working as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Linux or alike operating system such as Ubuntu, CentOS or any other.	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of Operating System	1a. Explain the functioning of given component of OS. 1b. Explain characteristics of the given type of operating system. 1c. Identify type of operating system suitable for the given type of application. 1d. Execute command on command line for the given task.	1.1 Operating System – Concept, Components of operating system, operations of OS: Program Management, Resource management, Security and protection. Views of OS: User view, System View 1.2 Different Types of Operating systems- Batch operating system, Multi Programmed, Time Shared OS, Multiprocessor Systems, Distributed Systems, Real time systems. Mobile OS (Android,iOS). 1.3 Command line based OS – DOS, UNIX GUI based OS –WINDOWS, LINUX.
Unit– II Services and Components of Operating System	2a. Start, stop, and restart the given service in Linux. 2b. Explain use of the given System call of specified OS. 2c. Explain process the OS follows in managing the given resource. 2d. Explain use of the given operating system tool.	2.1 Different Services of Operating System. 2.2 System Calls- Concept, types of system calls 2.3 OS Components: - Process Management, Main Memory Management, File Management, I/O System management, Secondary storage management. 2.4 Use of operating system tools- user management, security policy.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		device management, performance monitor, task scheduler
Unit– III Process Management	3a. Explain functions carried out in the given process state. 3b. Describe the function of the given component of process stack in PCB. 3c. Explain characteristics of the given multithreading model. 3d. Describe method of executing the given process command with example.	3.1 Process-: process states, Process Control Block (PCB). 3.2 Process Scheduling- Scheduling Queues, Schedulers, Context switch. 3.3 Inter-process communication (IPC): Introduction, shared memory system and message passing system. 3.4 Threads - Benefits, users and kernel threads, Multithreading Models - Many to One, One to One, Many to Many. 3.5 Execute process commands- like ps, wait, sleep, exit, kill
Unit-IV CPU Scheduling and Algorithms	4a. Justify the need and objective of given job scheduling criteria with relevant example. 4b. Explain with example the procedure of allocating CPU to the given process using the specified OS. 4c. Calculate turnaround time and average waiting time of the given scheduling algorithm. 4d. Explain functioning of the given necessary condition leading to deadlock.	4.1 Scheduling types – scheduling Objectives, CPU and I/O burst cycles, Pre-emptive, Non- Pre-emptive Scheduling, Scheduling criteria. 4.2 Types of Scheduling algorithms - First come first served (FCFS), Shortest Job First (SJF), Shortest Remaining Time(SRTN), Round Robin (RR) Priority scheduling, multilevel queue scheduling. 4.3 Deadlock - System Models, Necessary Conditions leading to Deadlocks, Deadlock Handling - Preventions, avoidance.
Unit –V Memory Management	5a. Describe the working of specified memory management function. 5b. Explain characteristic of the given memory management techniques. 5c. Write algorithm for the given page replacement technique. 5d. Calculate Page fault for the given page reference string.	5.1 Basic Memory Management - Partitioning, Fixed and Variable, Free Space management Techniques - Bitmap, Linked List. 5.2 Virtual Memory – Introduction to Paging, Segmentation, Fragmentation, and Page fault. 5.3 Page Replacement Algorithms: FIFO, LRU, Optimal.
Unit-VI File Management	6a. Explain structure of the given file system with example. 6b. Describe mechanism of the given file access method. 6c. Explain procedure to create and access directories and assign the given files access permissions. 6d. Explain features of the given Raid level structure of hard disk.	6.1 File – Concepts, Attributes, Operations, types and File System Structure. 6.2 Access Methods – Sequential, Direct, Swapping, File Allocation Methods- Contiguous, Linked, Indexed. 6.3 Directory structure-– Single level, two levels, tree-structured directory, Disk Organization and disk Structure- Physical structure, Logical structure, Raid structure of disk, raid level 0 to 6.

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Overview of Operating System	06	02	02	04	08
II	Services and Components of Operating System	06	02	04	04	10
III	Process Management	10	02	04	08	14
IV	CPU Scheduling and Algorithms	10	02	04	08	14
V	Memory Management	10	02	04	08	14
VI	File Management	06	02	04	04	10
Total		**48**	**12**	**22**	**36**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal of practicals.
b. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.
g. Encourage students to refer different websites to have deeper understanding of the subject.
h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Create a report depicting features of different types of Operating systems- Batch operating system, Multi Programmed, Time Shared, Multiprocessor Systems, , Real time systems. Mobile OS with example.
b. Make a comparative statement to calculate page fault for given page reference string by using different page replacement algorithms.
c. Prepare help guide using shell script for all the major Linux commands.
d. Make a comparative chart to calculate total waiting and turnaround time of n processes with different CPU scheduling algorithm.

Any other micro-projects suggested by subject faculty on similar line.
(Use features of 'C' or shell scripts to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Operating System Concepts	Silberschatz, Galvin	John Wiley and Sons, Ninth Edition, 2015, ISBN: 978-51-265-5427-0
2	Operating System	Godbole, Achyut S.	Tata McGraw Hill Education, 2015, ISBN: 9780070591134
3	Operating Systems: Internals and Design Principles	Stallings ,William	Pearsons, 8 edition 2015 ISBN: 978-0133805918
4	Unix Concept and Programming	Das, Sumitabha	McGraw Hill education, 2015, ISBN: 978-0070635463
5	Operating System	Dhamdhere, Dhanjay M.	McGraw Hill, 2015 ISBN MO 978-1-25-900558-9
6	Operating System	Dr. Rajendra Kawale	Devraj Publications,Mumbai ISBN 978-81-933551-1-4

14. SOFTWARE/LEARNING WEBSITES

a) www.cs.wisc.edu/~ bart/537 lecture notes-University of Wisconsin Madison.
b) www.cs.kent.edu/osf o3/notes/index.html- Vilinius Gediminas Technical University
c) http://www.howstuffworks.com/operating-system1.htm
d) www.computerhope.com/jargon/o/os.htm
e) www.en.wikipedia.org/wiki/Operating system
f) https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/12_MassStorage.html


MAHARASHTRA STATE BOARD OF

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Fifth**

Course Title : **Advanced Java Programming**

Course Code : **22517**

1. RATIONALE

Java technology is widely used for web applications development. Based on the object oriented concepts and core Java concepts, this course will equip the students with the required knowledge and skill of object oriented programming approach needed for the development of robust, powerful web applications. Through this course students will get hands-on experience on GUI Technologies viz. AWT and Swings, event handling mechanisms and network programming. The course also gives coverage to various web applications aspects like Database Interaction, server side components and servlets.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop web and stand-alone applications using advanced concepts of Java.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Develop programs using GUI Framework (AWT and Swing).
b) Handle events of AWT and Swings components.
c) Develop programs to handle events in Java Programming.
d) Develop Java programs using networking concepts.
e) Develop programs using database.
f) Develop programs using Servlets.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	1	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.*

5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

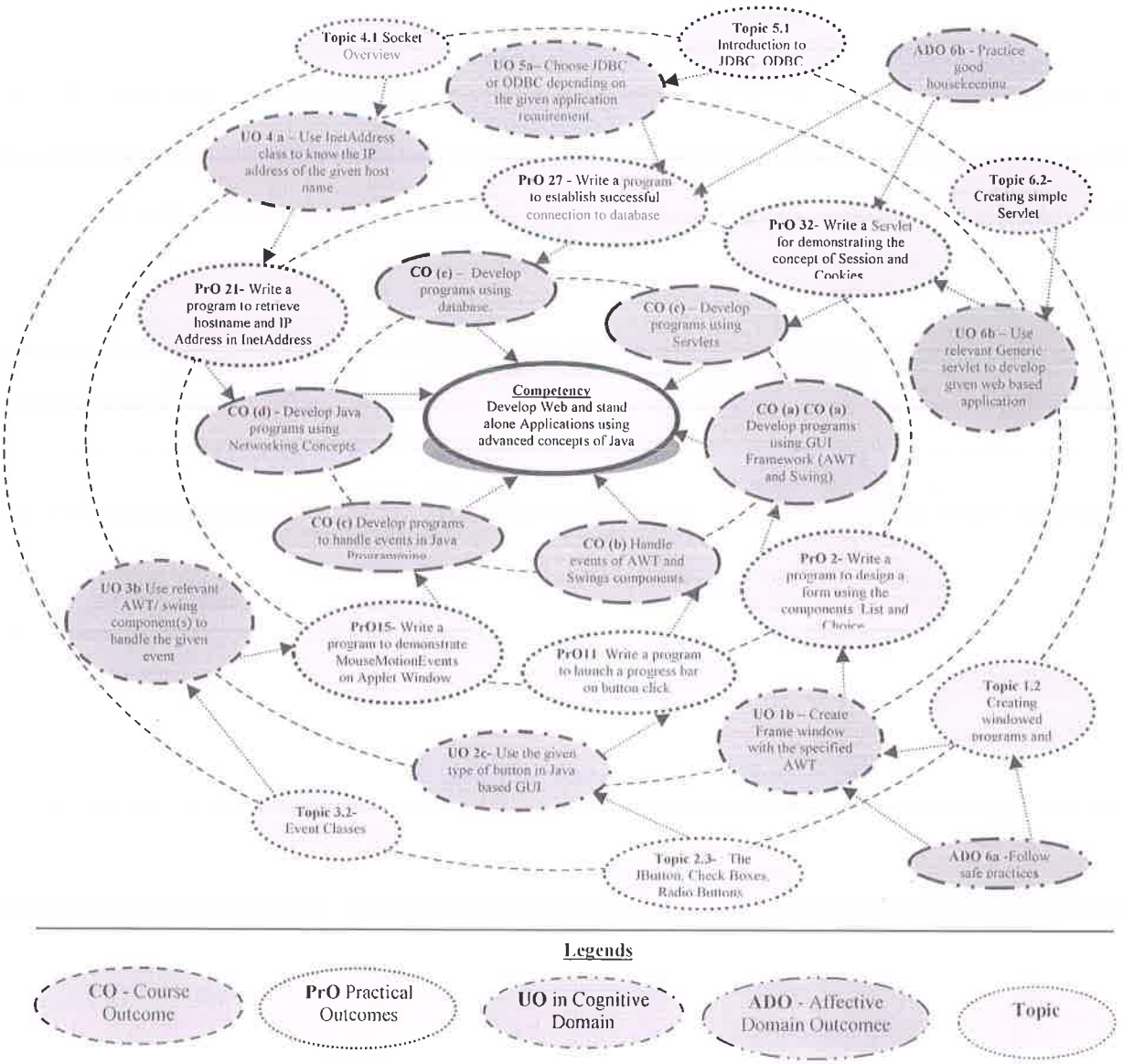

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Write a program to demonstrate the use of components like Label, Textfield, TextArea, Button, Checkbox, RadioButton (CheckboxGroup).	I	02*
2.	Write a program to design a form using the components List and Choice.	I	02*
3.	Write a program to demonstrate the use of Border layout showing four buttons at four sides of an applet with captions "left", "right", "top" and "bottom".	I	02*
4.	Write a program to design a simple calculator to demonstrate the use of Grid layout .	I	02*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5.	Use GridBag layout to write a program to create a NUM pad on keyboard.	I	02
6.	Use of Cardlayout to write a program to create a two-level card deck that allows the user to select an operating system.	I	02
7.	Write a program using AWT to create a menubar where menubar contains menu items such as File, Edit, View and create a submenu under the File menu: New and Open.	I	02*
8.	Write a program using swing to display a ScrollPane and JcomboBox in an Japplet with the items – English, Marathi, Hindi, Sanskrit.	II	02
9.	Write a program to create a Jtree and recognize mouse clicks on it in an Japplet.	II	02*
10.	Write a program to create a JTable on JApplet Window.	II	02*
11.	Write a program to launch a progress bar on button click.	II	02*
12.	Write a program to accept keyboard input to show the pressed/released status of each key on Applet Window.	III	02*
13.	Write a program to demonstrate use of some special keys (for example: F1, pgdown etc.) on Applet Window using KeyEvent class.	III	02*
14.	Write a program to demonstrate MouseEvents on Applet Window.	III	02*
15.	Write a program to demonstrate MouseMotionEvents on Applet Window.	III	02
16.	Write a program to perform basic arithmetic operations on two numbers using TextField and Button to handle ActionEvent in an applet.	III	02*
17.	Write a program to select checkbox item by using ItemEvent class in an applet.	III	02*
18.	Write a program that creates the user name and password screen using TextEvent class in an applet.	III	02*
19.	Write a program to handle window operations like minimize, maximize, close etc. to handle Window Events.	III	02*
20.	Write a program to demonstrate the use of Adapter class.	III	02
21.	Write a program to retrieve hostname and IP Address in InetAddress class.	IV	02*
22.	Write a program to use URLConnection class and display (I) Protocol (II) HostName (III) PortNumber (IV) File Name.	IV	02*
23.	Write a program (Procedure for Server Program) that demonstrates TCP/IP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client	IV	02*
24.	Write a program (Procedure for Client Program) that demonstrates TCP/IP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client.	IV	02*
25.	Write a program (Procedure for Server Program) that demonstrates UDP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client.	IV	02
26.	Write a program (Procedure for Client Program) that demonstrates UDP based communication between Client and Server. Client send a	IV	02

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	message to Server and Server replies back the acknowledgement of received message to Client.		
27.	Write a program to establish successful connection to database.	V	02*
28.	Write a program to send data to Table (for ex. "Student" table)in database using prepared statement and retrieve data from same Table "Student" and display on screen.**(Part-I)**	V	02*
29.	Write a program to send data to Table (for ex. "Student" table) in database using prepared statement and retrieve data from same Table "Student" and display on screen.**(Part-II)**	V	02*
30.	Write a Servlet (Procedure for Client side) to display the user name and password accepted from the client.	VI	02*
31.	Write a Servlet (Procedure for Server side) to display the user name and password accepted from the client.	VI	02*
32.	Write a Servlet for demonstrating the concept of Session and Cookies.	VI	02
	Total		**64**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. *It is advisable to conduct 50% of the practicals using ASCII text editor and compilation on command prompt so as to enhance fundamental understanding of basic concepts and syntax. The IDEs must be Introduced at later stage.*

iii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
1	Logic Building and Coding	50
2	Testing and Debugging of the Program.	30
3	Correctness of Program Output.	10
4	Submission of practical assignment in time.	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Work as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year

- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO No.
1	Computer with JDK1.5 or above , any IDE for Java Programming such as Eclipse, Jcreator, NetBeans.	All
2	Databases like MySQL, Oracle, MS-Access or any other	27,28, 29
3	Apache Tomcat web server version 7 or higher.	30,31, 32

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Abstract Windowing Toolkit (AWT)	1a. Develop Graphical user interface (GUI) programs using AWT components for the given problem. 1b. Create Frame window with the specified AWT components. 1c. Arrange the GUI components using specified layout manager. 1d. Develop a program using menu and Dialog Boxes for the given problem.	1.1 Component, container, window, frame, panel. 1.2 Creating windowed programs and applets. 1.3 AWT controls and layout managers: use of AWT controls: labels, buttons, checkbox, checkbox group, scroll bars, text field, text area. 1.4 Use of layout managers: flowLayout, borderLayout, gridLayout, cardLayout, gridbagLayout, menubars, menus, dialog boxes, file dialog.
Unit-II Swings	2a. Differentiate between AWT and Swing on the given aspect. 2b. Develop Graphical user interface (GUI) programs using swing components for the given problem. 2c. Use the given type of button in Java based GUI. 2d. Develop Graphical user interface (GUI) programs using advanced swing components for the given problem.	2.1 Introduction to swing: Swing features, Difference between AWT and Swing. 2.2 Swing Components: JApplet, Icons and Labels, Text Fields, Combo Boxes. 2.3 Buttons: The JButton, Check Boxes, Radio Buttons. 2.4 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips. 2.5 MVC Architecture.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– III Event Handling	3a. Use delegation event model to develop event driven program for the given problem. 3b. Use relevant AWT/ swing component(s) to handle the given event. 3c. Use Adapter classes in Java program to solve the given problem. 3d. Use inner classes in java program to solve the given problem.	3.1 The delegation Event Model: Event sources, Event listeners 3.2 Event classes: The Action Event class, the Item Event class, the Key Event class, the Mouse Event class, the Text Event class, the Window Event class. 3.3 Adapter classes. 3.4 Inner classes. 3.5 Event listener interfaces: ActionListener Interface, ItemListener Interface, KeyListener Interface, MouseListener Interface, MouseMotion Interface, TextListener Interface, WindowsListener Interface.
Unit– IV Networking Basics	4a. Use InetAddress class to know the IP address of the given host name. 4b. Use URLConnection classes to read and write data to the specified resource referred by the given URL. 4c. Develop program for Client/ Server communication through TCP/IP Server sockets for the given problem. 4d. Write program to illustrate the Client/Server communication using datagram protocol for the given problem.	4.1 Socket Overview: Client/Server , Reserved Sockets , Proxy Servers , Internet Addressing. 4.2 Java and the Net: The Networking Classes and interfaces. 4.3 InetAddress : Factory Methods , Instance Methods. 4.4 TCP/IP Client Sockets : Whois 4.5 URL: Format, The URI Class. 4.6 URLConnection : TCP/IP Server Sockets . 4.7 Datagrams : Datagram Packet , Datagram Server and Client .
Unit –V Interacting with Database	5a. Choose JDBC or ODBC depending on the given application requirement. 5b. Explain function of the given tier of JDBC architecture for two tier/three tier models. 5c. Use relevant type of JDBC Driver for the specified environment. 5d. Elaborate steps with example to establish connectivity with the specified database.	5.1 Introduction to JDBC, ODBC 5.2 JDBC Architecture: Two tier and three tier models 5.3 Types of JDBC Drivers 5.4 Driver Interfaces and Driver Manager class: Connection InterfacenStatement Interface, Prepared Statement Interface, ResultSet Interface 5.5 The essential JDBC Program
Unit –VI Servlets	6a. Explain function of the given method of Servlet life cycle. 6b. Use relevant Generic servlet to develop given web based application.	6.1 The Life Cycle of a Servlet 6.2 Creating simple Servlet:The Servlet API, javax.servlet Package, Servlet Interface, ServletConfig Interface , ServletContext Interface.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	6c. Use relevant HTTP servlet to develop specified web based application. 6d. Develop servlet for cookies and session tracking to implement the given problem.	ServletRequest Interface, ServletResponse Interface, GenericServlet Class 6.3 The javax.servlet.http Package:HttpServletRequest Interface , HttpServletResponse Interface, HttpSession Interface , Cookie Class, HttpServlet Class, HttpSessionEvent Class , HttpSessionBindingEvent Class. 6.4 Handling HTTP Requests and Responses Handling HTTP GET RequestsHandling HTTP POST Requests. 6.5 Cookies and Session Tracking. 6.6 Introduction to JSP

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Abstract Windowing Toolkit(AWT)	10	02	04	06	12
II	Swings	08	02	02	04	08
III	Event Handling	12	02	04	08	14
IV	Networking	10	02	04	06	12
V	Interacting with Database	12	02	04	06	12
VI	Servlets	12	02	04	06	12
Total		**64**	**12**	**22**	**36**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journals based on practical performed in laboratory.
b) Follow coding standards.
c) Develop variety of programs to improve the logical skills.
d) Develop Application oriented real world programs.

e) Prepare power point presentation depicting different advanced concepts in Java.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Use different Audio Visual media for Concept understanding.
f) Guide student(s) in undertaking micro-projects.
g) Demonstrate students thoroughly before they start doing the practice.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.
b) Medical Store stock Management System: Expected to develop an Inventory module.
c) Library book issue Management System.
d) Restaurant Management System: Expected to develop a module to place an order and generate bill.
e) Online Bus Reservation System: Expected to develop Ticket booking module.

Follow the below given guidelines for micro projects:

i. Must implement concepts of AWT or SWING and Event Handling.
ii. Use JDBC concepts.
iii. Use Servlet.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Complete Reference Java	Schildt, Herbert	Mcgraw Hill Education, New Delhi ISBN:9789339212094
2.	Java 2 Programming Black Book	Holzner, Steven et al.	Dreamtech Press, New Delhi ISBN 10: 817722655X / ISBN 13: 9788177226553
3.	Java Server Programming Tutorial JAVA EE6 Black Book	Kogent Learning Solutions	Dreamtech Press, New Delhi ISBN :978-81-7722-937-0
4.	Advance JAVA	Dr. Rajendra Kawale	Devraj Publications,Mumbai ISBN 978-81-933551-8-3

14. SOFTWARE/LEARNING WEBSITES

a) https://www.tutorialspoint.com/java
b) http://nptel.ac.in/courses/106105084/30
c) https://www.javatpoint.com/servlet-tutorial
d) https://www.tutorialspoint.com/servlets
e) https://www.javatpoint.com/free-java-projects
f) http://1000projects.org/java-projects.html


MAHARASHTRA STATE BOARD OF

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/CW**

Semester : **Fifth**

Course Title : **Software Testing**

Course Code : **22518**

1. RATIONALE

In today's software environment writing bug-free code is challenging task, which make software testing important tool to get the quality software. Testing techniques include the process of executing a program or application with the intent of finding software bugs and verifying that the software product is fit for use. Students will learn the way to find bugs by applying types, levels and methods of software testing on applications with effective test planning approach. It also covers manual testing.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply types, levels and methods of software testing on applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Apply various software testing methods.
b. Prepare test cases for different types and levels of testing.
c. Prepare test plan for an application.
d. Identify bugs to create defect report of given application.
e. Test software for performance measures using automated testing tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

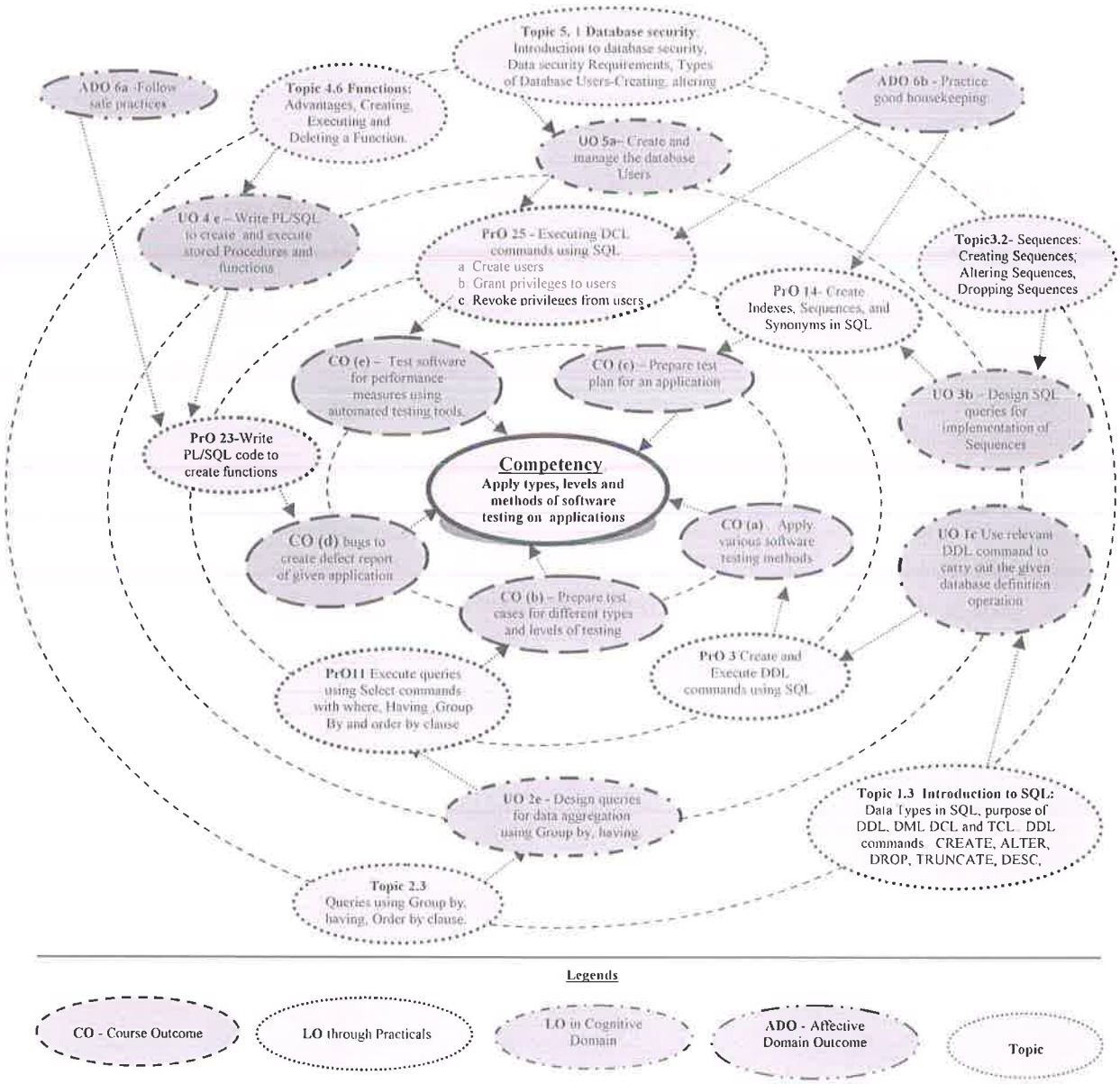

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify system specification & design test cases for purchase order Management.	I	02
2	Identify system specification & design test cases for Inventory management	I	02
3	Design test cases for simple calculator application.(BB Testing)	I	02
4	Design test cases for railway reservation form	II	02
5	Design test cases for e-commerce (Flipkart, Amazon) login form	II	02
6	Design test cases for Web Pages Testing any Web Sites	II	02
7	Write program and design test cases for the following Control and	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	decision making statement. 1) For… Loop 2) Switch…case 3) Do…While 4) If...else		
8	Prepare test plan for an identified Mobile application.	III	02
9	Design test plan and test cases for Notepad (MS Window based) Application.	III	02
10	Prepare defect report after executing test cases for library management system	IV	02
11	Prepare defect report after executing test cases for Withdrawn of amount from ATM Machine.	IV	02
12	Prepare defect report after executing test cases for any login form.	IV	02
13	Design and run test cases for WordPad (MS Windows based). Using an Automated tool.	V	02
14	Design and run test cases for MS Word application using an Automation Tool.	V	02
15	Project Assignment		04
	Total		**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Preparation of system specification, designing test plan using MS Excel.	50
2	Preparation of defect report	10
3	Execution of test cases using automation tool.	20
4	Answer to sample questions	10
5	Submit report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Work as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year

- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Selenium	V
1.3	Mantis Bug Tracker	IV
1.4	IBM Rational Functional Tester	V
1.5	Spreadsheet Package	I, II, III
1.6	Bugzila	IV

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Software Testing and Testing Methods	1a. Identify errors and bugs in the given program. 1b. Prepare test case for the given application. 1c. Describe the Entry and Exit Criteria for the given test application. 1d. Validate the given application using V model in relation with quality assurance. 1e. Describe features of the given testing method.	1.1 Software Testing, Objectives of Testing. 1.2 Failure, Error, Fault, Defect, Bug Terminology. 1.3 Test Case, When to Start and Stop Testing of Software (Entry and Exit Criteria). 1.4 Verification and Validation (V Model), Quality Assurance, Quality Control. 1.5 Methods of Testing: Static and dynamic Testing 1.6 The box approach: White Box Testing: Inspections, Walkthroughs, Technical Reviews, Functional Testing, Code Coverage Testing,Code Complexity Testing. 1.7 Black Box Testing: Requirement Based Testing, Boundary Value Analysis, Equivalence Partitioning,
Unit– II Types and Levels of Testing	2a Apply specified testing level for the given web based application. 2b Apply Acceptance testing for given web based application. 2c Apply the given performance testing for the specified application. 2d Generate test cases for the given application using regression and GUI testing.	2.1 Levels of testing 2.1 Unit Testing: Driver, Stub 2.2 Integration Testing: Top-Down Integration, Bottom-Up Integration, Bi-Directional Integration, 2.3 Testing on Web Application: Performance Testing:Load Testing, Stress Testing, Security Testing, Client-Server Testing 2.4 Acceptance Testing: Alpha Testing and

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Beta Testing, Special Tests: Regression Testing, GUI Testing,
Unit III- Test Management	3a. Prepare test plan for the given application. 3b. Identify the resource requirement of the given application. 3c. Prepare test cases for the given application. 3d. Prepare test report of executed test cases for given application.	3.1 Test Planning : Preparing a Test Plan, Deciding Test Approach, Setting Up Criteria for Testing, Identifying Responsibilities, Staffing, Resource Requirements, Test Deliverables, Testing Tasks 3.2 Test Management: Test Infrastructure Management, Test People Management. 3.3 Test Process: Base Lining a Test Plan, Test Case Specification. 3.4 Test Reporting: Executing Test Cases, Preparing Test Summary Report.
Unit-IV Defect Management	4a. Classify defects on the basis estimated impact. 4b. Prepare defect template on the given application. 4c. Apply defect management process on the given application. 4d. Write procedure to find defect using the given technique.	4.1. Defect Classification, Defect Management Process. 4.2. Defect Life Cycle, Defect Template 4.3. Estimate Expected Impact of a Defect, Techniques for Finding Defects, Reporting a Defect.
Unit –V Testing Tools and Measurements	5a. Improve testing efficiency using automated tool for given application. 5b. Identify different testing tools to test the given application. 5c. Describe Metrics and Measurement for the given application 5d. Explain Object oriented metrics used in the given testing application	5.1 Manual Testing and Need for Automated Testing Tools 5.2 Advantages and Disadvantages of Using Tools 5.3 Selecting a Testing Tool 5.4 When to Use Automated Test Tools, Testing Using Automated Tools. 5.5 Metrics and Measurement: Types of Metrics, Product Metrics and Process Metrics, Object oriented metrics in testing.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Software Testing and Testing Method	14	04	04	06	14
II	Types and Levels of Testing	16	04	06	08	18

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
III	Test Management	12	04	04	06	14
IV	Defect Management	10	02	02	06	10
V	Testing Tools and Measurements	12	04	04	06	14
	Total	**64**	**18**	**20**	**32**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journals based on practical performed in laboratory.
b) Give seminar on relevant topic.
c) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Guide student(s) in undertaking micro-projects.
f) Demonstrate students thoroughly before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a) Library Management: book issue /book stock system.
b) Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Software Testing: Principles and Practices	Srinivasan Desikan Gopalaswamy Ramesh	PEARSON Publisher: Pearson India 2005, ISBN: 9788177581218,
2	Software Testing: Principles, Techniques and Tools	Limaye M. G.	Tata McGraw Hill Education, New Delhi., 2007 ISBN 13: 9780070139909
3	Software Testing: Principles and Practices	Chauhan Naresh	Oxford University Press Noida –
4	Software Testing	Singh Yogesh	Cambridge University Press, Bangluru. ISBN 978-1-107-65278-1
5	Software Testing	Dr. Rajendra Kawale	Devraj Publications, Mumbai ISBN 978-81-933551-6-9

Note: Other available testing tools can be used at institute level.

14. SOFTWARE/LEARNING WEBSITES

a. http://www.selenium.com
b. http://en.wikipedia.org/wiki/Test_automation
c. http://en.wikipedia.org/wiki/Software_testing#Testing_tools
d. http://www.softwaretestingsoftware.com
e. www.toolsqa.com


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Fifth**

Course Title : **Client Side Scripting Language (Elective)**

Course Code : **22519**

1. RATIONALE

JavaScript is limited featured client side programming language. JavaScript runs at the client end through the user's browser without sending messages back and forth to the server. It is widely used by the web developers to do things such as build dynamic web pages, respond to events, create interactive forms, validate data that the visitor enters into a form, control the browser etc. This course helps student to create highly interactive web pages using these features.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop Dynamic Web Pages using JavaScript.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Create interactive web pages using program flow control structure.
b) Implement Arrays and functions in Java script.
c) Create event based web forms using Java script.
d) Use JavaScript for handling cookies.
e) Create interactive webpage using regular expressions for validations.
f) Create Menus and navigations in web Pages.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.*

5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

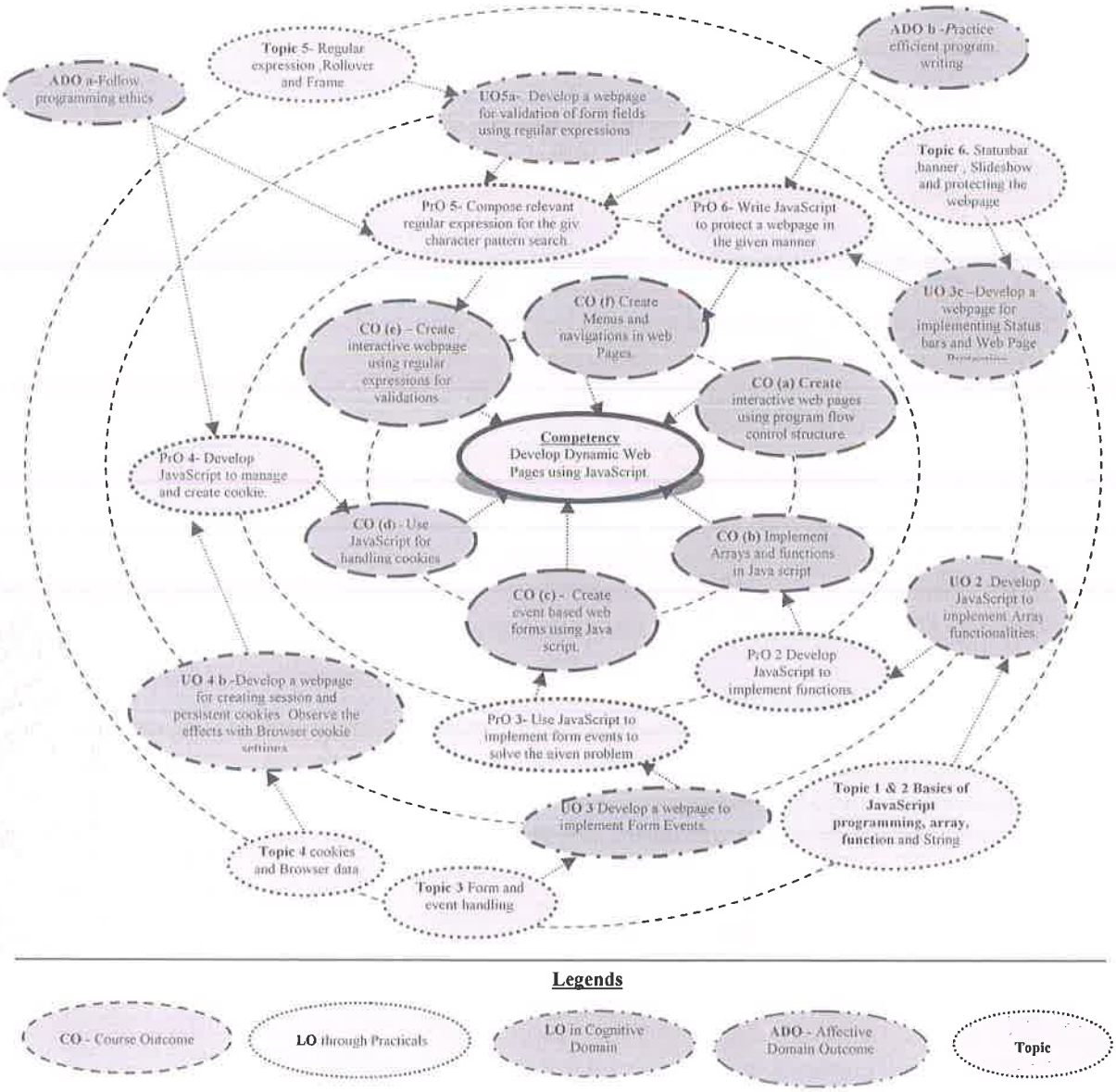

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Write simple javascript with HTML for arithmetic expression evaluation and message printing	I	02
2.	Develop JavaScript to use decision making and looping statements.	I	02*
3.	Develop JavaScript to implement Array functionalities.	II	02*
4.	Develop JavaScript to implement functions.	II	02*
5.	Develop JavaScript to implement strings.	II	02
6.	Create a webpage using Form Elements.	III	02
7.	Create a webpage to implement Form Events. Part-I	III	02*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8.	Create a webpage to implement Form Events. Part-II	III	02*
9.	Develop a webpage using Intrinsic Java Functions.	III	02*
10.	Develop a webpage for creating session and persistent cookies. Observe the effects with Browser cookie settings.	IV	02*
11.	Develop a webpage for placing the Window on the screen and working with child window.	IV	02*
12.	Develop a webpage for validation of form fields using regular expressions.	V	02*
13.	Create a webpage with Rollovers effect.	VI	02
14.	Develop a webpage for implementing Menus.	VI	02*
15.	Develop a webpage for implementing Status bars and Web Page Protection.	VI	02
16.	Develop a webpage for implementing Slideshow, banner.	VI	02*
	Total		**32**

Note:

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. 50% of Lab assignments must be done using traditional editor and run in different browsers so as to build up fundamental understanding capabilities of students.

iii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Use of relevant tags and attributes	10
2	Correctness of Coding.	40
4	Testing and Debugging of the Program.	30
5	Appearance of Program Output.	10
6	Submission of report in time.	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S.No.
1	Browser and Notepad/any Text editor/	All
2	Free Web page Designing Tool	All
3	Any IDE like Eclipse	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of JavaScript Programming	1a. Create object to solve the given problem. 1b. Develop JavaScript to implement the switch-case statement for the given problem. 1c. Develop JavaScript to implement loop for solving the given iterative problem. 1d. Display properties of the given object using getters and setters. 1e. Develop program using basic features of JavaScript to solve the given problem.	1.1 Features of JavaScript 1.2 Object Name, Property, method, Dot syntax, main event. 1.3 Values and Variables 1.4 Operators and Expressions- Primary Expressions, Object and Array initializers, function definition expression, property access expressions, invocation expressions. 1.5 If Statement, if…else, if..elseif, nested if statement. 1.6 Switch…case statement 1.7 Loop statement – for loop, for...in loop, while loop, do…while loop, continue statement. 1.8 Querying and setting properties and deleting properties, property getters and setters.
Unit-II Array, Function and String	2a. Create array to solve the given problem. 2b. Perform the specified string manipulation operation on the given String(s). 2c. Develop JavaScript to implement the given function. 2d. Develop JavaScript to convert the given Unicode to character form. 2e. Develop JavaScript to convert the given character to Unicode and vice-versa.	2.1 Array - declaring an Array, Initializing an Array, defining an Array elements, Looping an Array, Adding an Array element, sorting an Array element, Combining an Array elements into a String, changing elements of an Array, Objects as associative Arrays 2.2 Function – defining a function, writing a function, adding an arguments, scope of variable and arguments, 2.3 Calling a function – calling a function with or without an argument, calling function from HTML, function calling another function. Returning a value from a function 2.4 String – manipulate a string, joining a

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		string, retrieving a character from given position, retrieving a position of character in a string, dividing text, copying a sub string, converting string to number and numbers to string, changing the case of string, finding a Unicode of a character-charCodeAt(), fromCharCode().
Unit– III Form and Event Handling	3a. Write JavaScript to design a form to accept input values for the given problem. 3b. Use JavaScript to implement form events to solve the given problem. 3c. Develop JavaScript to dynamically assign specified attribute value to the given form control. 3d. Use the given intrinsic function with specified parameters.	3.1 Building blocks of a Form, properties and methods of form, button, text, text area, checkbox, radio button, select element. 3.2 Form events- mouse event, key events. 3.3 Form objects and elements. 3.4 Changing attribute value dynamically. 3.5 Changing option list dynamically 3.6 Evaluating checkbox selection 3.7 Changing a label dynamically 3.8 Manipulating form elements 3.9 Intrinsic JavaScript functions, disabling elements, read only elements.
Unit– IV Cookies and Browser Data	4a. Create cookies based on the given problem. 4b. Develop JavaScript to manage a cookie in the given manner. 4c. Write JavaScript to manipulate the specified attributes of window object in the given manner. 4d. Write JavaScript to create browser history of the given object.	4.1 Cookies – basic of cookies, reading a cookie value, writing a cookie value, creating a cookies, deleting a cookies, setting the expiration date of cookie 4.2 Browser – opening a window, giving the new window focus, window position, changing the content of window, closing a window, scrolling a web page, multiple windows at once, creating a web page in new window, JavaScript in URLs, JavaScript security, Timers, Browser location and history.
Unit –V Regular Expression, Rollover and Frames	5a. Compose relevant regular expression for the given character pattern search. 5b. Develop JavaScript to implement validations using the given regular expression. 5c. Create frames based on the given problem. 5d. Create window object as per	5.1 Regular Expression - language of regular expression, finding non matching characters, entering a range of characters, matching digits and non digits, matching punctuations and symbols, matching words, replacing a the text using regular expressions, returning the matched characters, regular expression object properties.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given problem. 5e. Develop JavaScript for creating rollover effect for the given situation.	5.2 Frames – create a frame, invisible borders of frame, calling a child windows, changing a content and focus of a child window, writing to a child window, accessing elements of another child window. 5.3 Rollover – creating rollver, text rollver, Multiple actions for rollover, more efficient rollover.
Unit –VI Menus, navigation and web page protection	6a. Develop JavaScript to manage the given status bar. 6b. Develop JavaScript to create the given banner. 6c. Develop JavaScript to create the given slide show. 6d. Develop JavaScript to create the given Menu. 6e. Write JavaScript to protect a webpage in the specified manner.	6.1 Status bar- builds a static message, changing the message using rollover, moving the message along the status bar 6.2 Banner –loading and displaying banner advertisement. Linking a banner advertisement to url 6.3 Slide Show – creating a slide show 6.4 Menus- creating a pulldown menu, dynamically changing a menu, validating menu selection, Floating menu, chain select menu, tab menu, pop-up menu, sliding menu, highlighted menu, folding a tree menu, context menu, scrollable menu, side bar menu. 6.5 Protecting web page – hiding your code, disabling the right mouse button, JavaScript, concealing email address. 6.6 Frameworks of javasript and its application

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of JavaScript Programming	10	04	04	04	12
II	Array, Function and String	10	02	04	08	14
III	Form and Event Handling	06	02	04	04	10
IV	Cookies and Browser Data	06	02	02	04	08
V	Regular Expression, Rollover & Frames	08	02	06	06	14
VI	Menus, navigation and web page protection	08	02	04	06	12
Total		**48**	**14**	**24**	**32**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

***Note**: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a) Prepare journals based on practical performed in laboratory.
b) Prepare powerpoint presentation or animation for understanding different Client side scripting Concepts.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Use different Audio Visual materials for Concept understanding.
f) Guide student(s) in undertaking micro-projects.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.
i) 50% of Lab assignments must be done using traditional editor and run in different browsers so as to build up fundamental understanding capabilities of students.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Create a web page that displays buyers information entry form containing name, address, city, pin code, mail Id, Phone Number, product details , payment mode. Frame different validation rules for user inputs. Use JavaScript and regular expressions to perform error checking on user input as per validation rules.
b) Build a simple slide show in JavaScript with six unique images. Design appropriate web page with at least two sections: with slide show in one section. When any image on this slide show is clicked display information about it in other section. Use features for controlling window locations.
c) Design and create web pages of an institute with different sections. Use pulldown menus in one section and implement validation of menu selections. Use other sections for displaying information about respective selected menu item.
d) Create a simple animation in JavaScript : create a basic page showing circle of white marble. Using the setTimeout() method create an animation on the page that that makes an orange marble rotate around this circle by moving the orange marble to the next location in the circle every second. Allow the user to stop the animation by placing the cursor on any marble(use clearTimeout()).

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	JavaScript Demystified	Keogh, Jim	McGraw-Hill, 2015, New Delhi ISBN:0-07-060347-2
2.	Beginning JavaScript	Wilton, Paul	Wily India, New Delhi, 2015, ISBN:0-7645-5587-1
3.	Beginning JavaScript	McPeak, Jeremy and Wilton, Paul	Wily India, New Delhi, 2015, ISBN:81-265-1304-7
4.	JavaScript in 24 hours (SAMS teach yourself)	Moncur, Michael	TechMedia, New Delhi, 2015, ISBN:978-0-672-33608-9

14. SOFTWARE/LEARNING WEBSITES

a) https://www.w3schools.com
b) http://www.nptelvideos.com
c) http://www.tutorialspoint.com.
d) Http://javapoint.com

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Fifth**

Course Title : **Advanced Computer Network (Elective)**

Course Code : **22520**

1. RATIONALE

The modern computer network includes different routing protocols and applying the concepts of network, transport and application layer protocols. In order to work with existing technology in building large, complex networked systems, students must be acquainted with the principles, architectures, and protocols used in modern networked systems. This course covers advanced computer network protocols, and advanced principles of the design of computer networks. After completing this course students will be able to configure various TCP/IP protocols at different layers.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Configure network protocols at different layers of TCP/IP protocol set.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Implement Network Layer Protocols.
b) Configure IPv6 Network.
c) Choose routing protocol in the given network situation.
d) Implement different Transport Layer Protocols.
e) Configure various Application Layer Protocols.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

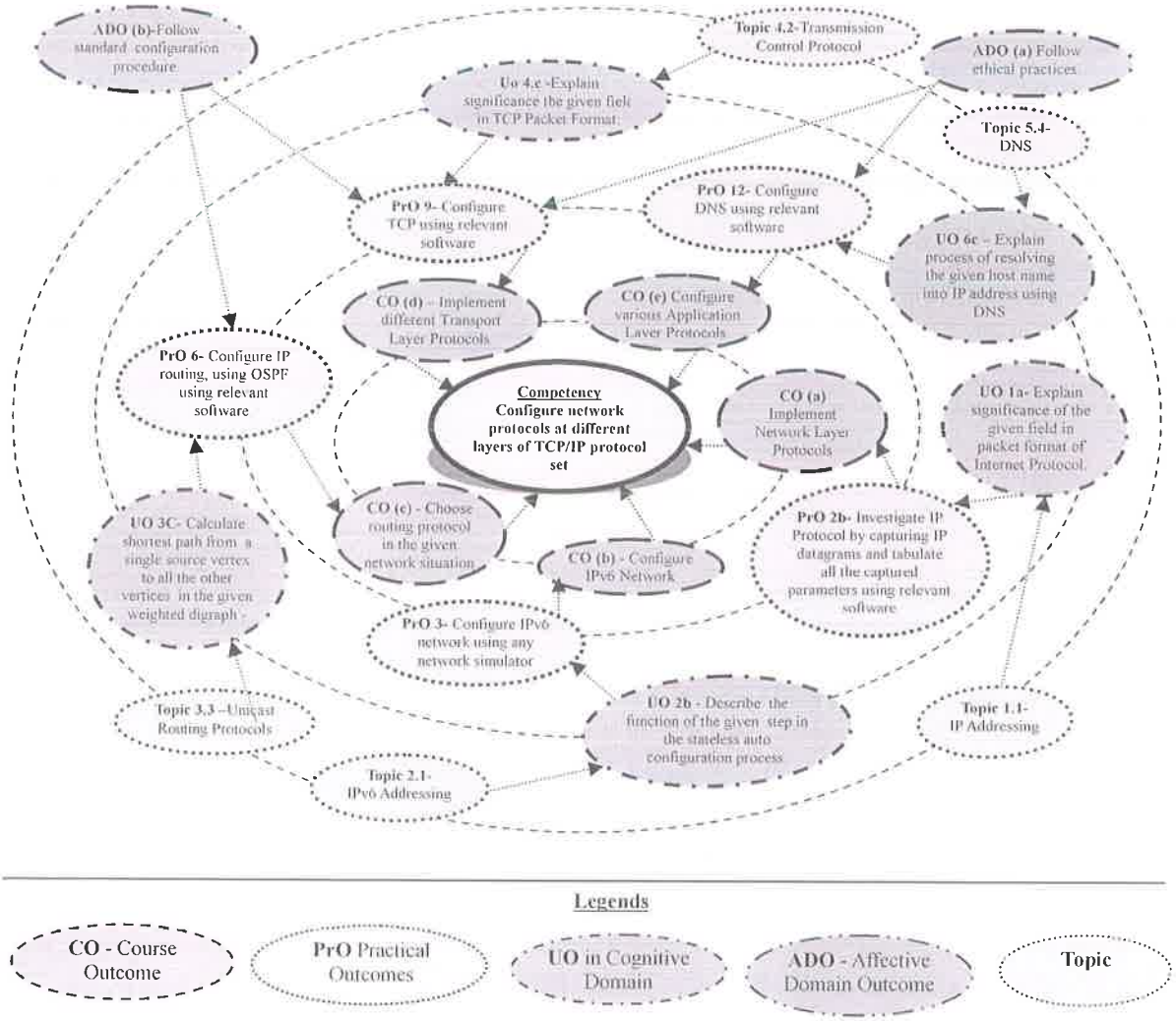

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Given an IP address, network mask, and subnetwork mask, determine other information and implement it. about the IP address such as: i. The subnet address of this subnet. ii. The broadcast address of this subnet. iii. The range of host addresses for this subnet. iv. The maximum number of subnets for this subnet mask. v. The number of hosts for each subnet. vi. The number of subnet bits.	I	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	vii. The number of this subnet.		
2.	a. Capture ICMPv4 packets generated by utility programs like ping, traceroute and tabulate all the captured parameters using relevant software b. Investigate IP Protocol by capturing IP datagrams and tabulate all the captured parameters using relevant software	I	2*
3.	Configure IPv6 network using any network simulator.	II	2*
4.	Configure IP static routing using relevant software.	III	02
5.	Configure IP routing with RIP using relevant software.	III	02*
6.	Configure IP routing with OSPF using relevant software	III	02*
7.	Configure User Datagram Protocol (UDP) Part-I using relevant software.	IV	02*
8.	Configure User Datagram Protocol (UDP) Part-II using relevant software.	IV	02*
9.	Configure Transmission Control Protocol (TCP) using relevant software.	IV	02*
10.	Run different STCP commands.	IV	02
11.	Configure Dynamic Host Configuration Protocol (DHCP) using relevant software.	V	02*
12.	Configure Domain Name Server (DNS) using relevant software.	V	02*
13.	a. Configure File Transfer Protocol (FTP) using relevant software. b. Configure Hypertext Transfer Protocol (HTTP) using relevant software.	V	02*
14.	a. Use Telnet to login a remote machine. b. Connect remote machine using Secure Shell (SSH).	V	02*
15.	Configure SMTP, POP3 and IMAP using relevant software.	V	02*
16.	Configure MIME and SNMP using relevant software.	V	02
	Total		**32**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practicals need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1.	Completion of given task.	25
2.	Correctness of the given task.	50
3.	Answer to sample questions.	15
4.	Submit report in time.	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Work as a leader/a team member.
d. Follow standard configuration procedures.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration, connected to LAN)	All
2	Wireshark or any other similar software to capture and investigate packets	1, 2
3	Cisco Packet Tracer or any other similar software	3 to 16

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Network Layer and Protocols	1a. Explain significance of the given field in the packet format of Internet Protocol. 1b. Implement IP addressing for the given network. 1c. Explain significance of the given field in packet format of ICMPv4. 1d. Explain the given inefficiency in Mobile IP.	1.1 **IP Addressing**: Address Space, Notations, Classfull addressing, Classless addressing, Network Address Translation (NAT). 1.2 **Internet Protocol (IP):** Datagram Format, Fragmentation, Options. 1.3 **ICMPv4:** Messages, Debugging Tools, ICMP Checksum. 1.4 **Mobile IP:** Addressing, Agents, Three Phases, Inefficiency in Mobile IP. 1.5 **Virtual Private Networks:** VPN Technology.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Next Generation IP	2a. Map the given IPv4 address to IPv6 address. 2b. Describe function of the given step in the stateless auto configuration process. 2c. Outline the given strategy of Transition from IPv4 to IPv6. 2d. Explain significance of the given field in Datagram format of IPv6.	2.1 **IPv6 Addressing:** Representation, address space, address space allocation, Autoconfiguration, Renumbering. 2.2 **Transition from IPv4 to IPv6:** Dual Stack, Tunneling, Header Translation. 2.3 **IPv6 Protocol:** Packet format, Extension Header.
Unit III- Unicast and Multicast Routing Protocols	3a. Choose relevant routing Protocol for the given network situation. 3b. Compare Dynamic Routing and Static Routing on the given aspect. 3c. Calculate shortest paths from a single source vertex to all the other vertices in the given weighted digraph. 3d. Explain functioning of the given multicast routing protocol.	3.1 **Introduction:** Inter-domain, Intra-domain Routing. 3.2 **Routing Algorithms:** Distance Vector Routing, Bellman–Ford algorithm, Link State Routing, Path Vector Routing. 3.3 **Unicast Routing Protocols:** Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4). 3.4 **Introduction:** Unicast, Multicast and Broadcast. 3.5 **Intradomain Multicast Protocols:** Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF), Protocol Independent Multicast (PIM).
Unit-IV Transport Layer Protocols	4a. Explain significance of the given field in UDP Packet format. 4b. Describe the given State Transition of TCP. 4c. Explain significance of the given field in TCP Packet format. 4d. Describe the given field in the packet format of SCTP. 4e. Explain the functioning of the given Protocol with Flow and Error control by taking an example.	4.1 **User Datagram Protocol:** User Datagram, UDP Services, UDP Applications. 4.2 **Transmission Control Protocol:** TCP Services, TCP features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options. 4.3 **SCTP:** SCTP Services, SCTP Features, Packet Format, An SCTP Association, Flow Control, Error Control.
Unit –V Application Layer	5a. Explain function of the given application layer protocol. 5b. Explain function of the given	5.1 World Wide Web and HTTP 5.2 File Transfer: FTP and TFTP 5.3 Electronic Mail: Architecture

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
protocols	FTP command. 5c. Explain working of the given components in the Architecture of Electronic Mail. 5d. Explain process of resolving the given host name into IP address using DNS. 5e. Explain working of the given Remote Login Protocol.	Web-Based Mail, Email Security, SMTP, POP, IMAP and MIME, SNMP. 5.4 DNS – Concept of Domain name space, DNS operation. 5.5 DHCP – Static and Dynamic Allocation, DHCP Operation. 5.6 Remote Login: TELNET and SSH.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Network Layer and Protocols	06	02	02	04	08
II	Next Generation IP	08	02	04	04	10
III	Unicast and Multicast Routing Protocols.	10	02	04	08	14
IV	Transport Layer Protocols	12	02	08	08	18
V	Application Layer Protocols.	12	04	08	08	20
Total		**48**	**12**	**26**	**32**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Give seminar on Identified topic.
c. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.
g. Encourage students to refer different websites to have deeper understanding of the topic.
h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

i. Prepare one Static and One dynamic Network with DHCP server. Use Routing Protocol to route packets between these networks using Cisco packet tracer or any other similar software.
ii. Setup a FTP server and client on one network. Transfer files from Client to server and vice versa.
iii. (a) Create DNS,
(b) Create Web server,
(c) Serve an HTML page on web server and call it on browser through DNS.
iv. Set-up a mailing system of users on intranet.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Data Communication and Networking 5E	Forouzan Behrouz A.	McGraw Hill Education (India), New Delhi, 2005, ISBN-13:978-1-25-906475-3
2	Internetworking with TCP/IP, Volume I, Fourth Edition.	Comer Douglas E.	Prentice Hall of India Private Limited, New Delhi, 2014 ISBN-81-203-2065-4
3	Computer Networks, Fourth Edition	Tanenbaum Andrew S.	PHI Learning, New Delhi- 2014 ISBN-81-203-2175-8

4	Advanced Computer Network	B.M. Harwani and DT Editorial Services	Dreamtech New Delhi- 2014 ISBN 978-93-5004-013-3
5	Computer Networks Principles, Technologies And Protocols For Network Design	Natalia Olifer, Victor Olifer	Wiley ISBN

14. SOFTWARE/LEARNING WEBSITES

a) TCP/IP Illustrated, Volume 1 The Protocols W. Richard Stevens
b) http://study-ccna.com/
c) http://www.packettracernetwork.com/
d) https://www.tutorialspoint.com/listtutorials/networking/1
e) www.txv6tf.org/wp-content/uploads/2010/08/Muhummad-Tutorial-ipv6-basics.pdf
f) http://cnp3book.info.ucl.ac.be/2nd/html/protocols/bgp.html
g) https://campus.barracuda.com/product/nextgenfirewallf/doc/46209264/dynamic-routing-protocols-ospf-rip-bgp/
h) http://www.ciscopress.com/articles/article.asp?p=2180210andseqNum=5
i) http://www.allsyllabus.com/aj/note/Computer_Science/Computer%20Networks%20-%20II/

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/CW**

Semester : **Fifth**

Course Title : **Advanced Database Management Systems (Elective)**

Course Code : **22521**

1. RATIONALE

Advanced database management systems contain comprehensive contents on various concepts related to database systems, database design and management. Broadly it discusses about parallel and distributed database systems, database transactions, big data management and advances in database data. The student will get a detailed introduction about database administration and management, the role of machine learning in big data management. This course includes study of structured and unstructured database like MongoDB, SQL and XML for data management. The concept big data is used in today's information driven business world for managing big data. After learning this subject student will be able to use ADBMS as a backend for developing database.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply Advanced Database Management Systems concepts using MongoDB and XML**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Differentiate various database architectures.
b. Use Object Oriented and Advanced XML queries on Database.
c. Manipulate data using MongoDB commands.
d. Use Data Mining And Data Warehousing Concepts.
e. Use Big Data Concepts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

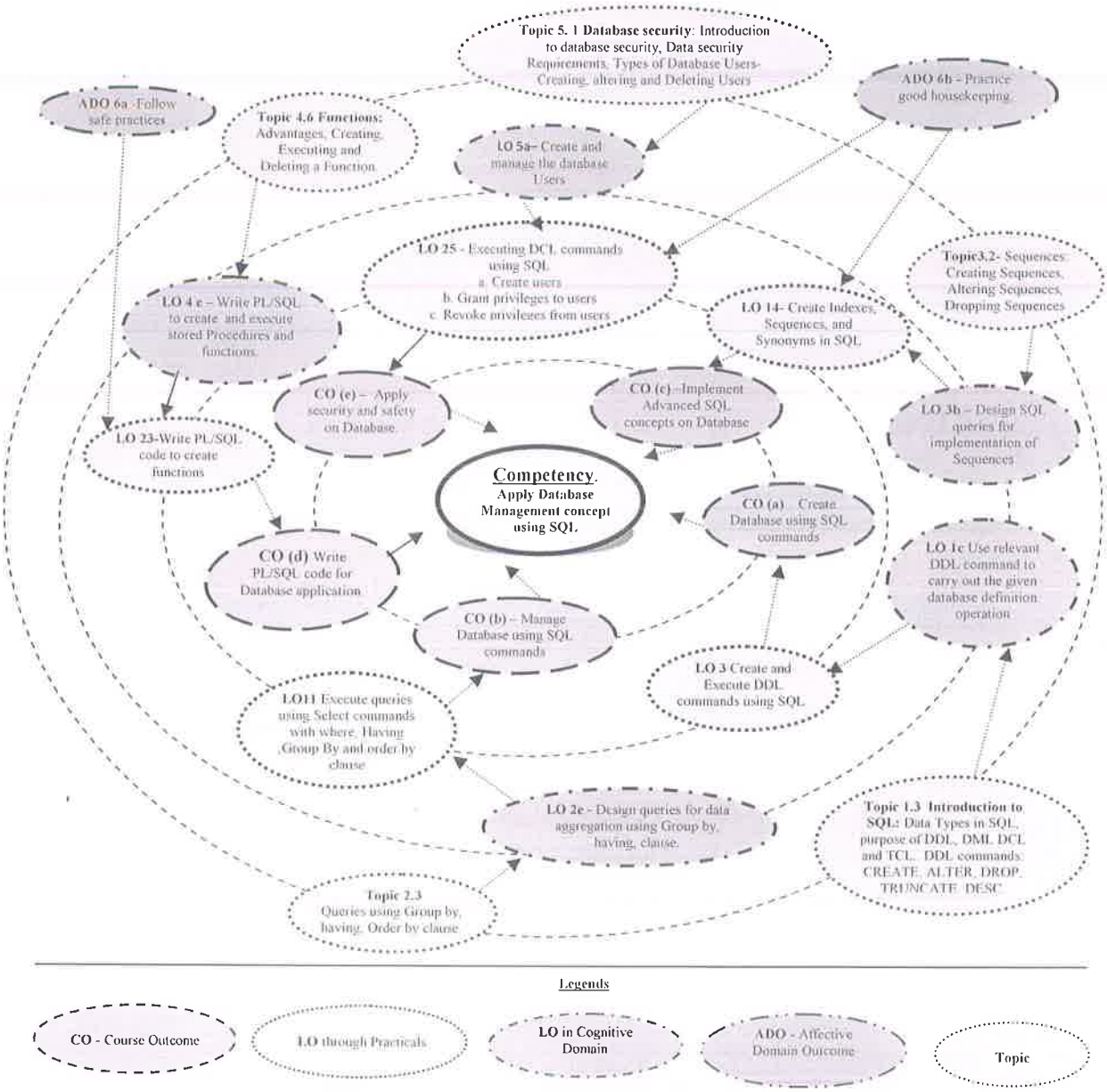

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Implementing Locking protocols	I	02
2.	Install and configure Database system (such as MySQL, MongoDB or any other relational database system)	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Implementing Locking protocols	I	02
3.	Create database using XML attributes and Elements.	II	02
4.	Implement queries based on FLOWER expressions and joins using XQuery.	II	02
5.	Implement queries based on Nested queries and sorting of results using XQuery.	II	02
6.	Implement queries based on functions and types using XQuery.	II	02
7.	Execute queries using structured type in SQL	II	02
8.	Execute queries using type inheritance and table inheritance in SQL	II	02
9.	Implement queries using Array and Multiset types in SQL	II	02
10.	Execute queries using object identity and reference types in SQL	II	02
11.	Design and Develop MongoDB Queries using basic operations	III	02
12.	Implement aggregation Queries using MongoDB	III	02
13.	Implement MongoDB Queries Usinf find() function	III	02
14.	Implement aggregation Queries in MongoDB through MapReduce	III	02
15.	Install and configure Any data mining tool (like WEKA) .	IV	02
16.	Make use of installed data mining tool(like WEKA)	IV	02
		Total	**32**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Installation and configuration of database system	10
b.	Coding of queries and MongoDB programming	40
c.	Quality of result displayed by queries.	30
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Work as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

17. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Any RDBMS software (MySQL/Oracle/SQL server/MongoDB or any other)	All

18. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Database Architecture	1a. Describe the given client-server Database Model. 1b. Use the given locking protocols for concurrency control. 1c. Apply parallel and distributed database techniques in given situation. 1d. Differentiate between Parallel and Distributed Databases.	1.1 Introduction to client-server Database Model: Two-Tier Client server model, Three-Tier Client server model. 1.2 Concurrency Control Techniques: Concurrency control protocols: Locked Based protocols, granting of locks, Two Phase Locking protocol. 1.3 Introduction to parallel databases: Parallel database system architecture, Types of parallelism, Parallel Database Implementation. 1.4 Introduction to distributed databases: Distributed database system architecture, Benefits of distributed database system, Issues with distributed database systems.
Unit II- Object Based Databases and XML	2a Create the given object based database using SQL 2b Write given SQL queries using Table Inheritance 2c Write given SQL queries using Array and Multiset. 2d Implement SQL queries to refer the given object using object identity. 2e Write XML queries on given data.	2.1 Object Based Databases overview 2.2 Complex data types 2.3 Structured types and inheritance in SQL 2.4 Table inheritance 2.5 Array and multiset types in SQL 2.6 Object identity (OI) and reference types in SQL 2.7 XML: Introduction, structure of XML data, XML document schema ,Xpath, XQuery:FlOWER Expressions, Joins,Nested Queries, Sorting of functions, Functions and Types.
Unit– II	3a. Differentiate structured and	3.1 Structured versus Unstructured Data

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Advanced Database Techniques	Unstructured Data. 3b. Use NoSQL database to solve given queries. 3c. Use MongoDB to solve given queries. 3d. Differentiate SQL and NoSQL databases. 3e. Write query to execute find() function on given data. 3f. Implement basic operations performed on MongoDB shell on given data. 3g. Write query using aggregate() method on given data.	3.2 NoSQL database concepts: Types of NoSQL databases, NoSQL data modeling, Benefits of NoSQL, comparision between SQL and NoSQL database system. 3.3 NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types ,Arrays, Embedded Documents 3.4 Querying with MongoDB: find() function, specifying which keys to return, query criteria, OR queries, Types specific querying 3.5 Aggregation Introduction: Aggregation Pipeline, Aggregation using Map reduce, Single purpose aggregation
Unit –IV Advances in Databases	4a. Define data mart, meta data 4b. Explain architecture of data warehouse 4c. Analyze given data using data mining. 4d. Describe the features of BI and BI components framework. 4e. Explain use of spatial databases in a given situation.	4.1 Introduction to Data Warehouse :Characteristics, Types of Data Warehouse Architecture, Data Marts, Data Warehousing Lifecycle, Data Warehouse Development 4.2 Introduction to Data Mining Techniques: Data mining technology and its relation to data warehousing, Association rules, classification and clustering, Applications of data mining. 4.3 Introduction to business Intelligence: Features, frameworks, Types and approaches for machine learning 4.4 Introduction to Multimedia Databases, Mobile Databases and digital databases
Unit-V Big Data Management	5.a Analyze the given situation for the use of Big data. 5.b Describe the given architecture of Hadoop. 5.c Explain given components of Hadoop. 5.d Explain use of cloudera in given situation. 5.e Explain given features of R-programming.	5.1 Big Data 5.2 Introduction to Hadoop: Building Blocks and Components, Hadoop architecture, HBase, HIVE, Solid -State Drive 5.3 Cloudera, Oracle cloud, 5.4 Introduction to R-programming

__Note__: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Database Architecture	08	04	04	04	12
II	Object Based Databases and XML	14	04	04	10	18
III	Advanced Database Techniques	12	06	04	06	16
IV	Advances in Databases	08	02	08	04	14
V	Big Data Management	06	02	04	04	10
Total		**48**	**18**	**24**	**28**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.
g. Encourage students to refer different websites to have deeper understanding of the subject.
h. Observe continuously and monitor the performance of students in Lab.
i. Demonstrate students thoroughly before they start doing the practice.
j. Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so

that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Develop and maintain XML database for Employee information System.
b. Design and develop MongoDB database for library management system.
c. Perform preprocessing of data using any data mining tool (like WEKA).
d. Install and configure Hadoop.
e. Perform database connectivity with any front end tool.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Database Management Systems Application	Kogent Learning Solutions Inc.	Dreamtech Press 2014, ISBN-978-93-5119-476-7
2	Database System Concepts	Korth Henery	Tata McGraw Hill Education, 6th Edition ,ISBN -13:978-93-329-0138-4
3	Complete Reference: Mysql	Vaswani Vikram	McGraw Hill Education, ISBN-13: 9780070586840
4	SQL, PL/SQL The Programming Language of ORACLE	Bayross Ivan	BPB Publications, 3rd Edition ISBN-13: 978-8176569644

14. SOFTWARE/LEARNING WEBSITES

a) https://www.tutorialspoint.com
b) https://www.w3schools.com
c) http://db.ucsd.edu/static/cse132b-sp01/oql.htm
d) https://docs.mongodb.com/manual/tutorial/install-mongodb-on-windows/
e) http://www.cs.stir.ac.uk/courses/CSC9T6/practicals/1%20Data%20Mining/1%20-%20Weka%201.pdf


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Program Name : **Diploma in Computer Engineering Group/ Diploma in Mechanical /Chemical Engineering /Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing**

Program Code : **CO/CM/CW/DC/EJ/ET/EN/EX/EQ/IE/ME/CH**

Semester : **Sixth**

Course Title : **Entrepreneurship Development**

Course Code : **22032**

1. RATIONALE

Globalisation, liberalization and privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer. Our fast growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop project proposals to launch small scale enterprises.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Identify your entrepreneurial traits.
b. Identify the business opportunities that suits you.
c. Use the support systems to zero down to your business idea.
d. Develop comprehensive business plans.
e. Prepare plans to manage the enterprise effectively.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	

@ : Internal examination

(~): For the practical only courses, *the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 11) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

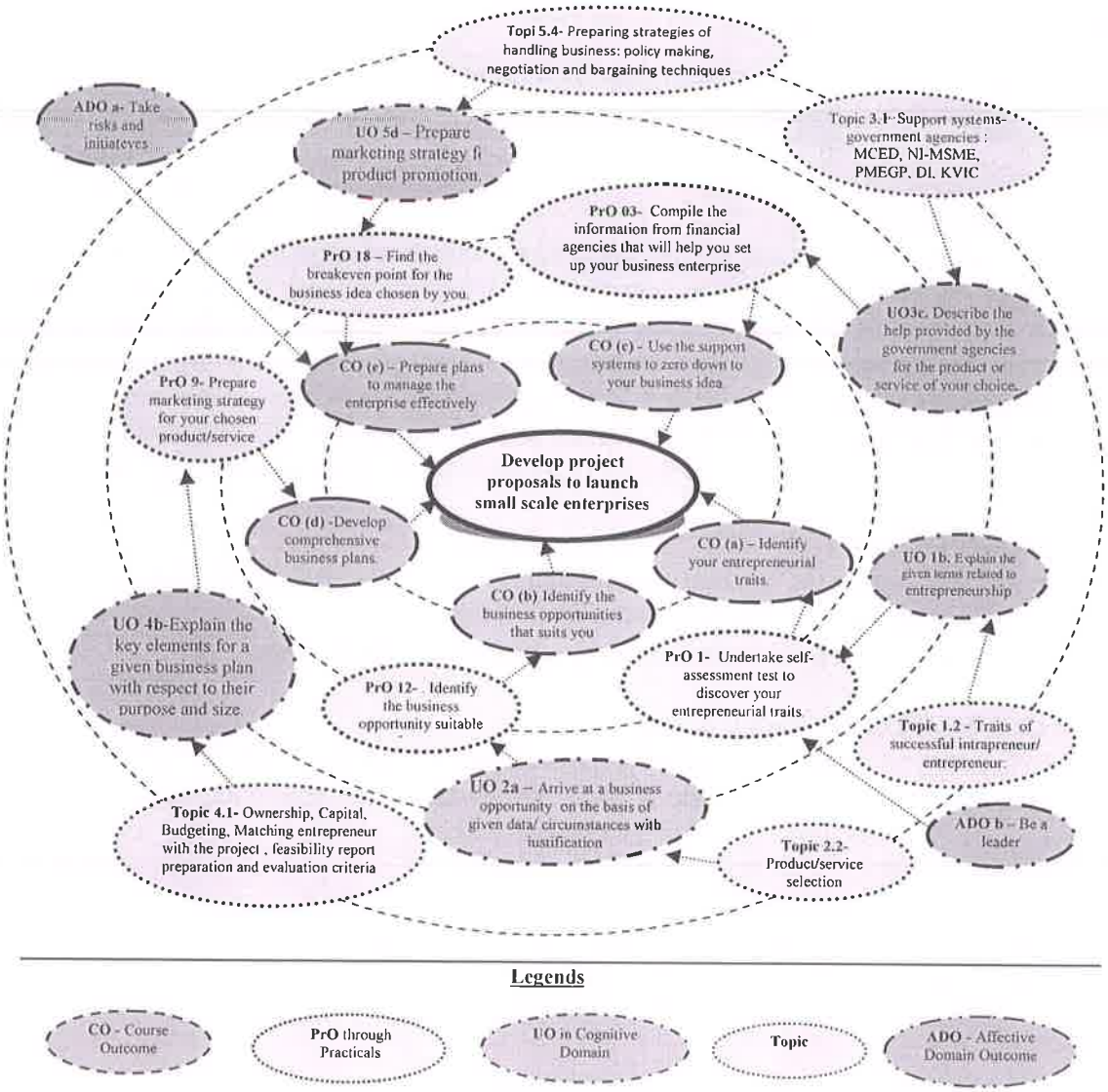

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about500words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02*
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02*
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02*
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02*
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02*
12	Prepare Technological feasibility report of a chosen product/service.	III	02*
13	Prepare financial feasibility report of a chosen product/service.	III	02*
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02*
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
	Total		**42**

Note:

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

Sample Products that can be manufactured under SME

1. Badges cloth embroidered and metals

2. Bags of all types i.e. made of leather, cotton, canvas and jute etc. including kit bags, mail bags, sleeping bags and water-proof bag
3. Bandage cloth
4. Basket cane (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
5. Bath tubs of plastic
6. Battery Charger
7. Belt leather and straps
8. Bolts and Nuts
9. Boot Polish
10. Brooms
11. Domestic Brushes of different types
12. Buckets of all types of plastic
13. Button of all types
14. Chappals and sandals
15. Cleaning Powder
16. Cloth Covers for domestic use
17. Cloth Sponge
18. Coir mattress cushions and matting
19. Cotton Pouches
20. Curtains mosquito
21. Domestic Electric appliances as per BIS Specifications: Toaster Electric, Elect. Iron, Hot Plates, Elect. Mixer, Grinders Room heaters and convectors and ovens
22. Dust Bins of plastic
23. Dusters Cotton all types except the items required in Khadi
24. Electronic door bell
25. Emergency Light (Rechargeable type)
26. Hand drawn carts of all types
27. Hand gloves of all types
28. Hand numbering machine
29. Hand Pump
30. Hand Tools of all types
31. Handles wooden and bamboo (Procurement can also be made from State Forest Corpn. and State Handicrafts Corporation)
32. Haver Sacks
33. Honey
34. Invalid wheeled chairs.
35. Iron (dhobi)
36. Lamp holders
37. Letter Boxes
38. Nail Cutters
39. Oil Stoves (Wick stoves only)
40. Paper conversion products, paper bags, envelops, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes
43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces

47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zeroxing)
6. Industrial photography
7. Industrial R & D Labs.
8. Industrial Testing Labs.
9. Desk Top publishing
10. Advertising Agencies
11. Internet Browsing/Setting up of Cyber Cafes
12. Auto Repair, services and garages
13. Documentary Films on themes like Family Planning, Social forestry, energy conservation and commercial advertising
14. Laboratories engaged in testing of raw materials, finished products
15. 'Servicing Industry' Undertakings engaged in maintenance, repair, testing or electronic/electrical equipment/ instruments i.e. measuring/control instruments servicing of all types of vehicles and machinery of any description including televisions, tape recorders, VCRs, Radios, Transformers, Motors, Watches.
16. Laundry and Dry Cleaning
17. X-Ray Clinic
18. Tailoring
19. Servicing of agriculture farm equipment e.g. Tractor, Pump, Rig, Boring Machines.
20. Weigh Bridge
21. Photographic Lab
22. Blue printing and enlargement of drawing/designs facilities
23. ISD/STD Booths
24. Teleprinter/Fax Services
25. Sub-contracting Exchanges (SCXs) established by Industry Associations.
26. Coloured or Black and White Studios equipped with processing laboratory.
27. Ropeways in hilly areas.
28. Installation and operation of Cable TV Network:
29. Operating EPABX under franchises
30. Beauty Parlours
31. Creches.

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20

S. No.	Performance Indicators	Weightage in %
6	Answer the sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safe practices
b. Practice good housekeeping
c. Practice energy conservation
d. Demonstrate working as a leader/a team member
e. Maintain tools and equipment
f. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table,chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered. 1b. Explain the given terms related to Entrepreneurship	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship : scope in local and

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	global market. 1.4 Intrapreneur and entrepreneur 1.5 Types of enterprises and their features : manufacturing, service and trading. 1.6 Steps in setting up of a business.
Unit – II Entrepreneurial Opportunities and selection process	2a. Arrive at a business opportunity on the basis of given data/circumstances with justification. 2b. Describe the scheme(s) offered by the government for starting the specified enterprise. 2c. Suggest a suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. 2d. Suggest the steps for the selection process of an enterprise for the specified product or service with justification. 2e. Describe the market study procedure of the specified enterprise.	2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified product/service. 3d. Compute the breakeven point for the specified	3.1 Categorisation of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment and return on sales.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	business enterprise, stating the assumptions made.	
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Develop two products from household waste (attach photographs).
b. Download product development and innovative films from internet.
c. Prepare a collage for 'Traits of successful entrepreneurs'.
d. Invite entrepreneurs, industry officials, bankers for interaction.
e. Identify your hobbies and interests and convert them into business idea.

f. Convert you project work into business.
g. Choose a product and design a unique selling preposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
h. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
i. Choose any advertisement and analyse its good and bad points.
j. Decide any product and analyse its good and bad features.
k. Select any product and prepare its cost sheet.
l. Choose any product and study its supply chain.
m. Arrange brainstorming sessions for improvement of any product.
n. Study schemes for entrepreneurship promotion of any bank.
o. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
p. Open a savings account and build your own capital.
q. Organise industrial visit and suggest modifications for process improvement.
r. Interview at least four entrepreneurs or businessman and identify Charms of entrepreneurship and Traits of successful entrepreneurs.
s. Analyse case studies of any two successful entrepreneurs.
t. Perform a survey and identify local resources available for setting up of an enterprise.
u. Engage in marketing of products.
v. Carry out a demand supply gap analysis for a particular product.
w. Organise a prototype development competition.
x. Arrange fairs, events in the institute and try for sponsorships.
y. Select any performance criteria and continuously compete with yourself.
z. On any performance criteria continuously compete with others.
aa. Foresee your dream and make a long term plan for its accomplishment.
bb. Dream for something unique and make a write-up.
cc. Read articles, books on creativity.
dd. Using morphological analysis technique, reduce cost or increase quality of a product.
ee. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix.
ff. Prepare a business plan and organize a business plan competition.
gg. Select a social cause, set objectives, plan and work for its accomplishment.
hh. Videograph as many as possible from the above and upload on your website, YouTube, facebook.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs/UOs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

e. Use Flash/Animations to explain various maintenances techniquies.
f. Guide student(s) in undertaking micro-projects.
g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
i. They must be encouraged to surf on net and collect as much information as possible.
j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

One Business Plan as a micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he should submit it by the end of the semester to develop the industry oriented COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation in the middle of the semester and one at the end of the semester before submission of the project proposal incorporating the concepts taught during semester. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

a. Choose any advertisement and analyse its good and bad points.
b. Decide any product and analyse its good and bad features.
c. Select any product and prepare its cost sheet.
d. Choose any product and study its supply chain.
e. Arrange brainstorming sessions for improvement of any product.
f. Study schemes for entrepreneurship promotion of any bank.
g. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
h. Open a savings account and build your own capital.
i. Organise industrial visit and suggest modifications for process improvement.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R. D.	McGraw-Hill Education, New Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI,

S. No.	Title of Books	Author	Publication
			Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad,
5	Product Design and Manufacturing	Chitale, A K	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special edition for MSBTE	CPSC, Manila	Tata Mc-Graw Hill, New Delhi,
8	Entrepreneurship and Small Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businesstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html
14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm

16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium EnterpriseS	http://www.dcmsme.gov.in/schemes/TEQUPDetail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20/thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP

Program Name : **All Branches of Diploma in Engineering and Technology.**

Program Code : **CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/ MU/EE/EP/EU/IS/IC/AE/FG/ME/PG/PT/DC/TX/TC**

Semester : **Sixth**

Course Title : **Capstone Project – Execution & Report Writing**

Course Code : **22060**

1. RATIONALE

This course on 'Capstone Project–Execution and Report Writing' is the continuation of the previous semester course on 'Capstone Project–Planning'. So, in this semester, the students are to implement the detailed Capstone Project Plan, which they have prepared in the preceding semester. Therefore, to successfully complete this Capstone Project by the end of this semester, it is necessary to incorporate the suggestions of the guide/examiners of the preceding semester. Hence, it is of utmost importance for the student to again re-capitulate and comprehend the importance, concept and need of the 'Capstone Projects' which are well explained in the 'Capstone Project–Planning' course in the previous semester.

Often, the jobs in the industry, which the diploma holders will come across when they join it and will be in the form of small or large projects. Such projects are generally an integration of the various types of skills which cut across the three major domains of learning i.e. cognitive, psychomotor and affective domain which must have acquired during their journey from first semester to the last semester. Hence, it is essential that students are also given an opportunity to do large projects which require more time compared to the micro-projects in order to develop and integrate the highly essential industry oriented competencies and associated skills in the students. Therefore, in this semester the 'Capstone Project – Execution and Report Writing' will continue to integrate some more additional competencies along with those in the previous semester and hence build up greater confidence to face such situations in the world of work.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

- **Implement the Capstone Project Plan to solve the identified problem/task faced by industry/user related to the concerned occupation by integrating the various types of skills acquired during the programme.**

3. COURSE OUTCOMES (COs)

Depending upon the nature of the projects undertaken, the following could be some of the major course outcomes that could be attained, although, in case of some projects few of the following course outcomes may not be applicable.

a) Implement the planned activity individually and/or as team.
b) Select, collect and use required information/knowledge to solve the identified problem.
c) Take appropriate decisions based on collected and analysed information.
d) Ensure quality in product.
e) Incorporate energy and environment conservation principles.
f) Consider the ethical issues related to the project (if there are any).
g) Assess the impact of the project on society (if there is any).
h) Communicate effectively and confidently as a member and leader of team.

i) Prepare project report after performing due plagiarism check using appropriate tools.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. Course details

As the implementation of the Capstone project progresses and which has to be submitted at the end of project work, one of the outputs of this course is a detailed ***Project Report*** that is continuously prepared by the student. There will also be regular progressive assessment by the teacher as per the criteria no 7 on the basis of rubrics mentioned in **Appendix –C** and in the formats as shown in **Appendix-B** and also for the end-of-semester examination.

5.1 Guidelines for Capstone Project–Execution and Report Writing

a) The students would like to revise the 'Capstone Project – Plan' based on the feedback received in the fifth semester examination.

b) This revised 'Capstone Project – Plan' would be again approved by the project guide. As soon as the revised plan is approved by the teacher, the student will begin to work according to it and would also continue to maintain a dated ***'Project Diary'*** for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This 'Project Diary' should be got signed by the teacher at regular intervals for progressive assessment. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the ***Final Project Report*** at the end of the semester by him/her.

6. Project report

During the final Semester, the student will prepare a 'Project Report' in continuation with the activities conducted in fifth semester under Project Planning having following sub-titles:

Suggested contents of the Project report

- Title page (with name of team members and mentor teacher)
- Certificate (in the Format given in this document as annexure A)
- Acknowledgements (this may need revision at the end of the final semester)
- Abstract (in one paragraph not more than 150 words)
- Content Page

Chapters

1. Chapter–1 Introduction (background of the Industry or User based Problem/Task)
2. Chapter–2 Literature Survey (to finalise and define the Problem Statement)
3. Chapter–3 Scope of the project
4. Chapter–4 Methodology
5. Chapter-5 Details of designs, working and processes

6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Note:

i. The report should contain as many diagrams, figures and charts etc as relevant for the project.
ii. Originality of the report (written in own words) would be given more importance rather than quality of printing and use of glossy paper or multi-colour printing

7. ASSESSMENT OF PROJECT WORK

Project work has two components, first is Progressive Assessment (PA), while another is End Semester Examination (ESE).

7. 1. Progressive Assessment (PA) Guidelines and Criteria

Project guide is supposed to carry out this assessment. It is a continuous process, during which for developing desired qualities in the students, faculty should orally give **informal feedback** to students about their performance and interpersonal behaviour while guiding them on their project work every week. **F**ollowing criteria should be considered while assessing students informally or formally during different stages of the project work.

The following factors need consideration for both Capstone Project-Planning and Capstone Project-Execution and Report Writing.

a) Students should be assessed during the project work so that students can also get feedback for further improvement.
b) It should be kept in mind that project work is mainly experiential learning and it is not the research work, so emphasis should be on work based learning or learning from experience and development of attitudes and skills as mentioned in course outcomes. So focus of assessment should also be on learning from the process of completing project work rather than on novelty or innovation in the project work.
c) For progressive assessment at the end, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the major project work they have to carry out in future)
d) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks if they have done enough efforts.)
e) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking some help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).
f) Originality of the report (written in own words) would be given more importance.
g) The Project Guide will assure the quality of project done by his group.

Criteria of Marks for PA for Capstone Project -Execution and Report Writing.

S. No.	Criteria	Marks
1	**Project Proposal /Identification**	10
2	**Punctuality and overall contribution**	
3	**Project Diary**	
4	**Execution of Plan during sixth semester**	20
5	**Project Report including documentation**	15
6	**Presentation**	05
	Total	**50**

7.2 END SEMESTER EXAMINATION (ESE)

Evaluation shall be carried out according to following criteria. For each project, students from the concerned group should be asked to make presentation of their project , in front of the external and internal examiners which should be followed by question answer session to ascertain the contribution made by each student.

Criteria of Marks for ESE for Capstone Project -Execution and Report Writing

S. No.	Criteria	Marks
1	Project Proposal	05
2	Punctuality and overall contribution	
3	Project diary	
4	Execution of Plan during sixth semester	10
5	Project Report including documentation	10
6	Presentation	10
7	Question and Answer	15
	Total	**50**

8. SPECIAL TEACHING STRETAGIES (If any)

a) Teacher's should not spoon feed the students and let them try on their own at different stages of the project work and even first let them strive hard and only when efforts of students have failed, then teacher should guide them. Guidance should be in initially in the form of clues or hints rather than complete explanation, detailed explanation should be given only when students are not able to work based on clues/hints. The role of teacher should be limited to guide and facilitator

b) Teachers should help students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.

c) ***Teachers should come out of the mindset that there should be compulsorily some innovation and novelty in the project work. Because as discussed earlier, project is mainly opportunity for work based or experiential learning, the aim of which is to develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation.*** The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete on their own without getting it done from market.

d) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.

e) Teachers should motivate students to maintain project document project diary and project report. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.

f) Project Guide should ensure that students submit chapter of report one by one to him/her as per schedule and should check the content of the chapters. The Project guide should monitor that schedule is maintained and report writing is not left till last few weeks. It should not be a problem since first three chapters of the report should have been written in fifth semester itself.

g) Teachers should also encourage students to openly discuss their weaknesses and shortcomings .Teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them.

h) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.

i) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

Appendix–A

CERTIFICATE

This is to certify that Mr./Ms.....

from .....Institute having Enrolment No: .....

has completed project of final year having title .....,.... during the academic year20__-20__. The project completed by individually/ in a group consisting of..... persons under the guidance of the Faculty Guide.

.....

.....

Name & Signature of Guide: .....

Telephone:.....

Appendix–B

PROGRESSIVE ASSESSMENT (PA) OF CAPSTONE PROJECT – EXECUTION AND REPORT WRITING

Evaluation Sheet for Internal Assessment

Name of Student: .....

Name of Programme..... **Semester: Sixth**

Course Title: Capstone Project : Execution and Report Writing **Code:22060.**

Title of the Capstone Project: .....

.....

A. **POs addressed by the Capstone Project** (Mention only those predominant POs)

a) .....
b) .....
c) .....
d) .....

B. **COs addressed by the Capstone Project** (Mention only those predominant POs)

a) .....
b) .....
c) .....
d) .....

C. **OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT**

1. **Unit Outcomes (Cognitive Domain)**
   a) .....
   b) .....
   c) .....
   d) .....

2. **Practical Outcomes (in Psychomotor Domain)**
   a) .....
   b) .....
   c) .....
   d) .....

3. **Affective Domain Outcomes**
   a) .....
   b) .....
   c) .....
   d) .....

PROGRESSIVE ASSESSMENT (PA) Sheet		
S. No.	**Criteria**	**Marks**
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		**50**

Appendix–B

Suggested Rubric for Capstone Project – Execution and Report Writing

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	**Problem/Task Identification (Project Title)**	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	• Take care of more than three POs ii. Scope of problem/task very clear
2	**Literature Survey /Industrial Survey**	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest
3	**Project proposal**	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)
4	**Project Diary**	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week
5	**Final Report Preparation**	Very short, poor quality sketches, Details about methods, material, precaution and conclusions	Detailed, correct and clear description of methods, materials, precautions and	Conclusions. Sufficient Graphic Description.	Very detailed, correct, clear description of methods, materials, precautions and conclusions. Enough tables,

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
		omitted, some details are wrong			charts and sketches
6	**Presentation**	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not presented well	Well organized, includes major information ,well presented
7	**Defense**	Could not reply to considerable number of question.	Replied to considerable number of questions but not very properly	Replied properly to considerable number of question.	Replied to most of the questions properly

Appendix C
Suggestive Project Diary format

Week no:
Activities planned:
Activities Executed:
Reason for delay if any
Corrective measures adopted
Remark and Signature of the Guide

Program Name : **Diploma in Automobile Engineering / Civil Engineering Group / Electronics Engineering Group / Diploma in Plastic Engineering / Diploma in Production Engineering /Diploma in Fashion & Clothing Technology/ Computer Engineering Group**

Program Code : **AE/CE/CR/CS/ DE/EJ/ET/EN/EX/EQ/IS/IC/IE/PG/PT/DC/ CO/CM/CW/IF**

Semester : **Sixth**

Course Title : **Management**

Course Code : **22509**

1. RATIONALE

An engineer has to work in industry with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use relevant managerial skills for ensuring efficient and effective management.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Use basic management principles to execute daily activities.
b. Use principles of planning and organising for accomplishment of tasks.
c. Use principles of directing and controlling for implementing the plans.
d. Apply principles of safety management in all activities.
e. Understand various provisions of industrial acts.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos.(#): Online examination*

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

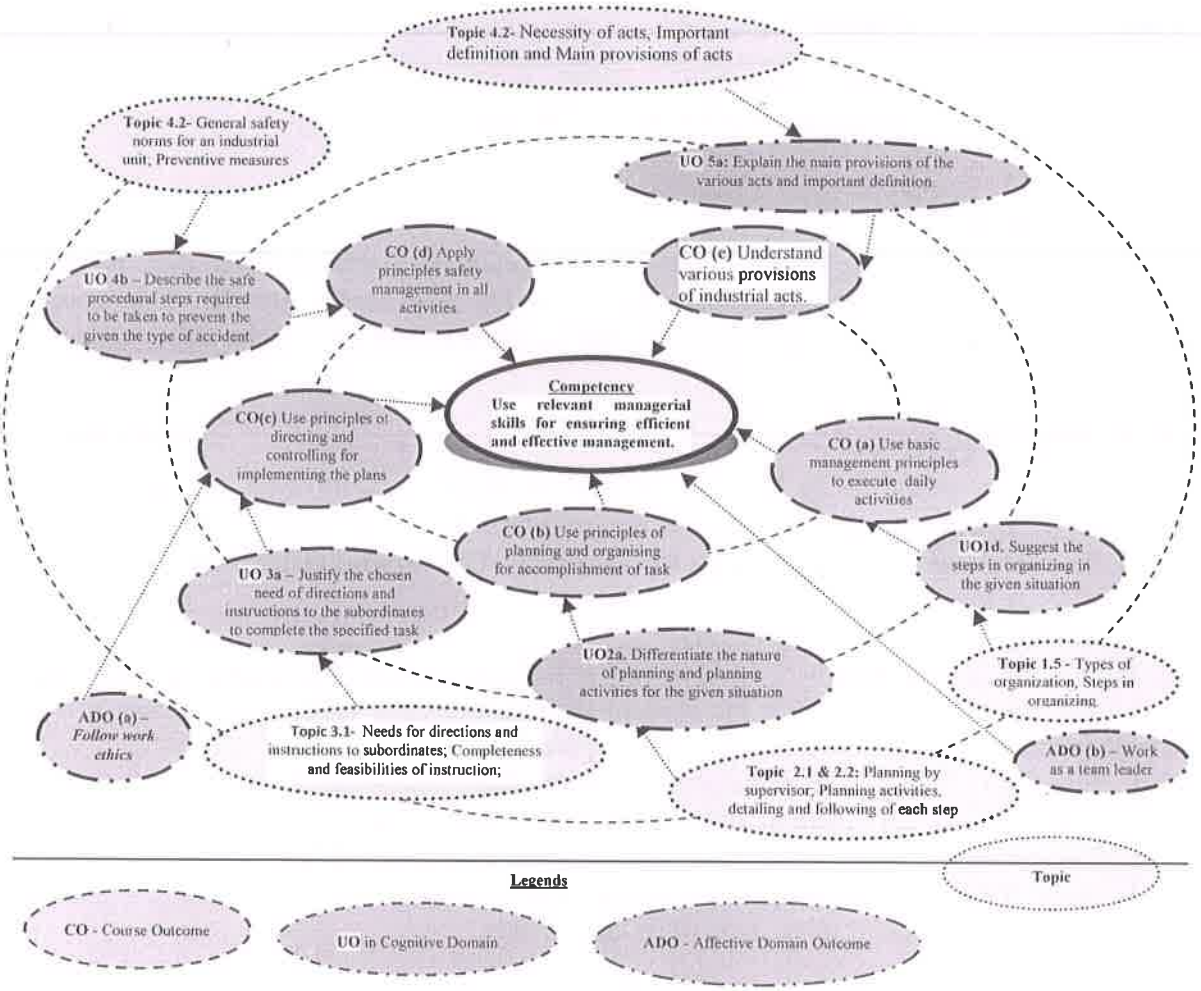

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	**Planning at supervisory level** 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. **Organizing at supervisory level** 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control	**Directing at supervisory level** 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working **Controlling at supervisory level**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	actions and remedial measures required to be taken for completing the given task successfully.	3.4 Managerial control; Understanding team and link between various departments in respect of process and quality standards; Steps in control process 3.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.
Unit – IV Safety Management	4a. State the general safety norms required to be taken in the given case. 4b. Suggest preventive measures of plant activities in the given situation. 4c. Describe the safe procedural steps required to be taken to prevent the given the type of accident. 4d. Prepare a work permit in to conduct the given maintenance activity. 4e. Explain the causes of the specified type of accident in the given situation. 4f. Prepare the specifications of the firefighting equipment required for the given type of fire.	4.1 Need for safety management measures 4.2 General safety norms for an industrial unit; Preventive measures. 4.3 Definition of accident, types of industrial accident; Causes of accidents; 4.4 Fire hazards; Fire drill. 4.5 Safety procedure 4.6 Work permits.
Unit – V Legislative Acts	5a. Explain the purpose of the act 5b. Explain the main provisions of the various acts and important definition.	5.1 Necessity of acts, Important definition and Main provisions of acts. 5.2 Industrial Acts: a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to management	12	06	06	04	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	concepts and managerial skills					
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	12
Total		**48**	**20**	**30**	**20**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Write assignments based on the theory taught in classrooms. Assignments consist of ten questions having long answers including charts, symbols, drawing, observations etc.
b. Prepare/Download information about various industrial acts.
c. Visit to any Manufacturing industry and prepare a report consisting of:
    i. Organization structure of the organization/ Dept.
    ii. Safety measures taken in organization.
    iii. Mechanism to handle the disputes.
    iv. Any specific observation you have noticed.
d. Give seminar on relevant topic.
e. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open onlinc courscs (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.

g. Encourage students to refer different websites to have deeper understanding of the subject.
h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Study of management principles applied to a small scale industry.
b. Study of management principles applied to a medium scale industry.
c. Study of management principles applied to a large scale industry.
d. Prepare case studies of Safety measures followed in different types of organization.
e. Study of measures to be taken for ensuring cyber security.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Management and entrepreneurship	Veerabhadrappa, Havinal	New age international publishers, New Delhi, 2014: ISBN: 978-81-224-2602-1
2	Principles of management	Chaudhry omvir Singh prakash	New Age international publishers, 2012, New Delhi ISBN: 978-81-224-3039-4
3	Industrial Engineering and management	Dr. O. P. Khanna	Dhanpath ray and sons, New Delhi
4	Industrial Engineering and management	Banga and Sharma	Khanna Publication, New Delhi

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. https://www.versesolutions.com/
b. https://www.books.google.co.in/books?isbn=817758412X
c. https://www. www.educba.com › Courses › Business › Management

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Sixth**

Course Title : **Mobile Application Development**

Course Code : **22617**

1. RATIONALE

Android application development is one of the rising and growing trend in the industry of mobile. This course examines the principles of mobile application design and covers the necessary concepts which are required to understand mobile based applications and develop Android based Applications in particular. After completing this course students will design and build a variety of real-time Apps using Android.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Create simple Android applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Interprete features of Android operating system.
b) Configure Android environment and development tools.
c) Develop rich user Interfaces by using layouts and controls.
d) Use User Interface components for android application development.
e) Create Android application using database.
f) Publish Android applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	4	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

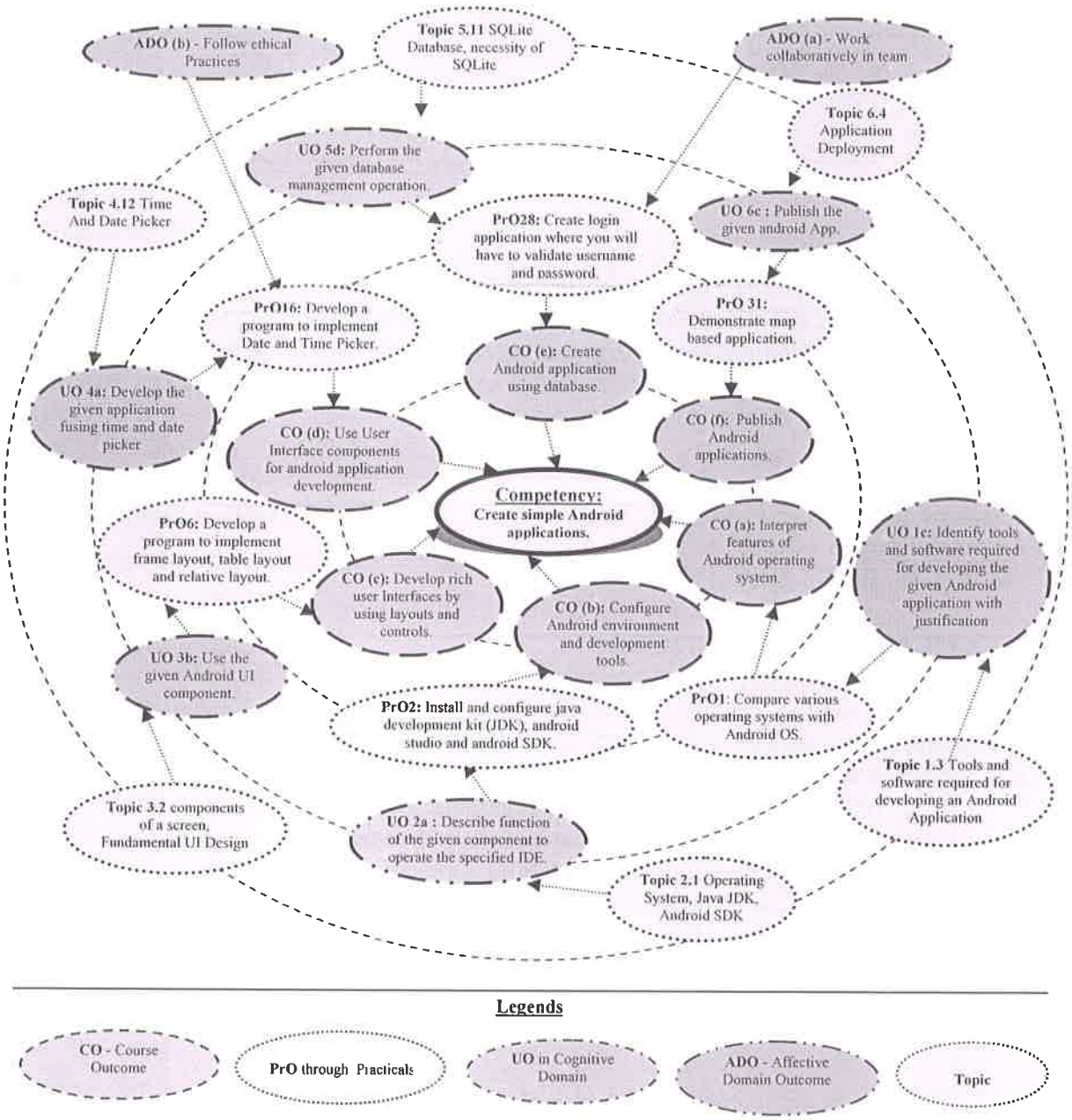

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the above stated competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Compare various operating systems with Android OS.	I	2
2	Install /configure java development kit (JDK), android studio and android SDK.	II	2*
3	Configure android development tools (ADT) plug-in and create android virtual device.	II	2*
4	Develop a program to display Hello World on screen.	III	2*
5	Develop a program to implement linear layout and absolute layout.	III	2*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	Develop a program to implement frame layout, table layout and relative layout.	III	2*
7	Develop a program to implement Text View and Edit Text.	IV	2*
8	Develop a program to implement Auto Complete Text View.	IV	2
9	Develop a program to implement Button, Image Button and Toggle Button.	IV	2*
10	Develop a program to implement login window using above UI controls.	IV	2*
11	Develop a program to implement Checkbox.	IV	2*
12	Develop a program to implement Radio Button and Radio Group.	IV	2*
13	Develop a program to implement Progress Bar.	IV	2*
14	Develop a program to implement List View, Grid View, Image View and Scroll View.	IV	2*
15	Develop a program to implement Custom Toast Alert.	IV	2*
16	Develop a program to implement Date and Time Picker.	IV	2*
17	Develop a program to create an activity.	V	2*
18	Develop a program to implement new activity using explicit intent and implicit intent.	V	2*
19	Develop a program to implement content provider.	V	2
20	Develop a program to implement service.	V	2
21	Develop a program to implement broadcast receiver.	V	2*
22	Develop a program to implement sensors.	V	2*
23	Develop a program to build Camera.	V	2*
24	Develop a program for providing Bluetooth connectivity.	V	2*
25	Develop a program for animation.	V	2
26	Perform Async task using SQLite.	V	2*
27	Create sample application with login module. (Check username and password) On successful login, Change TextView "Login Successful". And on login fail, alert user using Toast "Login fail".	V	2*
28	Create login application where you will have to validate username and password till the username and password is not validated, login button should remain disabled.	V	2*
29	Develop a program to: a) Send SMS b) Receive SMS	VI	2*+2*
30	Develop a program to send and receive e-mail.	VI	2*
31	Deploy map based application. Part I	VI	2*
32	Deploy map based application. Part II	VI	2*
	Total		**66**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. The practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Correctness of User Interface design	30
2	Correctness of business logic applied	40
3	Debugging ability	10
4	Correctness of answers to sample questions	10
5	On time submission	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Work collaboratively in team
b) Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system (Any computer system which is available in laboratory with minimum 2GB RAM)	All
2	Any compatible open source tools (e.g. Android Studio/ Eclipse IDE, Any compatible web server, Any compatible database tool e.g. SQLite)	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Android and its tools	1a. Explain the given basic terms related to Android system. 1b. Explain with sketches Android architecture for the given application. 1c. Identify tools and software required for developing the given Android application with justification.	1.1 Introduction to Android, open handset alliance, Android Ecosystem. 1.2 Need of Android, Features Of Android 1.3 Tools and software required for developing an Android Application 1.4 Android Architecture

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1d. Explain significance of the given component in Android architecture.	
Unit– II Installation and configuration of Android	2a. Describe function of the given component to operate the specified IDE. 2b. Explain the given term related to virtual machine. 2c. Explain the given basic term related to Android development tools. 2d. Describe the features of given android emulator. 2e. Describe the steps to configure the given android development environment	2.1 Operating System, Java JDK, Android SDK 2.2 Android Development Tools(ADT) 2.3 Android Virtual Devices(AVDs) 2.4 Emulators 2.5 Dalvik Virtual Machine, Difference between JVM and DVM 2.6 Steps to install and configure Android Studio and SDK
Unit– III UI Components and Layouts	3a. Explain with relevant analogy the given Directory Structure. 3b. Describe the steps to use the given Android rich UI component. 3c. Describe the steps to use the given type of Layout. 3d. Develop the given basic Android application.	3.1 Control Flow, Directory Structure 3.2 Components of a screen, Fundamental UI Design 3.3 Linear Layout; Absolute Layout; Frame Layout; Table Layout; Relative Layout
Unit-IV Designing User Interface With View	4a. Develop rich user Interfaces for the given Android application. 4b. Develop Android application using the given view. 4c. Explain the significance of the given display Alert. 4d. Develop the given application using time and date picker.	4.1 Text View, Edit Text; Button, Image Button; Toggle Button; Radio Button And Radio Group; Checkbox; Progress Bar 4.2 List View; Grid View; Image View; Scroll View; Custom Toast Alert 4.3 Time And Date Picker
Unit –V Activity And Multimedia with databases	5a. Apply the given Intents and service in Application development. 5b. Use Fragment to generate the given multiple activities. 5c. Develop programs to play the given multimedia. 5d. Write the query to perform the given database management operation.	5.1 Intent, Intent_Filter 5.2 Activity Lifecycle; Broadcast Lifecycle 5.3 Content Provider; Fragments 5.4 Service: Features Of service, Android platform service, Defining new service, Service Lifecycle, Permission, example of service 5.5 Android System Architecture, Multimedia framework, Play Audio and Video, Text to speech, Sensors, Async tasks 5.6 Audio Capture, Camera 5.7 Bluetooth, Animation 5.8 SQLite Database, necessity of SQLite, Creation and connection

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		of the database, extracting value from cursors, Transactions.
Unit –VI Security and Application Deployment	6a. Explain the given location based service. 6b. Write the steps to customize the given permissions for users. 6c. Explain features of the given android security service. 6d. Write the steps to publish the given android App.	6.1 SMS Telephony 6.2 Location Based Services: Creating the project, Getting the maps API key, Displaying the map, Displaying the zoom control, Navigating to a specific location, Adding markers, Getting location, Geocoding and reverse Geocoding, Getting Location data, Monitoring Location. 6.3 Android Security Model, Declaring and Using Permissions, Using Custom Permission. 6.4 Application Deployment: Creating Small Application, Signing of application, Deploying app on Google Play Store, Become a Publisher, Developer Console

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Android and its tools	04	02	02	-	04
II	Installation and configuration of Android	06	02	02	02	06
III	UI Components and Layouts	08	02	02	04	08
IV	Designing User Interface With View	10	02	02	08	12
V	Activity and Multimedia with databases	18	02	06	12	20
VI	Security and Application Deployment	18	02	06	12	20
Total		**64**	**12**	**20**	**38**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various

outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journal of practical.
b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Use different Audio Visual media for Concept understanding.
f) Guide student(s) in undertaking micro-projects.
g) Demonstrate students thoroughly before they start doing the practice.
h) Ensure use of latest version of tools.
i) Encourage students to refer various web sites to have detail understanding of JSP and related concepts.
j) Encourage students to refer different web-applications to have deeper understanding of web-applications.
k) Observe continuously the performance of students in laboratory.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Develop an android application on traffic surveying.
b) Develop an android application on online shopping.
c) Develop an android application for making a calculator.
d) Develop an android application for game.

Guidelines For Developing Micro Projects:

(Implement Following Relevant Guidelines For Micro Projects)

i. Must implement concepts of Advance java.
ii. Must publish the sample application on play store.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Android	Dixit, Prasanna Kumar	Vikas Publications, New Delhi 2014, ISBN: 9789325977884
2	Pro Android 5	Maclean David, Komatineni Satya, Allen Grant	Apress Publications, 2015, ISBN: 978-1-4302-4680-0
3	Android Programming for Beginners	Hortan, John	Packet Publication, 2015, ISBN: 978-1-78588-326-2

14. SOFTWARE/LEARNING WEBSITES

a) https://www.tutorialspoint.com/android
b) http://developer.android.com/guide/index.html.
c) http://developer.android.com/reference/packages.html
d) http://developer.android.com/guide/components/fundamentals.html
e) http://developer.android.com/guide/topics/ui/index.html
f) http://developer.android.com/guide/topics/ui/declaring-layout.html
g) https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Sixth**

Course Title : **Emerging Trends in Computer and Information Technology**

Course Code : **22618**

1. RATIONALE

Advancements and applications of Computer Engineering and Information Technology are ever changing. Emerging trends aims at creating awareness about major trends that will define technological disruption in the upcoming years in the field of Computer Engineering and Information Technology. These are some emerging areas expected to generate revenue, increasing demand as IT professionals and open avenues of entrepreneurship.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Acquire knowledge of Emerging Trends.**

3. COURSE OUTCOMES (COs)

- Describe machine learning and data concepts.
- Interpret IoT concepts.
- Describe Blockchain technology.
- Describe Digital Forensic Models and Evidence Handling Procedures.
- Describe Ethical Hacking process.
- Detect Network, Operating System, and applications vulnerabilities.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	--	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

*(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests(**MCQ type**) to be taken during the semester for the assessment of the UOs required for the attainment of the COs.(* *#*) :Online Examination

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***PA*** *- Progressive Assessment.*

5. COURSE MAP (with sample COs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

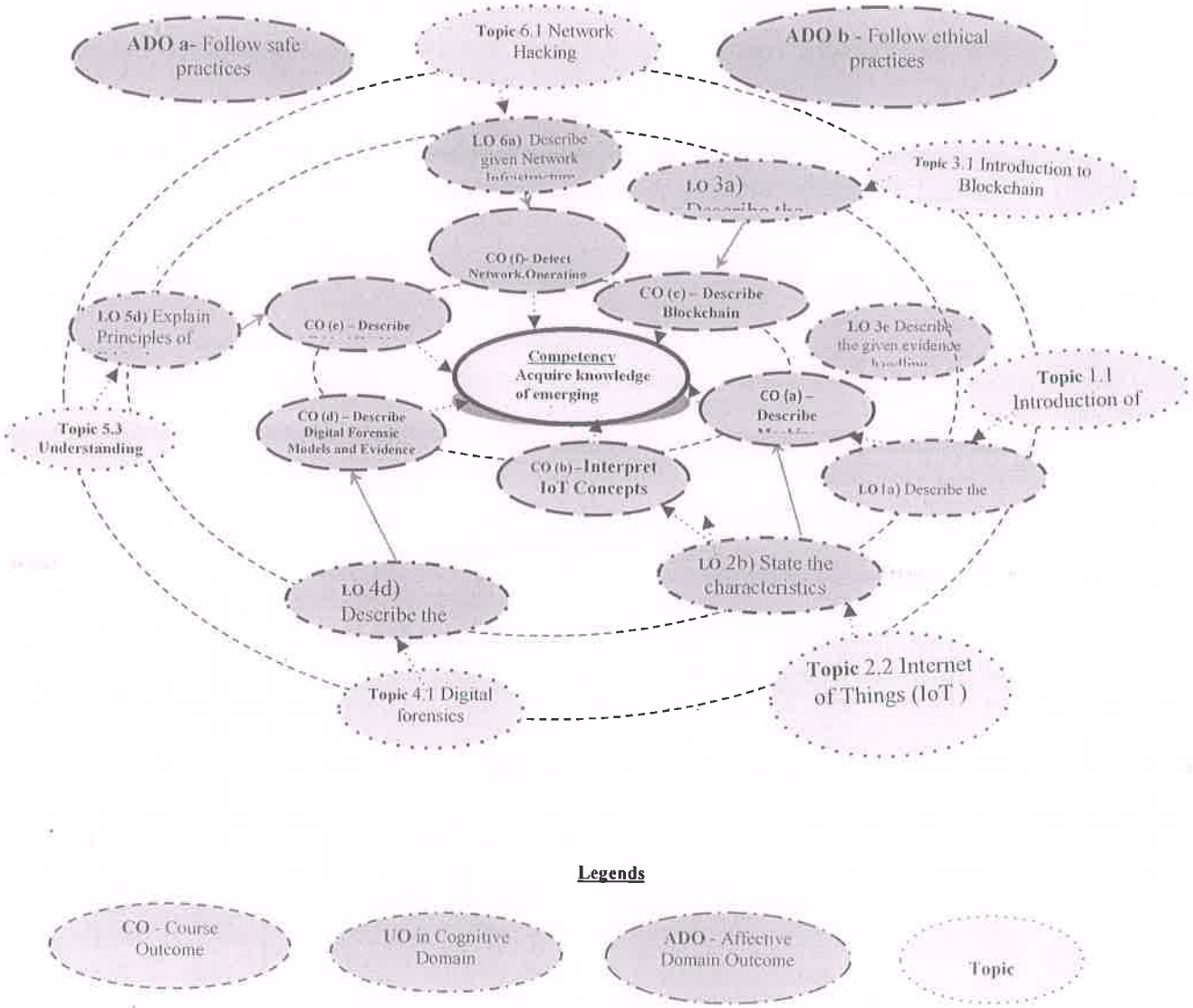

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Not Applicable		

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO
	Not Applicable	

8. UNDERPINNING THEORY COMPONENTS

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit I : Artificial Intelligence (14 m, 6 hrs)	1a) Describe the concept of AI. 1b) State the components of AI. 1c) List applications of AI 1d) Differentiate between machine learning & deep learning. 1e) Enlist data types of data variables 1f) Describe representation methods of 1g) Describe importance of data storytelling. 1h) Describe exploratory analysis in communication	**1.1 Introduction of AI** • Concept • Scope of AI • Components of AI • Types of AI • Application of AI **1.2 Data Visualization** • **Data types in data visualization** • **Scales map of data values in aesthetics** • **Use of coordinate system in data visualization** • **Use of colors to represent data values** • **Representing - Amounts, Distribution, and Proportions** **1.3 Data Storytelling** • **Introduction** • **Ineffectiveness of Graphical representation of data** • **Explanatory Analysis** ○ **Who** ○ **What** ○ **How** **1.4 Concept of machine learning and deep learning.**
Unit II: Machine to Machine Communication (10m, 10 hrs)	2a) Describe the concept of Embedded System 2b) State the characteristics and features Internet of Thing 2c) Describe the design the IoT 2d) State protocols used in IoT 2e) Compare generations of Mobile	**2.1 Internet of Things (IoT)** • Definition • Characteristics of IoT • Features and Applications of IoT • Advantages and Disadvantages of IoT **2.1.2 Design of IoT** • Physical design of IoT

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Network Evaluations. 2f) State characteristics of 5G Network. 2g) Explain NGN Architecture.	• Logical design of IoT **2.1.3 IoT Protocols** **2.1.4 Sensors and actuators used in IoT** **2.2 Introduction to 5G Network** • 5-G characteristics and application areas. • NGN architecture: Features, Functional block diagram, Network components: Media Gateway, Media Gateway Controller, and Application Server. • NGN Wireless Technology: Telecom network Spectrum: Types [licensed and unlicensed], Mobile Network Evolution (2G to 5G), Comparative features, • NGN Core: Features, Multi-Protocol Label Switching (MPLS): Concepts, Features and Advantages.
Unit III : Blockchain Technology	3a) Describe the concept of block-chain 3b) Differentiate between Centralize and Decentralize system 3c) Describe the layers of blockchain. 3d) State the importance of blockchain	**3.1 Introduction to Blockchain** • Backstory of Blockchain • What is Blockchain? **3.2 Centralize versus Decentralized System** **3.3 Layers of Blockchain** • Application Layer • Execution Layer • Semantic Layer • Propagation Layer • Consensus Layer **3.4 Importance of Blockchain** • Limitations of Centralized Systems • Blockchain Adoption So Far **3.5 Blockchain Use and Use Cases**
Unit IV: **Digital Forensics (m- hrs)**	3a. Describe the history of digital forensics 3b. Define digital forensics. 3c. List the rules of digital forensics. 3d. Describe the given model of digital forensic investigation. 3e. State the ethical and unethical	**4.1 Digital forensics** • Introduction to digital forensic • Digital forensics investigation process • Models of Digital Forensic Investigation - o Abstract Digital Forensics

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	issues in digital forensics. 3f. Define digital evidence. 3g. List the rules of digital evidence. 3h. State characteristics of digital evidence. 3i. Describe the given type of evidence. 3j. Describe the given evidence handling procedures. 3k. Explain Volatile Evidence.	Model (ADFM) o Integrated Digital Investigation Process (IDIP) o An extended model for cybercrime investigation **4.2 Ethical issues in digital forensic** • General ethical norms for investigators • Unethical norms for investigation **4.3 Digital Evidences** • Definition of Digital Evidence • Best evidence rule • Original Evidence **4.4 Characteristics of Digital Evidence** • Locard's Exchange Principle • Digital Stream of bits **4.5 Types of evidence** • Illustrative, Electronics, Documented, Explainable, Substantial, Testimonial **4.6 Challenges in evidence handling** • Authentication of evidence • Chain of custody • Evidence validation **4.7 Volatile evidence**
Unit V: Basics of Hacking (10M- 8Hrs)	5a. Define hackers. 5b. Explain the need to hack your own systems. 5c. Explain the types of attacks a system can face. 5d. Explain Principles of Ethical Hacking. 5e. Describe the Ethical hacking Process.	**5.1 Ethical Hacking** • How Hackers Beget Ethical Hackers • Defining hacker, Malicious users • Data Privacy and General Data Protection and Regulation(GDPR) **5.2 Understanding the need to hack your own systems** **5.3 Understanding the dangers your systems face** • Non Technical attacks • Network-infrastructure attacks • Operating-system attacks • Application and other specialized attacks **5.4 Obeying the Ethical hacking Principles** • Working ethically • Respecting privacy • Not crashing your systems

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		5.5 The Ethical Hacking Process • Formulating your plan • Selecting tools • Executing the plan • Evaluating results • Moving on 5.6 Cyber Security act
Unit VI: Types of Hacking (12 M- 10 Hrs)	6a. Describe given Network Infrastructure Vulnerabilities (wired/wireless). 6b. List operating system Vulnerabilities. 6c. Explain Buffer Overflow attack. 6d. Describe given Messaging Systems Vulnerabilities. 6d. Describe given Web Vulnerabilities. 6e. Describe given Database Vulnerabilities.	**6.1 Network Hacking** **Network Infrastructure:** • Network Infrastructure Vulnerabilities • Scanning-Ports • Ping sweep • Scanning SNMP • Grabbing Banners • MAC-daddy attack **Wireless LANs:** • Wireless Network Attacks **6.2 Operating System Hacking** • Introduction of Windows and Linux Vulnerabilities • Buffer Overflow Attack **6.3 Applications Hacking** **Messaging Systems:** • Vulnerabilities • E-Mail Attacks- E-Mail Bombs • Banners • Best practices for minimizing e-mail security risks **Web Applications:** • Web Vulnerabilities • Directories Traversal and Countermeasures • Google Dorking **Database system** • Database Vulnerabilities • Best practices for minimizing database security risks

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Artificial Intelligence	08	06	06	--	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Artificial Intelligence	08	06	06	--	12
II	Machine to Machine communication	08	06	02	02	10
III	Blockchain Technology	08	06	02	02	10
IV	Digital Forensics and Digital Evidences	10	06	06	02	14
V	Basics of Hacking	06	04	06	--	10
VI	Types of Hacking	08	06	06	02	14
	Total	**48**	**34**	**28**	**08**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*:* This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also **collect/record physical evidences for their (student's) portfolio** which will be useful for their placement interviews:

a) Prepare report on suggestive case study of digital forensic, digital evidence and hacking as give below:
   i. The Aaron Caffrey case – United Kingdom, 2003
   http://digitalcommons.law.scu.edu/cgi/viewcontent.gi?article=1370&context=chtlj
   ii. The Julie Amero case – Connecticut, 2007
   http://dfir.com.br/wp-content/uploads/2014/02/ julieamerosummary.pdf
   iii. The Michael Fiola case – Massachusetts, 2008
   http://truthinjustice.org/fiola.htm.
b) Prepare report on any given case study of IoT

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Use different Audio Visual media for Concept understanding.
f) Guide student(s) in undertaking micro-projects.

g) Demonstrate students thoroughly before they start doing the practice.
h) Observe continuously and monitor the performance of students.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In **special situations** where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) IoT Based Humidity and Temperature Monitoring

i. Explain the need of IoT Based Humidity and Temperature Monitoring.
ii. What will be the hardware requirements for designing this system.
iii. What will be the software requirements
iv. Explain how circuit can be designed for this system along with its working
v. Explain how to design an IoT application and how to store and retrieve a data on it.

b) IoT based Weather Monitoring System

i. Explain the need of IoT Based Weather Monitoring System .
ii. What will be the hardware requirements for designing this system?
iii. What will be the software requirements?
iv. Explain how circuit can be designed for this system along with its working
v. Explain how to design an IoT application and how to store and retrieve a data on it.

c) Study any case of fake profiling. Identify

i. The way digital forensics was used in detecting the fraud.
ii. Where was digital evidence located?
iii. Effects.

d) Study any case of forgery /falsification crime case solved using digital forensics:

i. Identify the model used for Digital Investigation.
ii. Was investigation done ethically or unethically.
iii. Where was digital evidence found for crime establishment?
iv. State the punishment meted.

e) Study Credit card fraud as an identity threat. Identify:

i. Use of digital media in carrying out fraud.

ii. Vulnerability Exploited.
iii. Effect of fraud.
iv. Protection/Precaution to be taken against such frauds.

f) Study any Trojan attack. Identify the Trojan attack:

i. State the way trojan got installed on a particular Machine.
ii. State the effects of the Trojan.
iii. Elaborate/Mention/State protection/Blocking mechanism for this specific Trojan, example specification of any anti-threats platform which filters the Trojan.

g) Case studies related to digital forensics

i. Hosting Obscene profile
ii. Illegal money transfer
iii. Fake travel agent
iv. Creating fake profile

h) Case Study on Blockchain
i. https://research.aimultiple.com/blockchain-case-studies/
ii. https://www.ibm.com/blockchain/use-cases/

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Artificial Intelligence	R.B. Mishra	PHI
2.	Introduction to Embedded systems	Shibu K. V	Tata Mcgraw Hill ISBN 978-0-07-014589-4
3.	Beginning Blockchain-A Beginner's Guide to Building Blockchain Solutions	Bikramaditya Singhal Gautam Dhameja Priyanshu Sekhar Panda	Apress, ISBN-13 (pbk): 978-1-4842-3443-3 ISBN-13 (electronic): 978-1-4842-3444-0
4.	Blockchain For Dummies	Tiana Laurence	Wiley India ISBN: 9788126527755
5.	Internet Of Things-A Hands-on Approach	Arshadeep Bahga, Vijay Madisetti,	University Press ISBN 978-8-17371-954-7
6.	The Basics of Digital Forensic	John Sammons	Elsevier ISBN 978-1-59749-661-2
7.	Digital Forensic (2017 Edition)	Dr. Nilakashi Jain Dr. Dhananjat R. Kalbande	Wiley Publishing Inc. ISBN: 978-81-265-6574-0
8.	Hacking for Dummies (5th Edition)	Kevin Beaver CISSP	Wiley Publishing Inc. ISBN: 978-81-265-6554-2
9.	Fundamentals of Data Visualization: A Primer making	Claus O. Wilke	O'Reilly Media Inc. ISBN: 9781492031086

S. No.	Title of Book	Author	Publication
	informative and compelling figures		
10.	Storytelling with data - a data visualization guide for business professionals	cole nussbaumer knaflic	Wiley Publishing Inc. ISBN 9781119002253

SOFTWARE/LEARNING WEBSITES

a) https://www.allitebooks.in/the-internet-of-things/
b) https://www.versatek.com/wp-content/uploads/2016/06/IoT-eBook-version5.pdf
c) https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
d) http://www.spmkck.co.in/Notes/Learning%20Internet%20of%20Things.pdf
e) https://resources.infosecinstitute.com/digital-forensics-models/#gref.
f) https://www.researchgate.net/publication/300474145_Digital_Forensics/download
g) https://docs.microsoft.com/en-us/sysinternals/downloads/psloggedon
h) www.openwall.com/passwords/windows-pwdump
i) https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_process.htm
j) https://slideplayer.com/slide/7480056/
k) https://www.investopedia.com/terms/b/blockchain.asp
l) https://www.javatpoint.com/blockchain-tutorial
m) https://www.tutorialspoint.com/blockchain/index.htm
n) https://www.guru99.com/blockchain-tutorial.html

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Sixth**

Course Title : **Programming with 'Python'**

Course Code : **22616**

1. RATIONALE

Python is powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python code is simple, short, readable, intuitive, and powerful, and thus it is effective for introducing computing and problem solving to beginners. It's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop general purpose programming using python to solve problems**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry-oriented*** COs associated with the above-mentioned competency:

a) Display message on screen using Python script on IDE.
b) Develop python program to demonstrate use of Operators
c) Perform operations on data structures in Python.
d) Develop functions for given problem.
e) Design classes for given problem.
f) Handle exceptions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

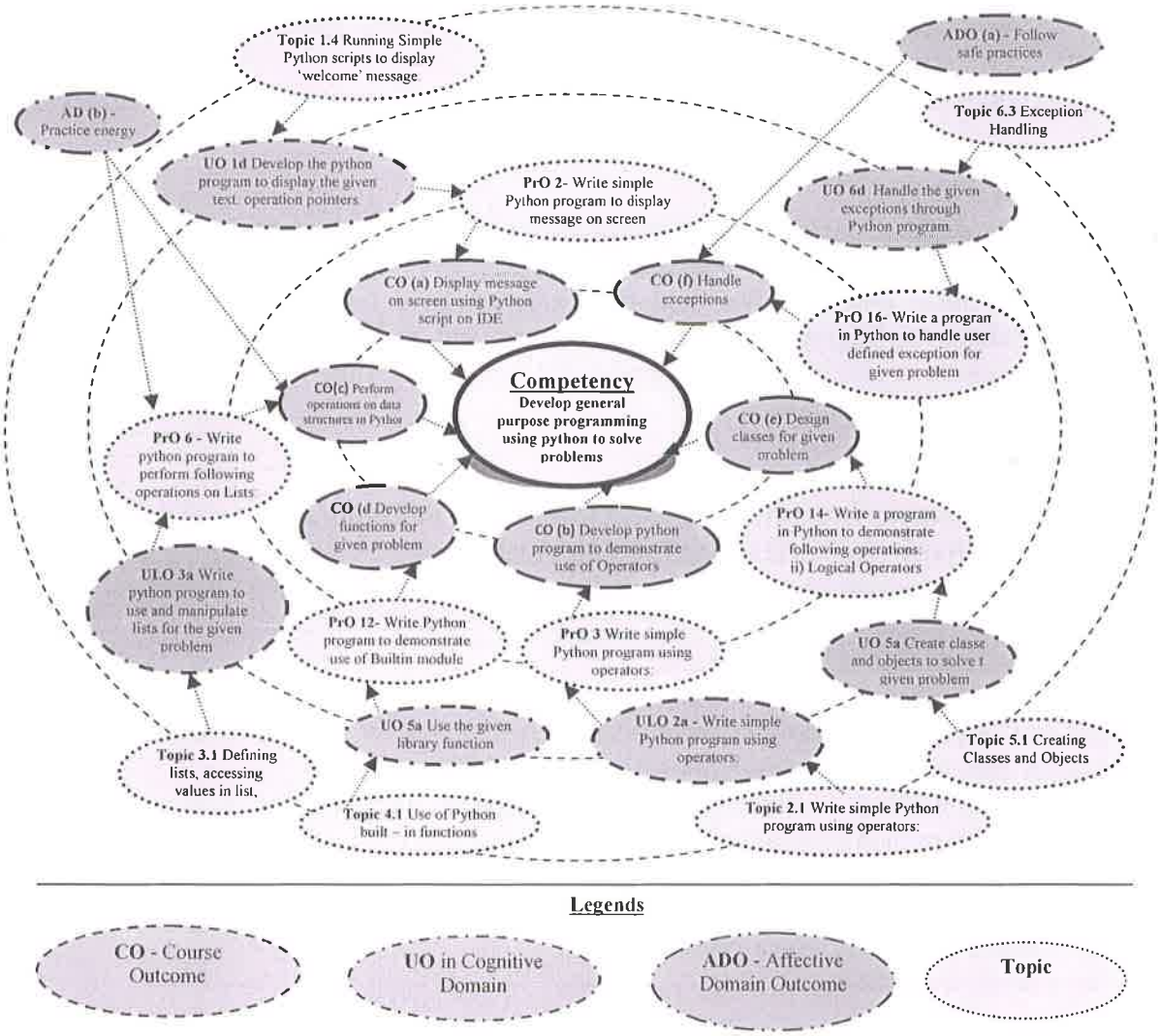

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install and configure Python IDE	I	02
2	Write simple Python program to display message on screen	I	02
3	Write simple Python program using operators: a) Arithmetic Operators b) Logical Operators c) Bitwise Operators	II	02
4	Write simple Python program to demonstrate use of conditional statements: a) 'if' statement	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	b) 'if … else' statement c) Nested 'if' statement		
5	Write python program to demonstrate use of looping statements: a) 'while' loop b) 'for' loop c) Nested loops	II	02
6	Write python program to perform following operations on Lists: a) Create list b) Access list c) Update list (Add item, Remove item) d) Delete list	III	02
7	Write python program to perform following operations on Tuples: a) Create Tuple b) Access Tuple c) Update Tuple d) Delete Tuple	III	02
8	Write python program to perform following operations on Tuples: a) Create Set b) Access Set elements c) Update Set d) Delete Set	III	02
9	Write python program to perform following operations on Dictionaries: a) Create Dictionary b) Access Dictionary elements c) Update Dictionary d) Delete Set e) Looping through Dictionary	III	02
10	a) Write Python program to demonstrate math built- in functions (Any 2 programs) b) Write Python program to demonstrate string built – in functions (Any 2 programs)	IV	02
11	Develop user defined Python function for given problem: a) Function with minimum 2 arguments b) Function returning values	IV	02
12	Write Python program to demonstrate use of: a) Builtin module (e.g. keyword, math, number, operator) b) user defined module.	IV	02
13	Write Python program to demonstrate use of: a) built-in packages (e.g. NumPy, Pandas) b) user defined packages	IV	02
14	Write a program in Python to demonstrate following operations: a) Method overloading b) Method overriding	V	02
15	Write a program in Python to demonstrate following operations: a) Simple inheritance b) Multiple inheritance	V	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
16	Write a program in Python to handle user defined exception for given problem	VI	02
	Total		**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Correctness of business logic	40
2	Debugging ability	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	On time term work submission	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Work collaboratively in team
b) Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	'Python' Interpreter/ IDE	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction and Syntax of Python Program	1a. Identify the given Variables, Keywords and constants in Python 1b. Use indentation, comments in the given program. 1c. Install the given Python IDE and editor. 1d. Develop the python program to display the given text.	1.1 Features of Python – Interactive, Object – oriented, Interpreted, platform independent 1.2 Python building blocks – Identifiers, Keywords, Indention, Variables, Comments 1.3 Python environment setup – Installation and working of IDE 1.4 Running Simple Python scripts to display 'welcome' message. 1.5 Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of data types
Unit– II Python Operators and Control Flow statements	2a. Write simple Python program for the given arithmetic expressions. 2b. Use different types of operators for writing the the arithmetic expressions. 2c. Write a 'Python' program using decision making structure for two-way branching to solve the given problem. 2d. Write a 'Python' program using decision making structure for multi-way branching to solve the given problem.	2.1 Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence 2.2 Control Flow: 2.3 Conditional Statements (if, if … else, nested if) 2.4 Looping in python (while loop, for loop, nested loops) 2.5 loop manipulation using continue, pass, break, else.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– III Data Structures in Python	3a. Write python program to use and manipulate lists for the given problem 3b. Write python program to use and manipulate Tuples for the given problem 3c. Write python program to use and manipulate Sets for the given problem 3d. Write python program to use and manipulate Dictionaries for the given problem	3.1 Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists. b) Basic List Operations c) Built – in List functions 3.2 Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples. b) Basic Tuple operations. c) Built – in Tuple functions 3.3 Sets: a) Accessing values in Set, deleting values in Set and updating Sets. b) Basic Set operations. c) Built – in Set functions 3.4 Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary and updating Dictionary. b) Basic Dictionary operations. c) Built – in Dictionaries functions
Unit-IV Python Functions, modules, and Packages	4a. Use the Python standard functions for the given problem. 4b. Develop relevant user defined functions for the given problem using Python code. 4c. Write Python module for the given problem 4d. Write Python package for the given problem	4.1 Use of Python built – in functions (e.g. type/ data conversion functions, math functions etc.) 4.2 User defined functions: Function definition, Function calling, function arguments and parameter passing, Return statement, Scope of Variables: Global variable and Local Variable. 4.3 Modules: Writing modules, importing modules, importing objects from modules, Python built – in modules (e.g. Numeric and mathematical module, Functional Programming Module) Namespace and Scoping. 4.4 Python Packages: Introduction, Writing Python packages, Using standard (e.g. math, scipy, Numpy, matplotlib, pandas etc.) and user defined packages
Unit-V Object Oriented Programming in Python	5a Create classes and objects to solve the given problem. 5b Write Python code for data hiding for the given problem. 5c Write Python code using data abstraction for the given problem. 5d Write Python program using inheritance for the	5.1 Creating Classes and Objects. 5.2 Method Overloading and Overriding. 5.3 Data Hiding. 5.4 Data abstraction. 5.5 Inheritance and composition classes 5.6 Customization via inheritance specializing inherited methods.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given problem.	
Unit –VI File I/O Handling and Exception Handling	6a Write Python code for the given reading values from keyboard 6b Read data from the given file. 6c Write the given data to a file. 6d Handle the given exceptions through Python program.	6.1 I/O Operations: Reading keyboard input, Printing to screen 6.2 File Handling: Opening file in different modes, accessing file contents using standard library functions, Reading and writing files, closing a file, Renaming and deleting files, Directories in Python, File and directory related standard functions 6.3 Exception Handling: Introduction, Exception handling - 'try: except:' statement, 'raise' statement, User defined exceptions

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction and Syntax of Python Program	04	02	02	04	08
II	Python Operators and Control Flow statements	06	02	04	04	10
III	Data Structures in Python	12	02	04	08	14
IV	Python Functions, modules, and Packages	12	02	02	10	14
V	Object Oriented Programming in Python	08	02	02	08	12
VI	File I/O Handling and Exception Handling	06	02	02	08	12
Total		**48**	**12**	**16**	**42**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journal of practicals.
b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Guide student(s) in undertaking micro-projects.
f) Demonstrate students thoroughly before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Create an English dictionary which is able to perform following function.
   i. Add a word and its meaning.
   ii. Delete a word and its meaning.
   iii. Update word or its meaning.
   iv. Print list of word and its meaning.
b) To create simple calculator using classes and objects.
c) Develop student management system which will able to:
   i) Add ii) Delete iii) Update iv) Display student related information like Roll No, Name, Age, Address, Email-Id, Contact Number etc.
d) Any other micro-projects suggested by subject faculty on similar line.

(Use functions, Classes, Objects and other features of 'Python' to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Python Programing	Rao, K. Nageswara Shaikh Akbar	Scitech Publications (India) Pvt. Ltd. ISBN: 9789385983450
2	Learning Python	Lutz, Mark	5th Edition, O'Reilly Publication ISBN-13: 978-1449355739
3	Python Essential Reference	Beazley, David	4th Edition, Addison-Wesley Professional, ISBN: 9780672329784
4	Head First Python, 2nd Edition	Paul, Barry	O'Reilly Publication, 2nd Edition, ISBN: 1491919531

14. SOFTWARE/LEARNING WEBSITES

a) https://www.tutorialspoint.com/python/index.htm
b) nptel.ac.in/courses/117106113/34
c) https://www.w3schools.com/python/default.asp
d) https://www.programiz.com/python-programming
e) http://spoken-tutorial.org/
f) https://docs.python.org/3/tutorial/errors.html
g) https://www.w3resource.com/python-exercises/
h) https://www.anandology.com/python-practice-book/


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Sixth**

Course Title : **Network and Information Security**

Course Code : **22620**

1. RATIONALE

Computer network security is an important aspect in today's world. Now days due to various threats designing security in organization is an important consideration. It is essential to understand basic security principles, various threats to security and techniques to address these threats. The student will be able to recognize potential threats to confidentiality, integrity and availability and also able to implement various computer security policies. This course will introduce basic cryptographic techniques, fundamentals of computer/network security, Risks faced by computers and networks, security mechanisms, operating system security, secure System design principles, and network security principles. Also it will create awareness about IT ACT and different Cyber laws.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain Network and Information security of an organization.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Identify risks related to Computer security and Information hazard in various situations.
b) Apply user identification and authentication methods.
c) Apply cryptographic algorithms and protocols to maintain Computer Security.
d) Apply measures to prevent attacks on network using firewall.
e) Maintain secured networks and describe Information Security Compliance standards.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical				
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

***(*):** Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.*
***Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

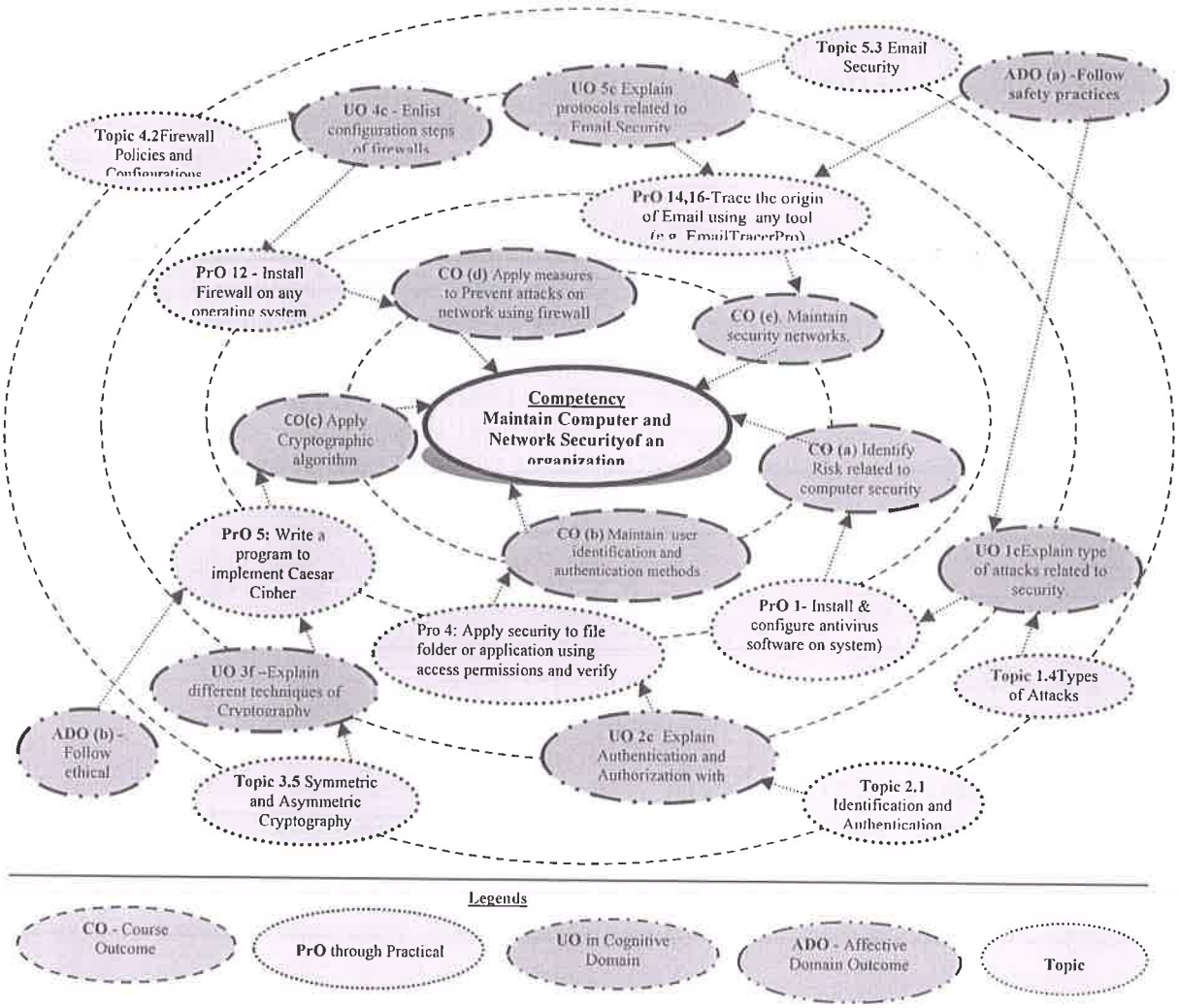

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Install and configure Antivirus software on system (any). b. Set up operating system Updates.	I	2
2	Perform Backup and Restore of the system.	I	2
3	Set up passwords to operating system and applications.	II	2
4	Apply security to file folder or application using access permissions and verify.	II	2
5	Write a program to implement Caesar Cipher	III	2
6	Write a program to implement Vernam Cipher	III	2
7	Create and verify Hash Code for given message	III	2
8	Write a program to implement Rail fence technique	III	2
9	Write a program to implement Simple Columnar Transposition technique	III	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
10	Create and verify digital signature using tool (e.g. Cryptool)	III	2
11	Use Steganography to encode and decode the message using any tool.	III	2
12	a. Install firewall on any operating system. b. Configure firewall settings on any operating system.	IV	2
13	Create and verify Digital Certificate using tool (e.g. Cryptool)	V	2
14	Trace the origin of Email using any tool(e.g. emailTrackerPro)	V	2
15	Trace the path of web site using Tracert Utility	V	2
16	PGP Email Security a. Generate Public and Private Key Pair. b. Encrypt and Decrypt message using key pair.	V	2
		Total	**32**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Correctness of the flow of procedures.	40
2	Debugging ability.	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	Submission of report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Work collaboratively in team
b) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Antivirus Software(any)	
3	Any compiler	6,7,8,9
4	Encryption Decryption tool(preferably Open source based)	10,13
5	Steganography Tools. (preferably Open source based)	11
6	E-mail tracing Tools. (preferably Open source based)	14
7	Web tracing Tools. (preferably Open source based)	15

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Computer and Information Security	1a. Explain the importance of the given component of computer security. 1b. Explain the characteristics of the given type of threat. 1c. Explain the given type of attacks related with security. 1d. Describe the features of given type of update of operating system. 1e. Classify Information. 1f. Explain Principles of Information Security.	1.1 Foundations of Computer Security: Definition and Need of computer security, Security Basics: Confidentiality, Integrity, Availability, Accountability, Non-Repudiation and Reliability. 1.2 Risk and Threat Analysis: Assets, Vulnerability, Threats, Risks, Counter measures. 1.3 Threat to Security: Viruses, Phases of Viruses, Types of Virus, Dealing with Viruses, Worms, Trojan Horse, Intruders, Insiders. 1.4 Type of Attacks: Active and Passive attacks, Denial of Service, DDOS, Backdoors and Trapdoors, Sniffing, Spoofing, Man in the Middle, Replay, TCP/IP Hacking, Encryption attacks. 1.5 Operating system security: Operating system updates : HotFix, Patch, Service Pack. 1.6 Information, Need and Importance of Information, information classification, criteria for information classification, Security, need of security, Basics principles of information security.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II User Authentication and Access Control	2a. Explain techniques of the given type of attack on passwords. 2b. Explain mechanism of the given type of Biometric. 2c. Apply the relevant Authentication method for the given situation with an example. 2d. Describe features of the given access control policy.	2.1 Identification and Authentication: User name and Password, Guessing password, Password attacks-Piggybacking, Shoulder surfing, Dumpster diving. 2.2 Biometrics: Finger Prints, Hand prints, Retina, patterns, Voice patterns, Signature and Writing patterns, Keystrokes. 2.3 Access controls: Definition, Authentication Mechanism, principle-Authentication, Authorization, Audit, Policies: DAC, MAC,RBAC.
Unit– III Cryptography	3a. Encrypt/Decrypt the given text using different substitution techniques. 3b. Convert plain text to cipher text and vice versa using the given transposition technique. 3c. Convert the given message using steganography. 3d. Explain the given technique of cryptography using example.	3.1 Introduction: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption. 3.2 Substitution Techniques: Caesar's cipher, Modified Caesar's Cipher, Transposition Techniques: Simple Columnar Transposition. 3.3 Steganography : Procedure 3.4 Symmetric and Asymmetric cryptography: Introduction to Symmetric encryption, DES (Data encryption Standard) algorithm, Asymmetric key cryptography: Digital Signature.
Unit-IV Firewall and Intrusion Detection System	4a. Compare types of firewall on the given parameter(s). 4b. Explain function of the given type of firewall configuration. 4c. Compare various IDS techniques on the given parameter(s). 4d. Describe features of the given IDS technique.	4.1 Firewall : Need of Firewall, types of firewall- Packet Filters, Stateful Packet Filters, Application Gateways, Circuit gateways. 4.2 Firewall Policies, Configuration, limitations, DMZ. 4.3 Intrusion Detection System : Vulnerability Assessment, Misuse detection, Anomaly Detection, Network-Based IDS, Host-Based IDS, Honeypots
Unit –V Network Security, Cyber Laws and Compliance Standards.	5a. Explain the given component of Kerberos authentication protocol. 5b. Explain the given IP Security protocol with modes. 5c. Explain working of the given protocol for Email security. 5d. Describe the given component of Public Key Infrastructure. 5e. Classify the given Cyber crime.	5.1 Kerberos : Working, AS, TGS, SS 5.2 IP Security- Overview, Protocols- AH, ESP, Modes- transport and Tunnel. 5.3 Email security- SMTP, PEM, PGP. 5.4 Public key infrastructure (PKI): Introduction, Certificates, Certificate authority, Registration Authority, X.509/PKIX certificate format. 5.5 Cyber Crime: Introduction, Hacking , Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography , Identity Theft and Fraud , Cyber terrorism, Cyber Defamation. 5.6 Cyber Laws: Introduction, need,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5f. Explain the specified Cyber law. 5g. Describe compliance standards for Information Security.	Categories: Crime against Individual, Government, Property. 5.7 Compliance standards: Implementing and Information Security Management System, ISO 27001, ISO 20000, BS 25999, PCI DSS, ITIL framework, COBIT framework.

***Note**:To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Computer and Information Security	12	06	06	02	14
II	User Authentication and Access Control	06	04	04	02	10
III	Cryptography	06	02	04	08	14
IV	Firewall and Intrusion Detection System	12	04	06	08	18
V	Network Security, Cyber Laws and Compliance Standards.	12	06	06	02	14
	Total	**48**	**22**	**26**	**22**	**70**

Legends: R=Remember, U=Understand, *A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journal of practicals.
b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the

development of the COs through classroom presentations (see implementation guideline for details).

d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e) Guide student(s) in undertaking micro-projects.
f) Demonstrate students thoroughly before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Case Studies in Secure Computing: Achievements and Trends.
b) Implement Client/Server communication using cryptography tools in your laboratory.
c) Create digital certificate for your departmental/ personal communication.
d) Implement communication system using steganography. Encrypt image and message using any cryptography technique.
e) Implement communication system using steganography using audio files. Encrypt audiofile and message using any cryptography technique.
f) Implement Three Level Password Authentication System.
g) Any other micro-projects suggested by subject faculty on similar line.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Security	Dieter Gollmann	Wiley Publication, New Delhi, ISBN : 978-0-470-74115-3
2	Cryptography and Network Security	Atul Kahate	McGraw Hill Education, New Delhi ISBN: 978-1-25-902988-2
3	Cyber Laws And IT Protection	Harish Chander	PHI Publication,New Delhi, 2012 ISBN: 978-81-203-4570-6
4	Implementing Information Security based on ISO 27001 / ISO 27002 (Best Practice)	Alan Calder	Van Haren Publishing ISBN-13: 978-9087535414 ISBN-10: 9087535414

14. SOFTWARE/LEARNING WEBSITES

a) http://nptel.ac.in/courses/106105162/
b) https://www.tutorialspoint.com//computer_security/computer_security_quick_guide.htm
c) http://learnthat.com/introduction-to-network-security/
d) https://freevideolectures.com/course/3027/cryptography-and-network-security
e) https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/video-lectures/
f) http://stylesuxx.github.io/steganography/
g) https://smartninja-pgp.appspot.com/
h) http://www.cyberlawsindia.net/cyber-india.html
i) https://www.upcounsel.com/cyber-law
j) http://cyberlaws.net/cyber-law/

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/CW**

Semester : **Sixth**

Course Title : **Data Warehousing with Mining Techniques**

Course Code : **22621**

1. RATIONALE

Data mining and warehousing are the essential components of decision support systems for the modern days in industry and business. These techniques enable students to take better and faster decisions. The objective of this course is to introduce students to various Data Mining and Data Warehousing concepts and techniques. This course introduce principles, algorithm, architecture, design and implementation of data mining and data warehousing techniques. Learning this course would improve the employment potential of students in the information management sector.

2. COMPETENCY

The aim of this course is to help the student develop required skills so that they are able to acquire following competency:

- **Use Data mining techniques for data analysis to maintain Data warehouse.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Establish scope and necessity of Data Mining for various applications.
b) Establish scope and necessity of Data warehouse for various applications.
c) Use concept of data mining components and techniques in designing data mining systems.
d) Use data mining tools for different applications.
e) Apply basic Statistical calculations on Data.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical				
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

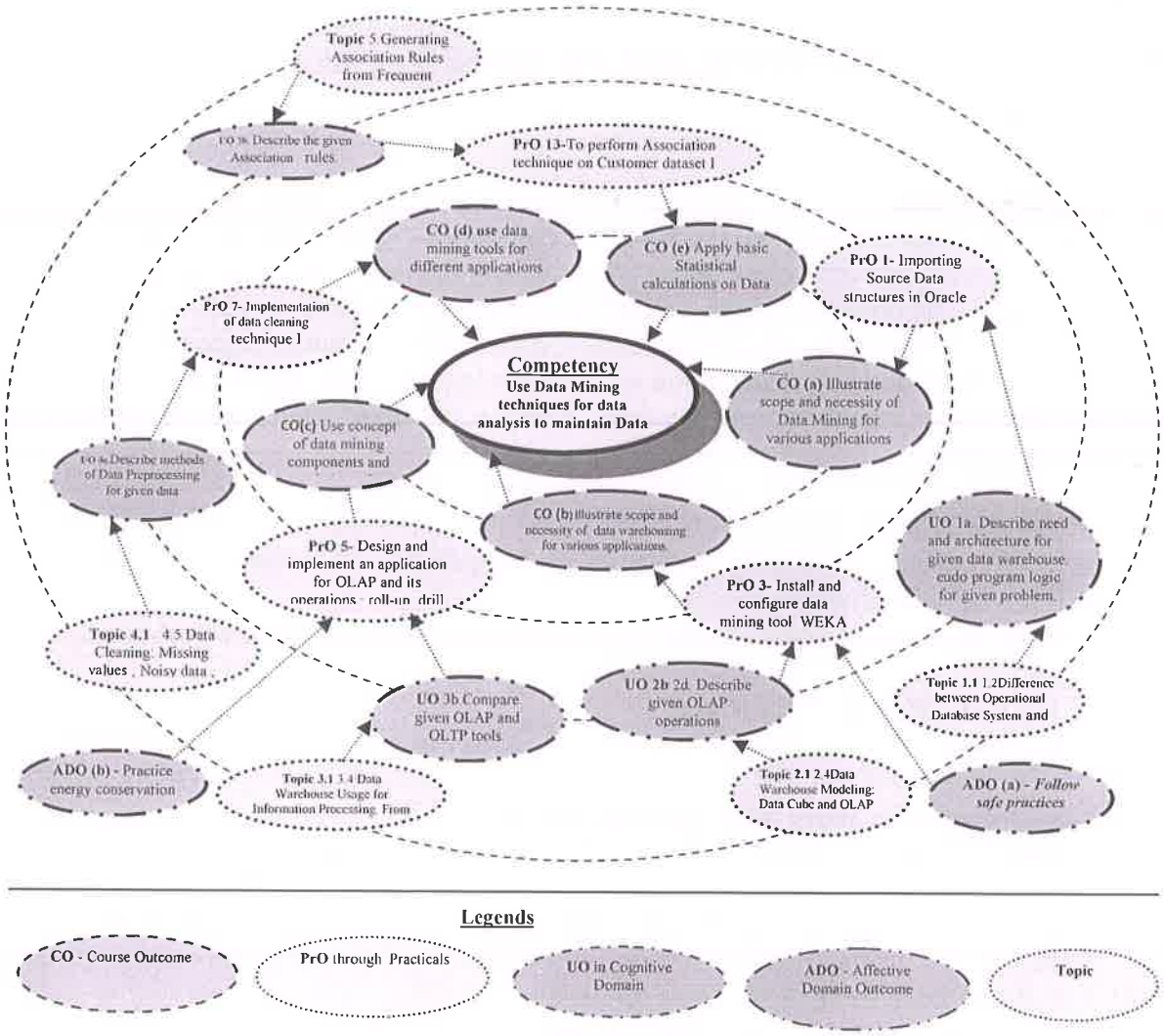

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install Oracle Database Server and client.	I	02
2	Import Source Data structures in Oracle	I	02
3	Develop Target Data structures in Oracle	II	02
4	Install data mining tool WEKA. Study the GUI explorer on WEKA	II	02
5	Develop an application for OLAP and its operations: roll-up, drill down.	III	02
6	Develop an application for OLAP and its operations: Slice and dice.	III	02
7	Implement data cleaning technique I (Data Preprocessing --Finding and replacing Missing value in sample Dataset.)	IV	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8	Implement data cleaning technique II (Data Transformation - Transforming data from one format to another format on sample data set)	IV	02
9	Preprocess dataset WEATHER.arff including creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Part - I	IV	02
10	Preprocess dataset WEATHER.arff including creating an ARFF file and reading it into WEKA, and using the WEKA Explorer. Part - II	IV	02
11	Demonstration of preprocessing on dataset Customer.arff ~~includes creating an ARFF file and reading it into WEKA, and using the WEKA Explorer.~~ Attributes Selection and Normalization.	IV	02
12	Demonstration of preprocessing on dataset Customer.arff ~~includes creating an ARFF file and reading it into WEKA, and using the WEKA Explorer.~~ Draw various graphs using WEKA	IV	02
13	Perform Association technique on Customer dataset I. (Implementing Apiori algorithm on customer dataset.)	V	02
14	Perform Association technique on Customer dataset II. (Using classification algorithm of KNN on sample dataset)	V	02
15	Apply clustering technique on Customer dataset I. (Using K-means clustering on sample customer dataset.)	V	02
16	Apply clustering technique on Customer dataset II. (Using K-means clustering on sample weather dataset)	V	02
	Total		**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Correctness of implementation of algorithm	40
2	Analysis and implementation ability	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	Submit report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Work collaboratively in team
b) Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
	Computer system (Any computer system with basic configuration)	All
	Oracle Client and server	
	Data Mining tool : WEKA	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Data Warehousing	1a. Describe need and architecture for the given data warehouse. 1b. Explain the benefits of data warehousing of the given application. 1c. Describe the given Data warehouse Models. 1d. Describe Extraction, Transformation and Loading for the given data warehouse 1e. Describe Metadata Repository for the given data warehouse.	1.1 Data warehousing, Difference between Operational Database System and Data warehouse. 1.2 Need for data warehousing. 1.3 A Multi tiered Architecture of data warehousing. 1.4 Data Warehouse Models: Enterprise Warehouse, Data Mart, and Virtual Warehouse. 1.5 Extraction, Transformation, and Loading. 1.6 Metadata Repository. 1.7 Benefits of Data warehousing.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Data Warehouse Modeling and Online Analytical Processing I	2a. Describe Data Cube and OLAP for the given data warehouse. 2b. Explain Schemas for Multidimensional data models for the given data warehouse. 2c. Compare Stars, Snowflakes and Schema models for the given data warehouse on the basis of the given criteria. 2d. Describe the given OLAP operations 2e. Explain the benefits of the given OLAP tool.	2.1 Data Warehouse Modeling: Data Cube and OLAP, Data Cube: A Multidimensional Data Model. 2.2 Stars, Snowflakes, and Fact Constellations. 2.3 OLAP : Need of OLAP, OLAP Guidelines 2.4 Typical OLAP Operations
Unit– III Data Warehouse Designing and Online Analytical Processing II	3a. Describe design Process for the given data warehouse. 3b. Compare the given OLAP and OLTP tools, based on the given criteria. 3c. Design the given Data warehouse. 3d. Explain Bitmap and Join Index for the given OLAP. 3e. Compare OLAP server Architectures for the given data warehouse.	3.1 Data Warehouse Design and Usage. 3.2 A Business Analysis Framework for Data Warehouse Design. 3.3 Data Warehouse Design Process 3.4 Data Warehouse Usage for Information Processing. From Online Analytical Processing to Multi-dimensional Data Mining 3.5 Data Warehouse Implementation- Efficient Data Cube Computation: An Overview. 3.6 Indexing OLAP Data: Bitmap Index and Join Index, Efficient Processing of OLAP Queries 3.7 OLAP Server Architectures: ROLAP Versus MOLAP versus HOLAP
Unit-IV Introduction to Data Mining	4a. Explain concept of Data Mining. 4b. Describe the given data mining steps 4c. Explain Major issues for the given data. 4d. Explain the given data objects and attributes types. 4e. Describe methods of Data Preprocessing for the given data. 4f. Explain data cleaning process for the given data.	4.1 Introduction to Data Mining: Mining Steps in the process of knowledge discovery of Database (KDD) . 4.2 What Kind of data can be mined? Major issues in data mining. 4.3 Data Objects and Attributes types. 4.4 Data Preprocessing: Why Preprocess the data? Major Tasks in Data Preprocessing. 4.5 Data Cleaning: Missing values , Noisy data , Data cleaning as a process.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Mining Frequent Patterns and Cluster Analysis	5a. Define the Itemsets for the given data. 5b. Describe the given Association Rules. 5c. Explain clustering methods for the given data 5d. Analyze Apriori Algorithm for the given data.	5.1 Mining Frequent Patterns: Basic Concepts: Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules 5.2 Frequent Itemsets Mining Methods: The Apriori Algorithm, Finding Frequent Itemsets Using Candidate Generation. 5.3 Generating Association Rules from Frequent Itemsets. 5.4 What is Cluster Analysis? Requirements for Cluster Analysis 5.5 Overview of Basic Clustering Methods. 5.6 General Applications of Clustering.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Data Warehousing	06	02	02	04	08
II	Data Warehouse Modeling and Online Analytical Processing	10	02	04	06	12
III	Data Warehouse Designing and Online Analytical Processing	10	04	06	08	18
IV	Introduction to Data Mining	12	02	08	08	18
V	Mining Frequent Patterns and Cluster Analysis	10	02	04	08	14
Total		**48**	**12**	**24**	**34**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journal of practicals.
b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

e) Guide student(s) in undertaking micro-projects.

f) Demonstrate students thoroughly before they start doing the practice.

g) Encourage students to refer different websites to have deeper understanding of the subject.

h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Perform Association technique on Customer dataset /Agriculture dataset /

b) Weather dataset.

c) Create the data warehouse for any medical shop having 2 or more branches.

d) Predict traffic conditions for allocating more buses on various routes by bus controller.

e) Predict Job opportunities in Computer /IT field looking into the work generated last year.

f) Design a data mart or data warehouse for any organization.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Data mining concepts and techniques	Han, Jiawei and Micheline Kamber.	Morgan Kaufmann Publications, Elsevier, 2012, ISBN: 978-0123814791
2	Data warehousing, data mining and OLAP	Berson, Alex	McGraw Hill New Delhi 2008. ISBN-13: 978-0070062726

S. No.	Title of Book	Author	Publication
3	The Data warehouse life cycle tool Kit	Kimball, .Ralph	John Wiley Third Edition ISBN: 978-0-471-20024-6
4	Data Based Management	Dr. Rajedra Kawle	Devraj Publication, ISBN- 978-93-86492-00-5

14. SOFTWARE/LEARNING WEBSITES

a) https://docs.oracle.com/
b) https://www.analyticsvidhya.com/learning-paths-data-science-business-analytics-business-intelligence-big-data/weka-gui-learn-machine-learning/
c) https://www.guru99.com/online-analytical-processing.html
d) https://www.tutorialspoint.com/dwh/dwh_relational_olap.htm
e) https://www.tutorialride.com/big-data-analytics/stream-cluster-analysis.htm

Program Name : **Computer Engineering Program Group**

Program Code : **CO/CM/IF/CW**

Semester : **Sixth**

Course Title : **Web Based Application development with PHP**

Course Code : **22619**

1. RATIONALE

PHP is a general purpose, server-side scripting language run a web server that's designed to make dynamic pages and applications. PHP as a web development option is secure, fast and reliable. In the growing field of Web technology it is essential for every Diploma pass outs to learn PHP Language to help them build interactive web applications. This course is designed to inculcate web based applications development skills in students using server side scripting with PHP.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop simple web-based application using PHP language.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a) Develop program using control statement.
b) Perform operations based on arrays and graphics.
c) Develop programs by applying various object oriented concepts.
d) Use form controls with validation to collect user's input.
e) Perform database operations in PHP.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

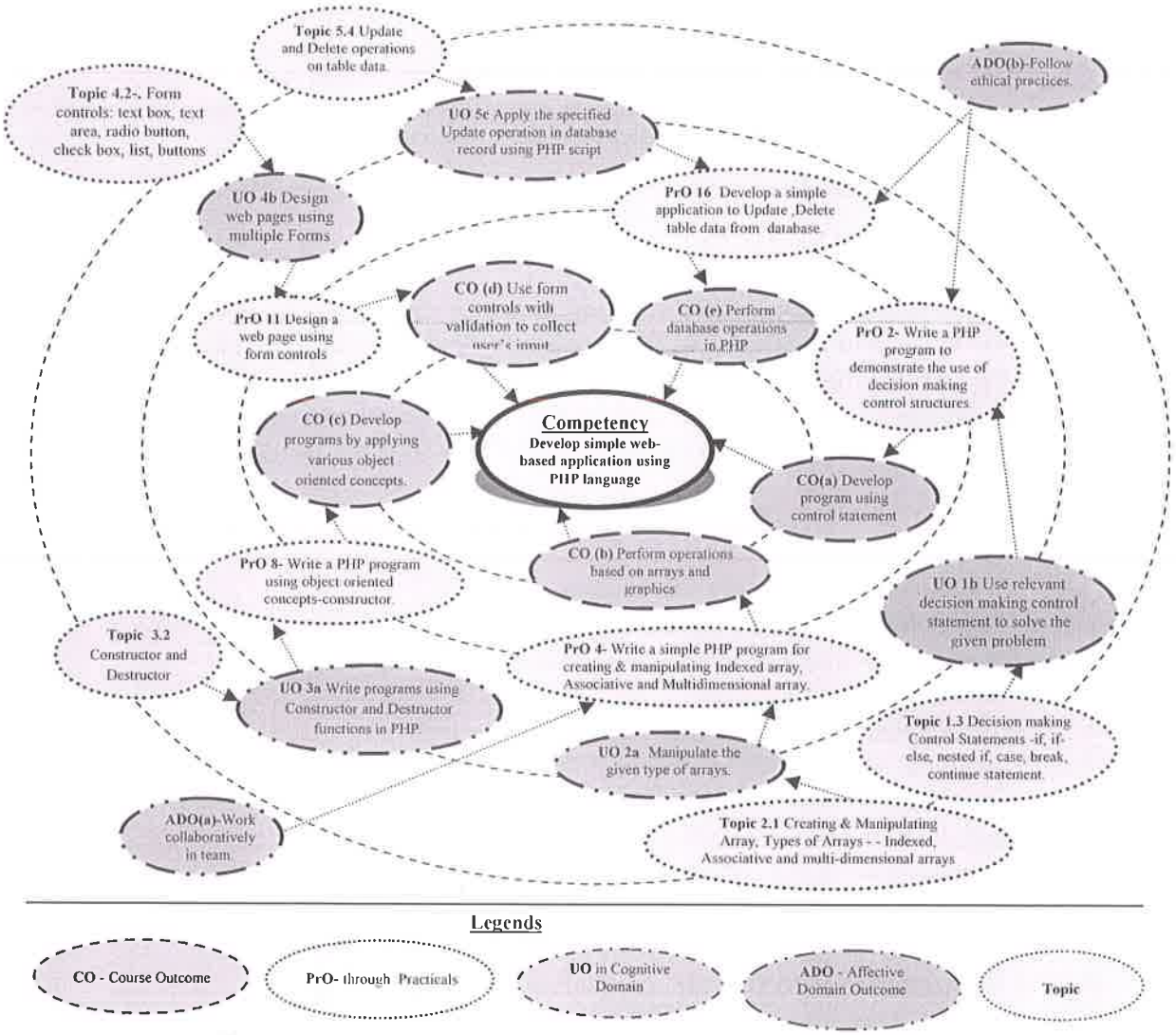

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Install and configure PHP, web server, MYSQL b. Write a program to print "Welcome to PHP". c. Write a simple PHP program using expressions and operators.	I	02*
2	Write a PHP program to demonstrate the use of Decision making control structures using- a. If statement b. If-else statement c. Switch statement	I	02*
3	Write a PHP program to demonstrate the use of Looping structures using- a. While statement, b. Do-while statement c.For statement d. Foreach statement	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Write a PHP program for creating and manipulating- a. Indexed array b. Associative array c. Multidimensional array	II	02
5	a. Write a PHP program to– i. Calculate length of string. ii. Count the number of words in string -without using string functions. b. Write a simple PHP program to demonstrate use of various built-in string functions.	II	02*
6	Write a simple PHP program to demonstrate use of Simple function and Parameterized function.	II	02
7	Write a simple PHP program to create PDF document by using graphics concepts.	II	02
8	Write a PHP program to- a. Inherit members of super class in subclass. b. Create constructor to initialize object of class --by using object oriented concepts	III	02*
9	Write a simple PHP program on Introspection and Serialization.	III	02
10	Design a web page using following form controls: a. Text box, b. Radio button, c. Check box, d. Buttons	IV	02*
11	Design a web page using following form controls: a. List box, b. Combo box, c. Hidden field box	IV	02*
12	Develop web page with data validation.	IV	02*
13	Write simple PHP program to - a. Set cookies and read it. b. Demonstrate session Management.	IV	02*
14	Write a simple PHP program for sending and receiving plain text message (e-mail).	IV	02*
15	Develop a simple application to- a. Enter data into database b. Retrieve and present data from database.	V	02*
16	Develop a simple application to Update, Delete table data from database.	V	02*
	Total		**32**

Note:

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Bloom's 'Cognitive Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Write appropriate code to generate desired output in Web application	30

S. No.	Performance Indicators	Weightage in %
2	Debug, Test and Execute the programs	30
3	Presentation of Output	20
4	Able to Answer to oral questions	10
5	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Work collaboratively in team.
b) Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Hardware : Computer system (Any computer system, preferably i3 - i5 with basic configuration)	All
2	Operating system : Windows / Linux	
3	Any database tool such as MySQL, MariaDB or any equivalent tool	15,16

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Expressions and control statements in PHP	1a Write simple PHP program to solve the given expression. 1b Use relevant decision making control statement to solve the given problem 1c Solve the given iterative problem using relevant loop statement.	1.1 History and Advantages of PHP, , Syntax of PHP. 1.2 Variables, Data types, Expressions and operators, constants 1.3 Decision making Control statements - if, if-else, nested if, switch, break and continue statement. 1.4 Loop control structures-while , do-while , for and foreach

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Arrays, Functions and Graphics	2a Manipulate the given type of arrays to get the desired result. 2b Apply implode, explode functions on the given array. 2c Apply the given string functions on the character array. 2d Scale the given image using graphics concepts/ functions.	2.1 Creating and Manipulating Array, Types of Arrays- Indexed , Associative and Multi-dimensional arrays 2.2 Extracting data from arrays, implode, explode, and array flip. 2.3 Traversing Arrays 2.4 Function and its types –User defined function, Variable function and Anonymous function. 2.5 Operations on String and String functions:str_word_count(),strlen(),strrev(),strpos(),str_replace(), ucwords(),strtoupper(), strtolower(),strcmp(). 2.6 Basic Graphics Concepts, Creating Images, Images with text, Scaling Images, Creation of PDF document.
Unit-III Apply Object Oriented Concepts in PHP	3a Write constructor and destructor functions for the given problem in PHP. 3b Implement inheritance to extend the given base class. 3c Use overloading / overriding to solve the given problem. 3d Clone the given object.	3.1 Creating Classes and Objects 3.2 Constructor and Destructor 3.3 Inheritance, Overloading and Overriding, Cloning Object. 3.4 Introspection, Serialization
Unit –IV Creating and validating forms	4a Use the relevant form controls to get user's input. 4b Design web pages using multiple Forms for the given problem. 4c Apply the given validation rules on form. 4d Set/ modify/ delete cookies using cookies attributes. 4e Manage the given session using session variables.	4.1 Creating a webpage using GUI Components, Browser Role-GET and POST methods, Server Role 4.2 Form controls: text box, text area, radio button, check box, list, buttons 4.3 Working with multiple forms : - A web page having many forms - A form having multiple submit buttons. 4.4 Web page validation. 4.5 Cookies - Use of cookies, Attributes of cookies, create cookies, modify cookies value, and delete cookies. 4.6 Session - Use of session, Start session, get session variables, destroy session. 4.7 Sending E-mail.
Unit-V Database Operations	5a Create database for the given problem using PHP script. 5b Insert data in the given database using PHP script. 5c Apply the specified update operation in database record	5.1 Introduction to MySQL – Create a database. 5.2 Connecting to a MySQL database : MySQL database server from PHP 5.3 Database operations: Insert data, Retrieving the Query result 5.4 Update and delete operations on table

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	using PHP script. 5d Delete the given record from the database using PHP script.	data.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Expressions and control statements in PHP	06	02	02	08	12
II	Arrays, Functions and Graphics	10	02	04	10	16
III	Apply Object Oriented Concepts in PHP	12	02	04	10	16
IV	Creating and validating forms	12	02	04	06	12
V	Database operations	08	02	04	08	14
Total		**48**	**10**	**18**	**42**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare journal of practicals.
b) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c) About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

e) Guide student(s) in undertaking micro-projects.
f) Demonstrate students thoroughly before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a) Develop web application for- Sending plain text email, Sending HTML message, Sending e-mails with attachment
b) Develop web application for Library Management system. – Add book , Display list of book , Search book .
c) Develop web application for Student Feedback System.
d) Develop web application for Employee Pay Management System.

(Any other micro-projects suggested by subject faculty on similar line.)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming PHP	Rasmus Lerdorf, Kevin.T and Peter M.	O'Reilly, USA, ISBN -978-1-449-39277-2, 2013
2	The Complete Reference PHP (Third Edition covers PHP)	Holzner, Steven	McGraw hill, New Delhi, ISBN 9780070223622, 2008.
3	PHP and MySQL	McGrath, Mike	McGraw Hill, New Delhi, ISBN-13: 978-1259029431
4	Advance Web Technology	Dr. Rajedra Kawle	Devraj Publication , ISBN- 978-93-86492-01-2

14. SOFTWARE/LEARNING WEBSITES

a) https://www.w3schools.com/php/default.asp
b) https://www.guru99.com/what-is-php-first-php-program.html
c) https://www.tutorialspoint.com/php/
d) https://tutorialehtml.com/en/php-tutorial-introduction/
e) www.tizag.com/phpT/
f) https://books.goalkicker.com/PHPBook/
g) https://codecourse.com/watch/php-basics


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION MUMBAI

Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Diploma in Computer Engineering / Diploma in Computer Technology / Diploma in Computer Science and Engineering

Program Code : CO/CM/CW **With Effect From Academic Year: 2017 - 18**

Duration of Program : 6 Semesters **Duration : 16 Weeks**

Semester : Sixth **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory							Practical						
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	Management	MGT	22509	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Programming with Python	PWP	22616	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
3	Mobile Application Development	MAD	22617	3	-	4	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
4	Emerging Trends in Computer and Information Technolgy	ETI	22618	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
	Elective – II (Select Any One)																				
5	Web Based Application Development Using PHP	WBP	22619	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Network and Information Security	NIS	22620	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Data Warehousing with Mining Techniques	DWM	22621	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
6	Enterpreneurship Development	EDE	22032	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
7	Capstone Project - Execution & Report Writing	CPE	22060	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
			Total	**17**	**-**	**14**	**31**	--	**350**	--	**150**	--	**500**	--	**175**	--	**175**	--	**350**	--	**850**

Student Contact Hours Per Week: **31 Hrs.** Medium of Instruction: **English**

Theory and practical periods of 60 minutes each. Total Marks : **850**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination, ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**