Program Name : **Diploma in Information Technology/ Automobile Engineering / Digital Electronics / Medical Electronics / Plastic Engineering / Production Engineering / Fashion & Clothing Engineering / Electrical Engineering Group/ Instrumentation/ Instrumentation & Control**

Program Code : **IF/AE/DE/MU/IS/IC/PS/PG/PT/DC/EE/EP/EU**

Semester : **Fifth**

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	

(\$): *Online Examination; (~): PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 15 marks) and micro-project assessment (seen in section 12) and the remaining has a weightage 40% (i.e. 10*

marks) will be 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* **$:** Online examination.

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.

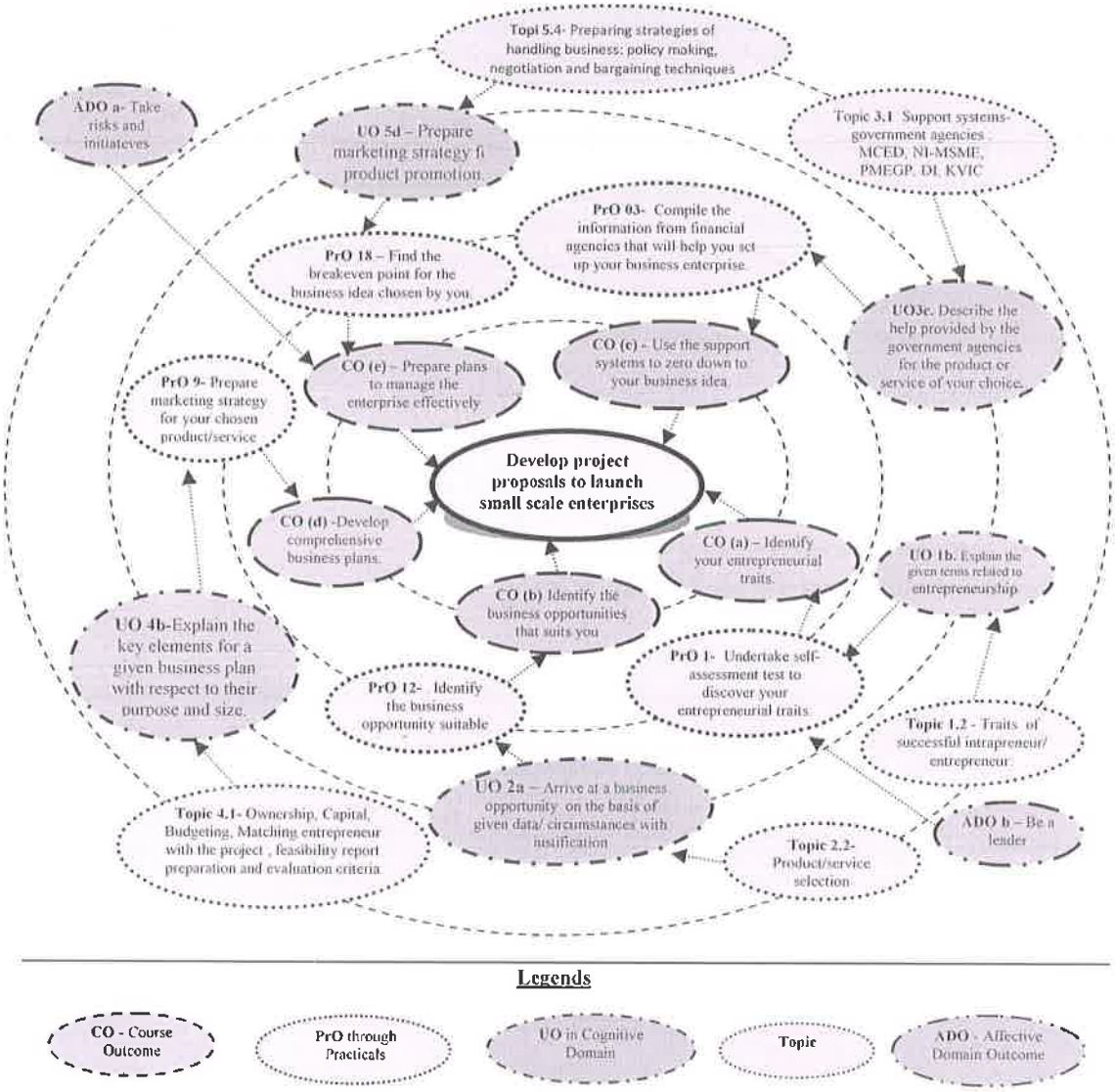

Figure 1 - Course Map

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
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

S. No.	Performance Indicators	Weightage in %
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20
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.	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking.

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	1b. Explain the given terms related to Entrepreneurship 1c. Describe the salient features of the resources required for starting the specified enterprise. 1d. Identify the characteristics for a given type of enterprise.	handling business communication, commitment to work contract, calculated risk taking. 1.3 Entrepreneurship : scope in local and 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	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
	point for the specified 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. SSUGGESTED 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.

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, 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	Khanka, S.S.	S.Chand and Sons, New Delhi;

S. No.	Title of Books	Author	Publication
	Business Management		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 : **Fifth**

Course Title : **Capstone Project – Planning**

Course Code : **22058**

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.

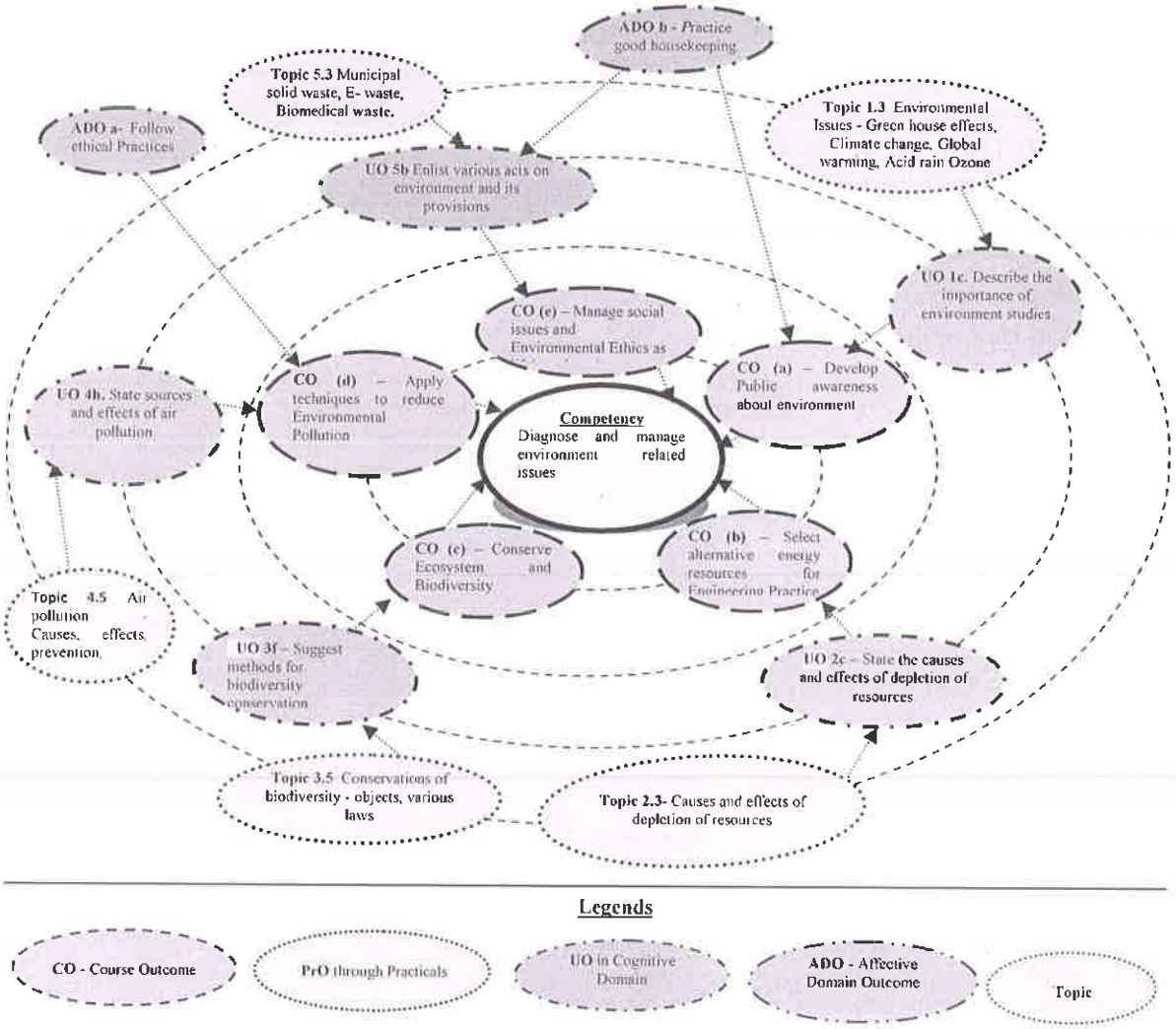

Figure 1 - Course Map

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 : Diploma in Automobile Engineering

Program Code : AE

Semester : Fifth

Course Title : Transport Management and Motor Vehicle Act

Course Code : 22557

1. RATIONALE

The growth of any country mainly depends on transportation of the passengers as well as Goods. The Automobile technologist can play key role in management of various transport organization. The transport industry provides good employment opportunities for Automobile Diploma Engineer as service engineer, fleet manager and depot manager. The Automobile Diploma Engineer requires in-depth knowledge of Motor vehicle act, rules, record keeping, estimation and valuation of vehicle, standard operating procedures and effective driving skills for deciding various transport related policies, fulfilling legal compliances, providing quality service, economic feasibility while working in transport industry.

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 management principles in Motor Transport industry.**

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. Interpret the Motor Vehicle Act and Traffic Rules.
b. Implement concept of Taxation and Insurance in vehicle registration.
c. Implement the business of buying and selling of vehicles.
d. Select suitable mode of transportation and vehicle as per requirement.
e. Identify role of various research organizations in Motor Industry.

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	3	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 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, 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.

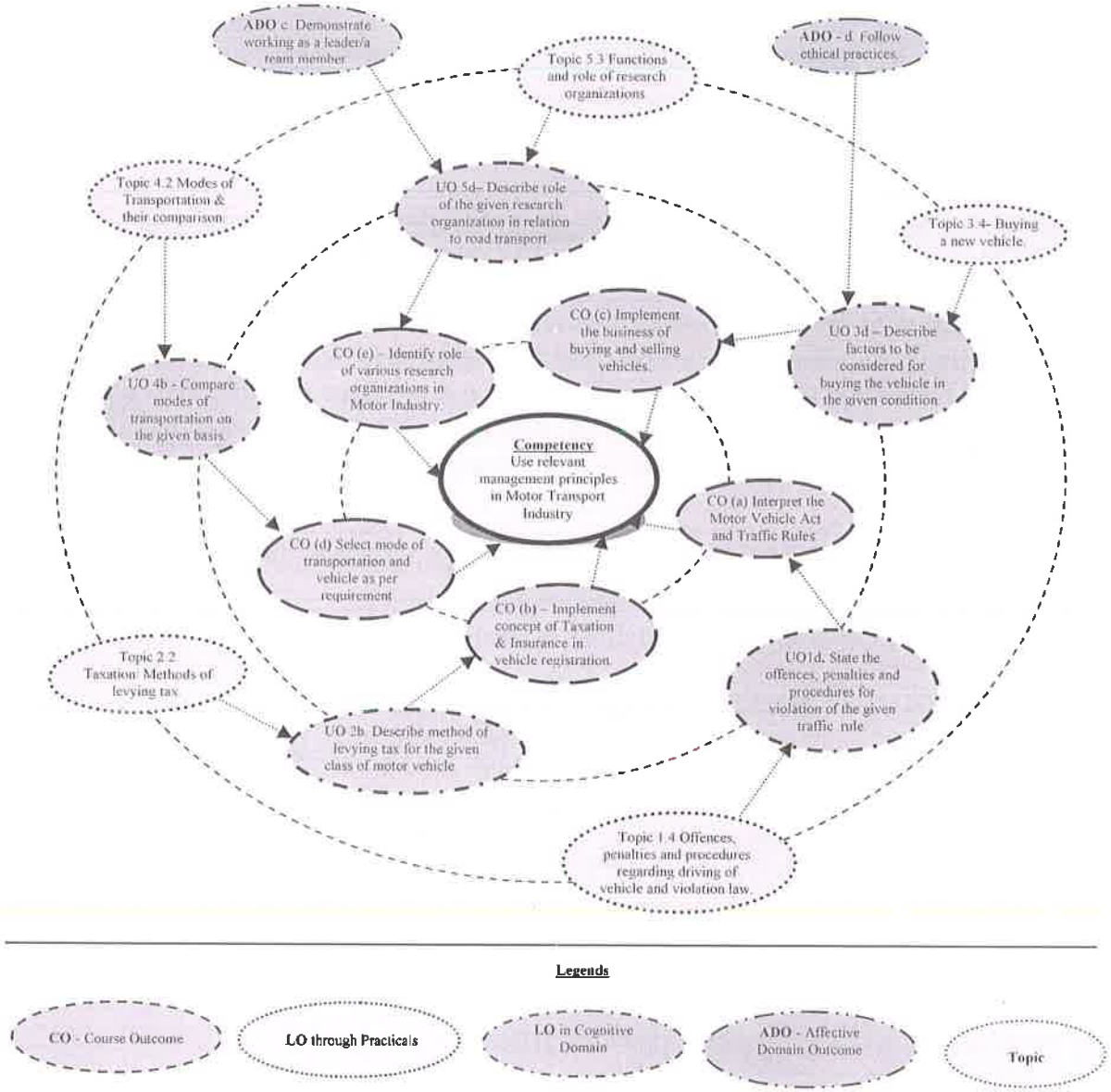

Figure 1 - Course Map

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 Motor Vehicle Acts S	1a. Interpret the given terms used in Motor Vehicle Act. 1b. Describe procedure to obtain the given type of license according to Motor Vehicle Act. 1c. Describe procedure for registration of the given type of motor vehicle according to Motor Vehicle Act. 1d. State the offences, penalties and procedures for violation of the given traffic rule. 1e. Describe the given advanced traffic control system with its features.	1.1 **Motor Vehicle Act:** Brief description, Short titles and Definitions of terms used. 1.2 **Licensing of Drivers and conductors of Motor Vehicle:** i. **Driver's License** - Necessity, Eligibility criteria, Documents required, Procedure to obtain Learner's License and Permanent Driving License, Driving Test, Validity and Renewal of driving license, Restriction on use of learner's license as a driving license, Addition of class to the driving license, Suspension or cancellation of driving license. ii. **Conductor's License** – Necessity, Eligibility criteria, Application for grant of conductor's license, Revocation of Conductor's License, Power to disqualify conductor's license, Renewal of conductor's license. iii. Duties and responsibilities of driver and conductor. 1.3 **Registration of Vehicles:** Necessity of registration, Exemption from registration, Procedure of registration of motor vehicles, Display of Registration mark, Validity of certificate of registration, Renewal of registration, Temporary registration, Transfer of Ownership of Motor Vehicle, Suspension and cancellation of registration. 1.4 **Offences, Penalties :-** Regarding driving of vehicle and violation of law. 1.5 **Transport Authorities and Control of Transport:** i. Transport authorities and their functions. ii. Necessity of Permits, Types of Permit -Stage Carriage Permit, Contract Carriage Permit, Private Service Vehicle Permit, Goods Carriage Permit, Tourist permit, National Permit, Temporary Permit, Exemption from Permit. 1.6 **Control of Traffic:** Traffic Signs

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		and Signals, Vehicle navigation system, GPS, Advance traffic control devices, intelligent transport system, Smart card.
Unit –II Construction of Motor Vehicle, Taxation and Insurance	2a. Describe general provisions regarding construction and maintenance of the given class of motor vehicle. 2b. Describe method of levying tax for the given class of motor vehicle. 2c. Describe significance of the given type of motor vehicle insurance. 2d. Describe the procedure to claim compensation in the given situation.	2.1 **Construction of Motor Vehicle:** Overall dimensions, General provision regarding construction and maintenance of motor vehicle, Power of state and central government to make rules. 2.2 **Taxation:** Objectives, Basis of taxation, Methods of levying tax to motor vehicle, Tax structure for motor vehicles in Maharashtra, Modes of payment of the tax, Tax exemption, Refund of tax. 2.3 **Insurance:** Types of Motor Vehicle insurance – Comprehensive and Third Party insurance, Procedure to claim compensation, Motor Accident Claim Tribunal, Liability without fault in certain cases, Provision of compensation in Hit and Run case.
Unit– III Estimation and Valuation of Vehicle	3a. Describe duties and responsibilities of a surveyor in the given condition. 3b. Prepare accident survey report in the given situation. 3c. Describe the significance of warranty for the given vehicle. 3d. Describe factors to be considered for buying the given type of vehicle in the given condition. 3e. Describe procedure for selling the given type of vehicle.	3.1 **Role of surveyor**: Eligibility for surveyor, Procedure to obtain surveyor's licence, Duties and responsibilities of Surveyor. 3.2 Procedure of accident survey and valuation of vehicle, Accident survey report. 3.3 Importance of warranty system and protection of law. 3.4 **Buying a new vehicle:** Factors to be considered -Ex-showroom price and on road price, use of vehicle, when and where to buy. 3.5 **Buying used vehicles:** When and where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. 3.6 **Sale of used vehicles:** Procedures - Before, During and after sale of vehicle, Auctions, Garages, Private sale, preparing the vehicle documents, selling price.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit IV- Passenger and Goods transport operation.	4a. Interpret the given terms used in transport operation. 4b. Compare different modes of transportation for the given conditions. 4c. State the criteria used for vehicle selection for the given transport operation. 4d. Describe services provided by transport organization to the given stakeholders. 4e. Describe factors considered in Bus scheduling for the given requirement. 4f. Draw a layout of bus depot for the given facilities. 4g. Explain the significance of records kept in the given transport organization	4.1 **Terms used in transportation**: Transport vehicle, Public service vehicle, Goods vehicle, Public place, Depot, Route, Trip, crew, Time table, Vehicle schedule, Fare. 4.2 Modes of transportation and their comparison. 4.3 **Basic elements in Transport Management –** Market Potential, Selection of vehicle, Organization setup, Legal compliance, Policies of transport organization towards Passenger and employee service. 4.4 **Bus and Crew scheduling:** Basic factors in bus, crew (staff) scheduling. 4.5 **Bus depot layout:** Site selection for depot, Layout, Passenger amenities and infrastructural facilities required. 4.6 **Record Keeping:** Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, various types of bookings.
Unit-V Motor Transport and Research organizations	5a. Draw organizational structure of the given transport organization. 5b. Explain the working of the given transport organization with sketch. 5c. Explain the role of automobile engineer in the given organization with justification. 5d. Describe role of the given research organization in relation to road transport.	5.1 **Structure and working of Transport Organizations** - MSRTC, BEST. 5.2 **Role of diploma automobile engineer in Motor Transport Industry.** 5.3 **Functions and Role of Research Organizations:** Central Institute of Road Transport, Automotive Research Association of India, Vehicle Research Development and Establishment, Central Road Research Institute, Petroleum Conservation and Research Association.

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 Motor Vehicle Act.	16	04	08	08	20
II	Construction of Motor Vehicle, Taxation and Insurance	06	02	02	08	12
III	Estimation and Valuation of Vehicle	06	02	04	06	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Passenger and Goods Transport Operation.	14	02	04	10	16
V	Motor Transport and Research organizations	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 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 a report by collecting different forms used in RTO office and fill them.
b. Prepare report on Traffic signs and Signals.
c. Prepare a report on buying or selling a old vehicle

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

a. Registration Process of Motor Vehicle – Steps involved in registration process of given class of motor vehicle.
b. Modern traffic management: Case study of implemented modern traffic management system.
c. Transfer of ownership: Formalities involved in the given case of transfer of ownership (Examples- Within state/region, Interstate, Class of vehicle, change of owner)
d. Transport Organization Management: Passenger transport or Goods Transport organization – Relevant resource management.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication/ISBN NO.
1	Passenger Amenities in STU	Sudarsanam, P.	Manual of Central Institute of Road Transport, Pune.
2	Bus station Management	Sudarsanam, P.	Manual of Central Institute of Road Transport, Pune.
3	Bus and Crew Scheduling	Sudarsanam, P.	Manual of Central Institute of Road Transport, Pune.
4	Central M. V. Rules 1989	Ministry of Transport, Central Government.	Govt. of India.
5	Bus operation	Kitchin, L. D.	Iliffe and Sons Ltd. London, 2nd Edition,1952, ISBN No.B0007J9ZJ6
6	Bus and Coach Operation	Rex W., Faulks	Butterworth-Heinemann, 1987.1st edition, ISBN No.9780408028103
7	Motor Vehicle Act and Transport Management	Khilery, V.S; Sharma, Satpal; Gupta, Shaman	Ishan Publications, 1st edition ISBN No.13: 978-9381551950

14. SOFTWARE/LEARNING WEBSITES

a. https://transport.maharashtra.gov.in/1035/Home
b. https://parivahan.gov.in/sarathiservice7/stateSelection
c. https://parivahan.gov.in/sarathiservice7/sarathiHomePublic
d. https://parivahan.gov.in/vahanservice/vahan/ui/statevalidation/homepage.xhtml

Program Name : **Diploma in Automobile Engineering**

Program Code : **AE**

Semester : **Fifth**

Course Title : **Automobile Component Design**

Course Code : **22558**

1. RATIONALE

The function carried out in the Design and Drawing Department of Automobile Industries is multifarious. Some of these functions are planning, selecting materials, deciding specification, determining design factors, computing and providing dimensions, coordinating with production, designing job fixtures and tools, specifying materials, evaluating design. The diploma engineer should possess some cognitive skill to assist the designers in performing the above-referred functions. This course therefore provides such experiences to the students where they can apply their knowledge from various courses. This course also aims at developing the ability to analyze the given problem, weight alternatives and find the suitable solution. This course would also reinforce the understanding of the basic features of different automobile components since designing would help them in better appreciation of relations between different parameters of components.

2. COMPETENCY

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

- **Design simple automobile components.**

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 design requirements while designing simple Automobile Components.
b. Use measures to reduce stress concentration in component design.
c. Design simple chassis components using available data.
d. Design simple engine components using available data.
e. Design simple axles using available 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	
4	-	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 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.

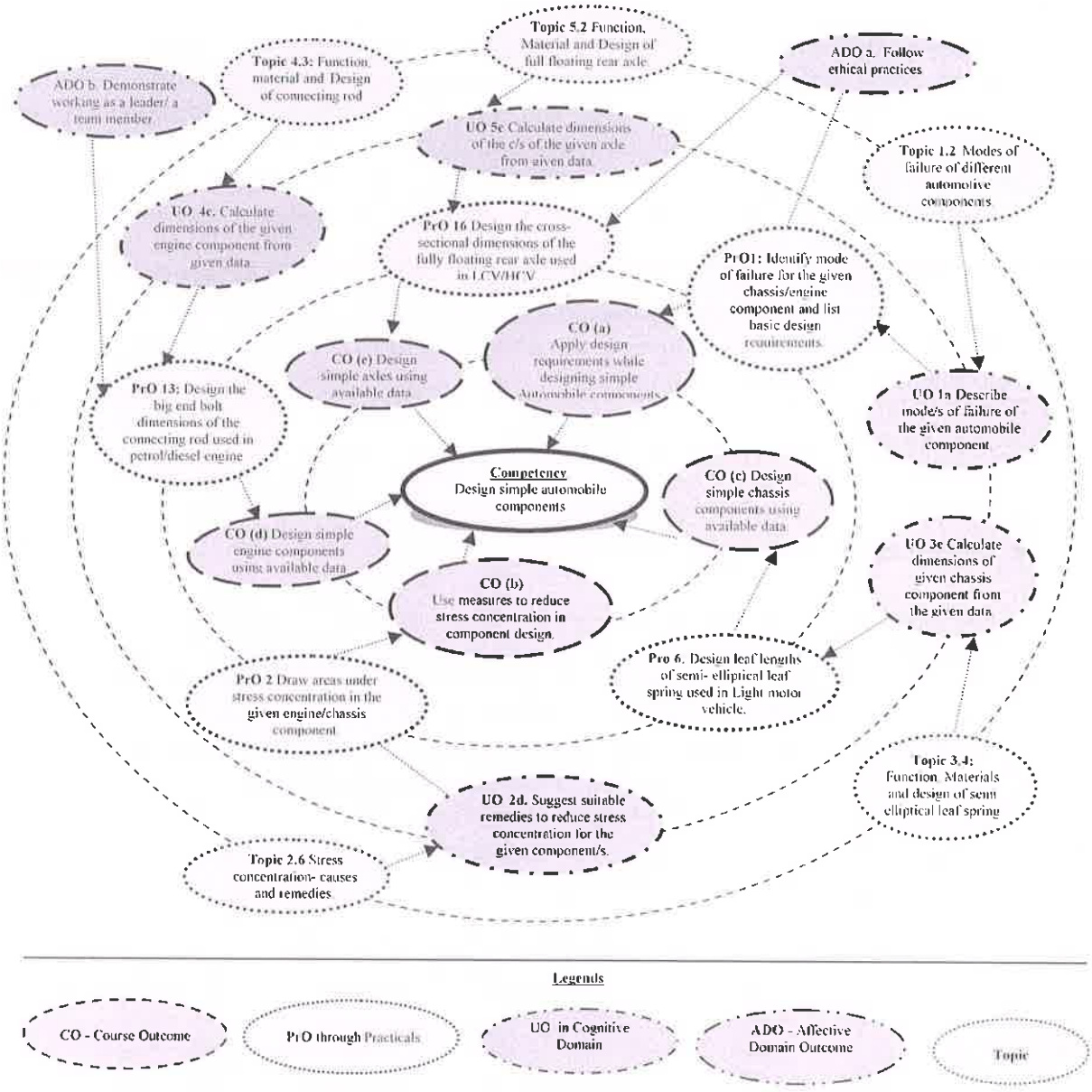

Figure 1 - Course Map

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 mode(s) of failure for the given chassis/engine component(s) and list basic design requirements for the components. (Refer videohttps://www.youtube.com/watch?v=-DXXtpPwbUE)	I	02
2.	Draw the areas under stress concentration in the given engine/ chassis component(s). (Refer video https://www.youtube.com/watch?v=eRQH0SgpoWE)	II	02
3.	Design the friction lining face width of a single plate dry clutch used in light/heavy motor vehicle and compare the same with commercially available vehicles. (Refer video https://www.youtube.com/watch?v=9uJh1WLcL4E)	III	02
4.	Design the friction lining face width for a multi plate clutch used in two-wheelers and compare the same with commercially available two-wheelers.	III	02
5.	Design the cross section of leaves of semi-elliptical leaf spring used in light motor vehicle and compare the same with commercially available light motor vehicles. (refer video https://www.youtube.com/watch?v=T4IgtIkBnOo)	III	02
6.	Design leaf lengths of semi-elliptical leaf spring used in light motor vehicle and compare the same with commercially available light motor vehicles. (refer videohttps://www.youtube.com/watch?v=CD136cE6rMI)	III	02
7.	Design the head thickness of the piston used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines. (refer video: https://www.youtube.com/watch?v=XT169YkNzIQ	IV	02
8.	Design the compression ring, ring zone dimensions of the piston used in petrol/diesel engine, and compare the same with commercially available petrol/diesel engines.	IV	02
9.	Design the skirt length of the piston used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02
10.	Design the piston pin cross section and its length, for the piston used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02
11.	Design the cross-sectional dimensions of the connecting rod used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02
12.	Design the small end dimensions of connecting rod used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02
13.	Design the big end bolt dimensions of connecting rod, used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02
14.	Design the big end dimensions of connecting rod, used in petrol/diesel engine and compare the same with commercially available petrol/diesel engines.	IV	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
15.	Design the cross sectional dimensions of the front axle beam, used in light/heavy motor vehicle and compare the same with commercially available light/heavy motor vehicle.	V	02
16.	Design the cross sectional dimensions of the fully floating rear axle, used in light/heavy commercial motor vehicle and compare the same with commercially available light/heavy motor vehicle.	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 %
a.	Identification of loads and relevant data	10
b.	Selection of material	10
c.	Apply suitable design procedure.	40
d.	Use of standards	10
e.	Draw neat and precise sketches	20
f.	Answer to sample questions	05
g.	Timely completion	05
	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.
1.1	Computer system (Any computer system with basic configuration) Processor (CPU):Intel Core i5-6xxx or equivalent Operating System: Microsoft Windows 10 Professional x64 SP1 (free via Imagine. Restrictions may apply.), Memory: 8 GB RAM Storage: 512 GB internal Solid State Drive (SSD) or 1 TB internal HDD Sustainability EPEAT Silver rating (preferably EPEAT Gold) Monitor/Display: 24" " LCD monitor Network Adaptor: 802.11ac 2.4/5 GHz wireless adaptor Other: Webcam, lock, external drive for backups (software: Latest and Licensed version of Auto Cad/Any other drafting software)	All
1.2	**Chassis Components:** a. Tubular tie rod with ball joints at end – From Steering system of any Car/Jeep/Truck/Bus. b. Coil spring / diaphragm type single plate dry clutch used in LMV/HCV, Multi-plate wet clutch used in two wheelers. c. Single piece Propeller shaft with two Hooks joint, a Slip joint along with universal coupling used in LCV/HCV. d. Constant rate swing semi-elliptical leaf spring. **Engine components:** a. Cylinder block of petrol/diesel engine. b. Petrol/diesel engine piston (solid skirt/split skirt/ fully split T skirt) c. Plain faced piston rings d. Fully floating piston pin e. Central pivoted forged/cast rocker arm f. Petrol/diesel engine straight cut connecting rod with fitted bolt joint g. Petrol/diesel engine inlet/exhaust valve spring (constant pitch helical coil spring) h. Solid/hollow push rod of over head valve and side cam shaft etc.	1 to14
1.3	Dead type Front axle (I cross-section) with reverse Elliot type stub axle arrangement of Make Mahindra /TATA Sumo/Ashok Leyland Truck etc.	15
1.4	Full-floating rear axle: Rear live axle of bus or truck of any make and model.	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 Fundamentals of Automobile Component Design	1a. Describe mode(s) of failure of the given automobile component/s with sketches. 1b. List the standards used in design of the given automobile component/s. 1c. Explain use of preferred numbers in designing the	1.1 Component design - Concept. 1.2 Modes of failure of different automotive components. 1.3 Basic requirements of automobile components. 1.4 Basic automobile component design procedure. 1.5 Use of standards in component

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given automobile component. 1d. Explain effect of ergonomics on the given automobile component design. 1e. Explain effect of aesthetics on the given automobile component design.	design. 1.6 Preferred numbers. 1.7 Ergonomic considerations in component design. 1.8 Aesthetic considerations in component design.
Unit– II Stresses in Automobile Components	2a. Identify stress(s) induced in the given component for the given load condition with justification. 2b. Describe mechanical properties / theories of failure of the given component material. 2c. Use safety factor in calculating dimensions of the given component under given load conditions. 2d. Suggest suitable remedies to reduce stress concentration for the given component/s with justification.	2.1 Normal and shear stresses, Crushing stress, Bearing pressure, Torsional and bending stresses, principal stresses, variable stresses, impact stresses, resilience. 2.2 Stress-strain diagram and its uses. 2.3 Working stress, factor of safety, selection of FOS. 2.4 Theories of failure under static loading- maximum principal or normal stress theory, Maximum shear stress theory, Maximum distortion energy theory. 2.5 Fatigue, Endurance limit, FOS for fatigue loading, S-N Curve. 2.6 Stress concentration, causes and remedies. 2.7 Load factor, Service factor and their applications.
Unit - III Design of Chassis Components	3a. Choose suitable materials for the given chassis component with justification. 3b. Explain stepwise design procedure for the given chassis component. 3c. Calculate dimensions of the given chassis component from the given data. 3d. Draw proportionate diagram of the given chassis component.	3.1 Function of tie rod, Materials for tie rod with justification and design of tie rod. 3.2 Function of clutch, Material for friction lining with justification, Design of disc clutch and multi plate clutch considering uniform wear condition. 3.3 Function of propeller shaft, Design of propeller shaft including universal coupling. 3.4 Function of semi elliptical leaf spring, Materials of leaf spring with justifications and design of semi elliptical leaf spring.
Unit - IV Design of Engine Components	4a. Select the relevant material with justification for the given engine component. 4b. Explain stepwise design procedure for the given engine component. 4c. Calculate dimensions of the	4.1 Function of cylinder block, Materials for cylinder block with justifications. Design of bore diameter; bore length and thickness of cylinder wall. 4.2 Function of piston. Materials with justification and Design of piston

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given engine component from the given data. 4d. Draw proportionate diagram of the given engine component.	and piston pin. 4.3 Function of connecting rod, Materials with justification and Design of connecting rod. 4.4 Function of rocker arm, Materials with justification and Design of rocker arm (for rectangular cross section only) 4.5 Function of valve spring, Materials with justification and Design of valve spring. 4.6 Function of push rod, Material with justification and Design of push rod.
Unit - V Design of Axles	5a. Justify the selection of material for the given axle. 5b. Explain stepwise design procedure for the given axle. 5c. Calculate dimensions of the cross section of the given axle from the given data. 5d. Draw proportionate diagram of the given axle.	5.1 Function of front axle. Material with justification and Design of front axle. 5.2 Function of rear axle, Material for rear axle with justification and Design of full floating rear axle.

***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	Fundamentals of Automobile Component Design	10	04	04	04	**12**
II	Stresses in Automobile Components	12	04	04	04	**12**
III	Design of Chassis Components	16	04	04	08	**16**
IV	Design of engine Components	18	04	04	08	**16**
V	Design of Axles	08	04	04	06	**14**
Total		**64**	**20**	**20**	**30**	**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. Develop display boards of scrap engine/chassis components mentioned under sub section 8 above.
d. Prepare charts of materials currently used for automotive components.
e. Compare pistons of any two commercially available engines of same class.

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 is given here. The concerned faculty could add similar micro-projects:

a. Perform Case study of design of simple automobile component(s), except those mentioned in curriculum.eg. Flywheel, cylinder head design, design of bolts, coil springs, crankshaft, and bearing selection.
b. Design of joints/couplings used in automobiles.
c. Prepare a report on sizes/standardization in automobile components.
d. Prepare a report on manufacturing, ergonomic and aesthetic considerations in designing different automobile components.
e. Prepare a report on Trends in component design.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Design of machine elements.	Bhandari,V. B.	McGraw Hill Education, New Delhi, 3RD Edition, 2012 ISBN-13:9780070681798
2	A Textbook of Machine Design.	Khurmi, R. S. Gupta, J. K.	S. Chand Publishing, NewDelhi,2010, **ISBN**-13: 978-8121925372
3	Machine Design	Jindal, U. C.	Pearson Education, New Delhi, 2016, ISBN 13: 9788131716595
4	Design Data Book	---	PSG College of Technology Coimbatore, 2014, ISBN-13:9788192735504
5	IS Codes:	---	Indian Standard Bureau, New Delhi
6	Design of machine elements.	K, Ganesh Babu. K, Srithar.	McGraw Hill Education, New Delhi,110008. 2ND Edition, 2010,ISBN-13:9780070672840
7	Auto Design Problems.	Aggarwal, K .M.	Satya Prakashan, New Delhi 2012 ISBN:81-7684207-9
8	Automobile Technology	Giri, N. K.	Khanna Publishers- Delhi 110006, 2012, ISBN: -13: 978-8174091789

14. SOFTWARE/LEARNING WEBSITES

a) https://www.youtube.com/watch?v=Wcqwi-2TKr4
b) https://www.youtube.com/watch?v=STT0D3E4REE
c) http://freevideolectures.com/Course/2363/Design-of-Machine-Elements-I/28
d) http://freevideolectures.com/Course/2363/Design-of-Machine-Elements-I/15
e) https://www.youtube.com/watch?v=9uJh1WLcL4E
f) https://www.youtube.com/watch?v=rBaJ_4i7Xa0

Program Name : **Diploma in Automobile Engineering**

Program Code : **AE**

Semester : **Fifth**

Course Title : **Two and Three Wheeler Technologies**

Course Code : **22559**

1. RATIONALE

There is an increased need of public transport. The public transport systems in cities and in rural area do not meet the requirement effectively. This has led to huge demand of two and three wheelers. Presently the two wheelers are used by a large section of society as personalized transport. In view of the growth, large employment potential in this field and the manpower required to cater to the same, it is essential to inculcate the students with concept of frames, wheels, tyres, brakes and Suspension systems of two and three wheelers.

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 two and three wheeler automobile systems.**

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. Select frame and chassis for two and three wheeler vehicles.
b. Repair engine, fuel, lubrication and emission control systems of vehicles.
c. Repair transmission, steering, suspension and braking systems.
d. Maintain the electrical system of vehicles.
e. Rate the aerodynamics, aesthetics, ergonomics and safety aspects of vehicles.

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.

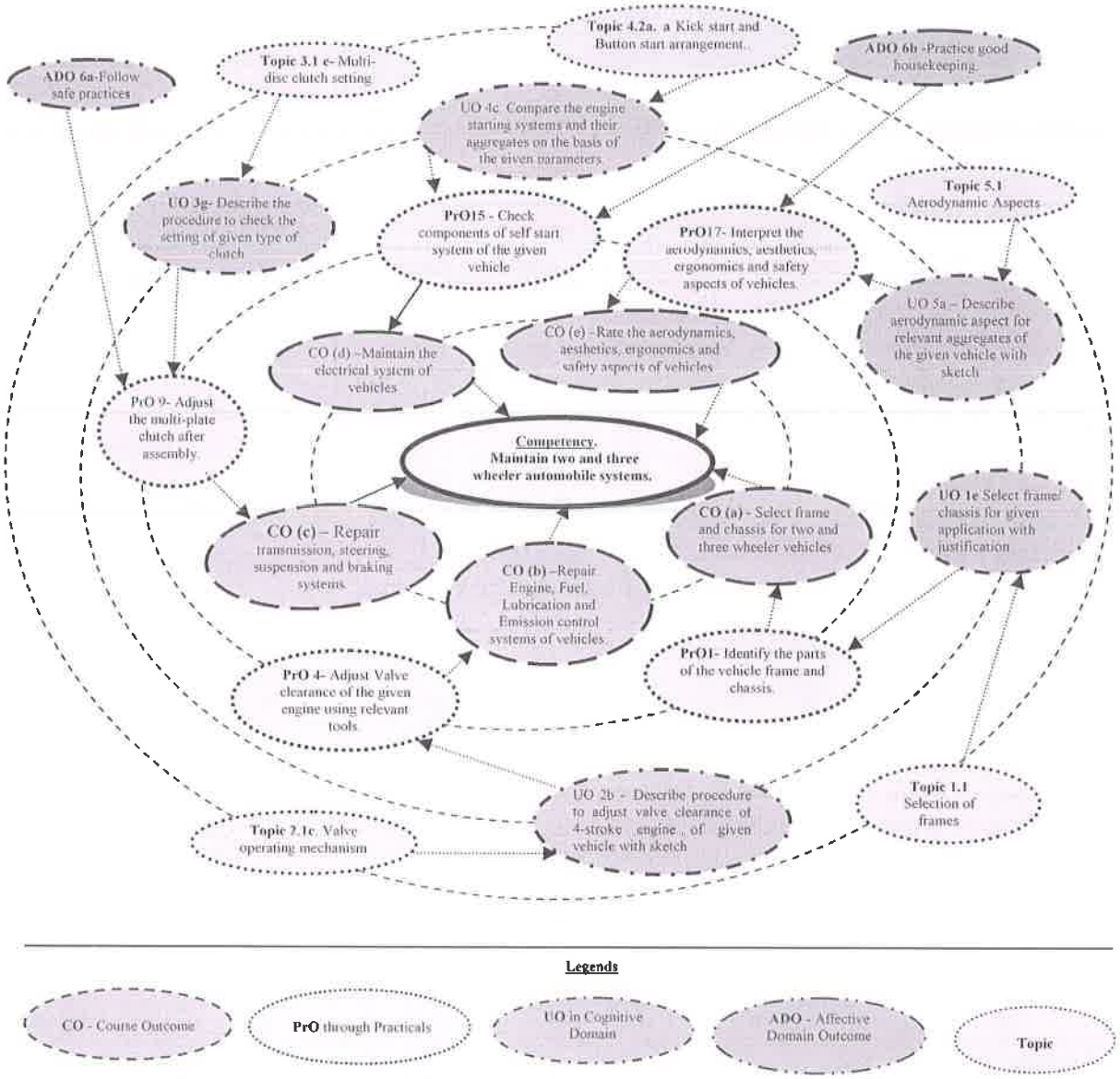

Figure 1 - Course Map

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 the parts of the vehicle frame and chassis. (Use relevant you-tube video)	I	02*
2.	Dismantle the given two or three wheeler engine.	II	02
3.	Assemble the given two or three wheeler engine.	II	02
4.	Adjust Valve clearance of the given engine using relevant tools.	II	02
5.	Service induction system of the given two or three wheeler	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	petrol engine for emission control.		
6.	Fine-tune idle speed of a two or three wheeler engine using the specified procedure. (including vehicle with centrifugal clutch)	II	02*
7.	Lubricate two or three wheeler chassis.	II	02
8.	Dismantle the given clutch assembly to check condition of components with reference to service manual.	III	02*
9.	Adjust the multi-plate clutch after assembly.	III	02*
10	Dismantle gearbox of given vehicle.	III	02
11	Assemble gearbox of given vehicle.	III	02
12	Adjust handlebar arrangement for precise steering of vehicles	III	02
13	Service brake system of the given two or three wheeler.	III	02
14	Maintain ignition system of the given two/three wheeler.	IV	02
15	Check components of self-start system of the given two-wheeler or three wheeler engines.	IV	02*
16	Maintain wiring harness of the given two-wheeler or three-wheeler.	IV	02*
17	Interpret the aerodynamic, ergonomic design and safety aspects of the given two or three wheelers.	V	02*
	Total		**34**

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 %
a.	Follow safety rules and adopt standard practices for handling tools and equipment's.	30
b.	Refer workshop manual and include relevant data in the journal.	20
c.	Sketching, drawing layouts and conclusion.	20
d.	Answer to sample questions	20
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. 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
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

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. Sr. No.
1.	Two Wheeler vehicle (Hero Moto corp.) or similar type, Three wheeler vehicle (Bajaj Auto) (4-stroke,single cylinder engine) or similar type	All
2.	Working model of Two wheeler transmission systems (4-Speed transmission)	8,9,10
3.	Working model of Three wheeler transmission systems (4-forward and 1-Reverse transmission)	8,9,10
4.	Two wheeler vehicle- frames (single and double cradle frame)	1
5.	Three wheeler vehicle- frame and body (Auto rickshaw – 4 Stroke)	1
6.	Allen (Wrench or Socket) Set - Metric (2mm - 8mm, 10mm, 12mm)	2,3,6,9,10
7.	Combination Wrenches: Standard (1/4" – 1 1/4") Metric (7mm - 24mm)	2,3,4,5,6,9, 10,12,13
8.	Feeler Gauge (Blade Type): .002" - .040" .006mm - .070mm	13
9.	Socket Set - 1/4" Drive: 1/4" - 1/2" Standard Depth 1/4" - 1/2" Deep 6mm - 12mm Standard Depth 6mm - 12mm Deep Flex/Universal Type 3", 6" Extensions Ratchet	2,3,4,5,6,9, 10,12,13
10.	Socket Set - 3/8" Drive: 5/16" - 3/4" Standard Depth (6 point) 3/8" - 3/4" Deep (6 point) 10mm - 19mm Standard Depth 10mm - 19mm Deep 3", 5", 10" Extensions	2,3,4,5,6,9, 10,12,13
11.	Magnetic Pickup Tool	14
12.	Brake Shoe Adjusting Gauge	12
13.	Wire and Terminal Repair Kit	15

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 Frame and Chassis	1a. Describe the given vehicle frame with sketch. 1b. Compare the given types of two wheeler chassis on the basis of frame construction and application. 1c. Compare the given vehicle layout on the	1.1 Frames: Single cradle frame, Double cradle frame, Tubular frame, Engine as stressed member and Twin-spar frame. 1.2 Chassis: Conventional chassis and monocoque or integral construction. 1.3 Layout of two-wheeler and three-wheeled Vehicle. 1.4 Frame material: Alloy Steel, aluminium alloy, Carbon fiber.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	basis of frame, engine location, transmission and application. 1d. Select relevant frame material for given vehicle application with justification. 1e. Select frame/ chassis for given application with justification.	
Unit– II Engine, Fuel, Lubrication and Emission systems.	2a Select an engine for the given vehicle with justification. 2b Describe procedure to adjust valve clearance of 4-stroke engine of given vehicle with sketch. 2c Select an air filter for given vehicle with justification. 2d Select an engine exhaust system component for given vehicle with justification. 2e Describe fuel supply system component/aggregate for the given two or three wheeler engine with sketch. 2f Explain lubrication system for the given two or three wheeler engine with sketch. 2g Describe the given emission control system of the given engine with sketch. 2h Describe procedure to find the fault in the emission control system of the given vehicle	2.1 Engines for two and three wheelers: a Four stroke S.I. and C.I. engines. b Engine selection criteria for two-wheeler and three-wheeler. c Valve operating mechanism. 2.2 Induction System: a Air filter/ Air Cleaner: construction and function - Washable oiled sponge element, washable Dual foam wet type. 2.3 Exhaust system: a Construction and function of Exhaust system: Header pipe, Muffler types and their application, Tail Pipe arrangement and location. 2.4 Fuel supply system a Carburetor: functions and working under various Engine operating conditions – Idling, Starting, accelerating, normal running. b Electronic petrol injection system. c Layout of throttle body injection system. 2.5 Lubrication system. Lubrication in four stroke engines 2.6 Emission Control system: a Block diagram and working of the following systems: Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation. b Diagnosis using exhaust gas analysis-procedure.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit III- Transmission, steering, suspension and braking systems.	3a. Compare transmission system of the given vehicles on basis of gear ratio, type of primary drive, final drive and gear shift mechanism. 3b. Describe effect of steering geometry relevant parameters for the given vehicles with sketch. 3c. Select the suspension system for the given application with justification. 3d. Compare the braking system of the given vehicles on basis of the given parameters. 3e. Select wheels and tyres for the given vehicle with justification. 3f. Sketch the layouts of Transmission system of the given two-wheeler or three-wheeler. 3g. Describe the procedure to check the setting of given type of clutch. 3h. Describe the procedure to adjust damper pre-load for rear wheel suspension of motorcycle.	3.1 **Transmission system:** a Layout of transmission system in two and three wheeler vehicle. b Cable Actuated Wet Multi-disc clutch, Centrifugal clutch. c Multi-disc Clutch setting d Chain drive, Belt drive with variator mechanism, Gear drive. e Gearbox – Working of constant mesh gearbox. f Gear shifting mechanism- hand and foot operated shifting mechanism. 3.2 **Steering system:** a Steering geometry and effects. (Caster angle and Trail) b Steering fork. c Handlebar arrangement. 3.3 **Suspension system:** a Two wheeler suspension system- Spring and damper- swing arm and telescopic type. b Mono-shock suspension, Gas filled shock absorber. Preload adjustment procedure for motorcycle rear wheel suspension. c Three-wheeler rear suspension for Auto-Rickshaw. 3.4 **Braking system:** a Drum brake and disc brake (Single calipers and double caliper) b Brake control system- Hand and foot operated brake. c Braking system of Auto-Rickshaw. 3.5 **Wheels and tyres:** Selection criteria of wheels and tyres, their specification for motorcycles, scooters, sports bike.
Unit-IV Electrical systems	4a. Describe working of the given ignition system with sketch. 4b. Describe procedure to check aggregates of CDI system with sketch. 4c. Compare the engine starting systems and their aggregates on the basis of the given parameters.	4.1 **Ignition system:** a Working of capacitive Discharge Ignition (CDI) system. b Procedure to check CDI system aggregates. c Microprocessor controlled Ignition system block diagram and working. d Concept of twin sparks ignition system. 4.2 **Starting system:** a Kick start and Button start arrangement. b Components of starting system and their functions: D C motor, Battery, Battery

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4d. Describe working of the given charging system with sketch. 4e. Describe specification and features of the given Dash board /lighting system aggregates.	Rating for use in Button start vehicles 4.3 **Charging system:**Components of charging system, Schematic circuit and working of charging system. 4.4 **Lighting system and accessories:** a Specifications and Application of -Head Lamp, Tail and number plate Lamp, Purpose of using LED lights in tail lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp, Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers b Dash units - Use of Speedometer (Analog and digital), Trip meter. Use of Engine Speed indicator/ Tachometer.
Unit –V Aerodynamic, Aesthetics, Ergonomics and Safety Aspect of vehicles	5a. Describe aerodynamic aspects for relevant aggregates of the given vehicle with sketch. 5b. Describe Ergonomic aspect relevant to the given vehicle handling/ seating arrangement with sketch. 5c. Explain significance of aesthetic aspect for relevant aggregates of the given vehicle with justification. 5d. Describe safety aspects of given two wheeler relevant to rider.	5.1 **Aerodynamic Aspects.** a Head lamp shape (Sealed beam and conventional). b Tail lamp and indicator light arrangements- body enclosed and separate. c Shape of Fuel Tank in Motorcycles 5.2 **Ergonomic Aspects.** a Seat Arrangement for rider and pillion rider. b Handle bar position. c Floor/ Foot rest for driver and pillion rider. 5.3 **Aesthetics Aspects.** a Headlamp fairing of motorcycles. b Side panels for scooter/ scooterate and motorcycle. c Ground clearance. d Mud guard shape and position. 5.4 **Safety Aspects.** a Crash bar, Saree guard b Driving Habits. c Drive gear – Jacket, Helmet, Day night goggle.

***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	Frame and Chassis	6	02	04	04	10
II	Engine, Fuel, Lubrication and Emission systems.	12	02	04	10	16
III	Transmission, Steering, Suspension and Braking system	12	02	04	10	16
IV	Electrical Systems	10	02	04	08	14
V	Aerodynamic, Aesthetics, Ergonomics and Safety Aspect of vehicles	08	02	04	08	14
Total		**48**	**10**	**20**	**40**	**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.
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 is given here. Similar micro-projects could be added by the concerned faculty:

a. Variator Assembly service: Identify need to service the variator assembly. Check components using relevant tools. Record Do's and don'ts. Prepare a report on the same.
b. Disc brake service: Identify need to replace friction pads of disc brake. Follow dismantling and assembly using relevant tools. Record Do's and don'ts. Prepare a report on the same.
c. Double acting damper service: Identify need to service double acting damper. Follow dismantling and assembly using relevant tools. Record Do's and don'ts. Prepare a report on the same.
d. Positive Crankcase Ventilation system service: Identify the need of PCV system service. Check PCV system using relevant tools. Record Do's and don'ts. Prepare a report on the same.
e. Collect data of any three two or three wheelers of same category and compare them on the basis of their technical specification and other relevant parameters. Prepare a report on the same.
f. Collect data of Indian two or three wheeler manufacturers and their products and prepare a report based on product range, market share, product innovation, emission control technology and economy.
g. Explore innovative and latest technology/features provided in two and three wheeler vehicle. Prepare a report containing relevant aspects of the technology /features.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Two and Three Wheeler Technology	Panchal, Dhruv, U.	PHI Learning Private Limited, Delhi, 2015, third edition ISBN-978-81-203-5143-1
2	Two Wheeler and Three Wheeler	Ramalingam, K.K.	SCITECH Publication, Chennai. Second edition. ISBN-978-93-85983-30-6

S. No.	Title of Book	Author	Publication
3	Automobile Engineering Vol-1	Dr. Kripal, Singh	Standard Publishes-Distributors-Delhi; 13th Edition (2012), ISBN-13: 978-8180141966
4	Automotive Mechanics	William, Crouse; Donald, Anglin	McGraw Hill Education; 10 edition (1 July 2017), ISBN-13: 978-0070634350

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=kTuybtMAiN8
b. https://www.youtube.com/watch?v=DUK6gjbsLpQ
c. https://www.youtube.com/watch?v=zvU6HeEobo0
d. https://www.youtube.com/watch?v=K0QAvF2PLsY
e. https://www.youtube.com/watch?v=m6AZ7_mACUg
f. https://www.youtube.com/watch?v=-Rup463OFHA
g. https://www.youtube.com/watch?v=QWAhLyL2lBk
h. https://www.youtube.com/watch?v=2EjW-iSP-Q8 for variator service

Program Name : **Diploma in Automobile Engineering**

Program Code : **AE**

Semester : **Fifth**

Course Title : **Motor Vehicle Insurance and Valuation (Elective)**

Course Code : **22560**

1. RATIONALE

Our country is one of the leading countries in the world in road accidents today. This situation is further worsening with increasing number of high speed and high load carrying vehicles. With increasing population of vehicle on roads the risk of motor vehicle accidents will increase which leads to increase in motor vehicle insurance claims. In order to process well the Motor insurance claims and to prevent from payment of fraudulent claims insurance sectors must be provided with practitioners who possess comprehensive knowledge and by applying provisions of MVA 1988 and principles of insurance can settle the claims for betterment of individual as well as our country.

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 motor vehicle acts and insurance policies to assess vehicle damage/theft claims.**

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 principles of general insurance in motor vehicle insurance.
b. Prepare insurance proposals and policy forms for motor vehicles.
c. Use relevant contract insurance forms by planning underwriting risk.
d. Assess the different types of hazards for insurance renewal.
e. Assess different types of insurance claims.

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 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.

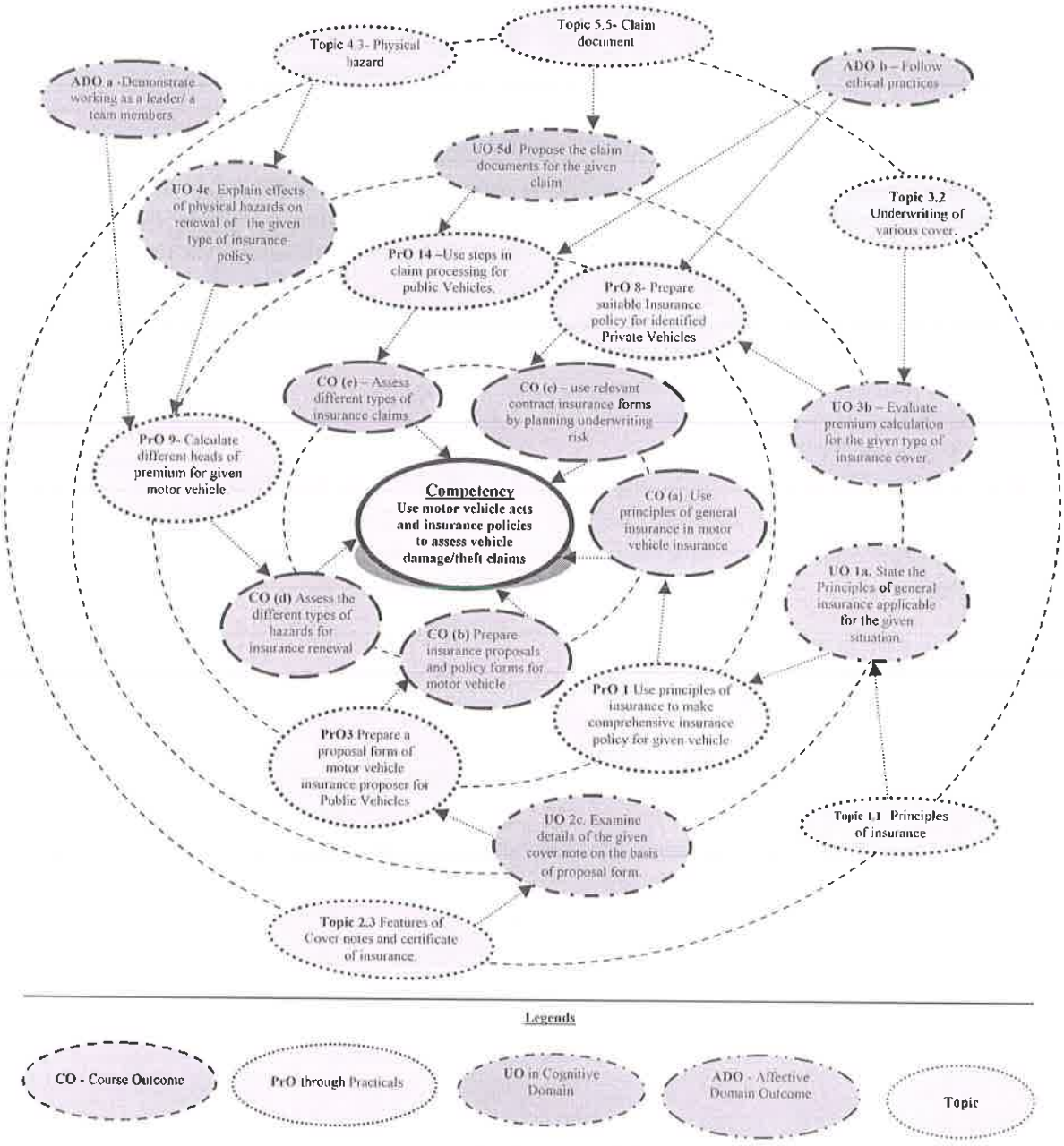

Figure 1 - Course Map

6. SUGGESTED 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.	Use Principles of Insurance to make comprehensive policy for	I	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	given vehicle (either in lab, parking lot or video).		
2.	Use Principles of Insurance to make third party policy for given vehicle (either in lab, parking lot or video).	I	02*
3.	Prepare a proposal form of motor vehicle insurance proposer for Public Vehicles. (using the video).	II	02
4.	Prepare a proposal form of motor vehicle insurance proposer for Private Vehicles.	II	02*
5.	Examine cover note and certificate of insurance issued based on proposal form for Public Vehicles.	II	02
6.	Examine cover note and certificate of insurance issued based on proposal form for Private Vehicles.	II	02*
7.	Prepare suitable Insurance policy for identified Public Vehicles.	II	02
8.	Prepare suitable Insurance policy for identified Private Vehicles.	II	02*
9.	Calculate different heads of premium for given motor vehicle comprehensive insurance by interpreting hazards	III	02*
10.	Calculate different heads of premium for given motor vehicle third party insurance.	III	02*
11.	Justify various possible discounts on insurance renewal for Public Vehicles.	IV	02
12.	Justify various possible discounts on insurance renewal for Private Vehicles.	IV	02*
13.	Assess a wrongly filled insurance renewal/ proposal form.	IV	02
14.	Use steps in claim processing for Public Vehicles.	V	02
15.	Use steps in claim processing for Private Vehicles.	V	02*
16.	Compare insurance ecosystem of a developed country and India.	V	02*
17.	Carry out loss assessment of accident vehicle using video/ photograph.	V	02
	Total		**34**

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 experimental set up	10
2	Setting and operation	10
3	Safety measures	10
4	Observations and recording	20
5	Interpretation of result and conclusion	30

S. No.	Performance Indicators	Weightage in %
6	Answer to 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 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.
1.1	Computer system (Any computer system with basic configuration) Processor (CPU):Intel Core i5-6xxx or equivalent Operating System: Microsoft Windows 10 Professional x64 SP1 (free via Imagine. Restrictions may apply.), Memory: 8 GB RAM Storage: 512 GB internal Solid State Drive (SSD) or 1 TB internal HDD Sustainability EPEAT Silver rating (preferably EPEAT Gold) Monitor/Display: 24" " LCD monitor Network Adaptor: 802.11ac 2.4/5 GHz wireless adaptor Other: Webcam, lock, external drive for backups.	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 Motor Vehicle Insurance	1a. State the principles of general insurance applicable for the given situation 1b. Select a relevant Motor vehicle insurance policy for the given	1.1 Principles of insurance 1.2 Introduction to motor insurance – need 1.3 Classification of insurance – Act liability only and comprehensive

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	category of vehicle with justification 1c. Select a competent insurance authority for the given requirement with justification. 1d. State the need of approaching tribunal for third party claim settlement for the given situation with justification.	1.4 Comparison of above insurance policies on following parameters – Risk cover, other provisions, conditions, premium and application of vehicle 1.5 Insurance Regulatory Authority of India (IRDAI): Role, organization structure and its Jurisdiction a) State level organization structure b) Various motor vehicle insurance organizations in India. (Brief comparison) c) Tribunals for third party claim settlement
Unit– II Insurance Proposal and Policy Form	2a Interpret clauses in the given insurance proposal form. 2b Interpret the specified clauses in the given policy form. 2c Examine details of the given cover note on the basis of proposal form. 2d Examine details of certificate of insurance on the basis of given proposal form.	2.1 **Proposal forms:** Bio-data of proposer, previous convictions, garage ownership and registration, cover required, insurance history, no claim discount, claims experience, declaration. 2.2 **Policy Form**: Recital clause, operative clause, avoidance of certain terms and right of recovery, emergency treatment, no claim discount schedule, signature clause, conditions, notification, control of claim and subrogation, cancellation, contribution, maintenance and examination, arbitration, observance of condition. 2.3 **Features of Cover notes and certificate of insurance.**
Unit III- Underwriting An Insurance	3a. Examine various factors considered in underwriting in the given situation. 3b. Evaluate premium calculation for the given type of insurance cover. 3c. Examine provision of compulsory excess in the given category. 3d. Justify the exclusions in insurance cover in the given situation. 3e. Justify insurance contract clause for risk assessment in the given circumstances.	3.1 Underwriting: Need and definition, various aspects of under writing viz. Acceptance of proposal, complete declinature. 3.2 Underwriting of third party cover only, own Damage cover, Third party fire/theft cover, increased premium, exclusion and exclusions of various cover 3.3 Compulsory excess and voluntary excess applicable 3.4 Insurance of Government vehicles and State transport undertaking

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		(STU)
Unit-IV Insurance Renewal Procedure and Hazards	4a. Describe insurance renewal procedure for the given insurance policy. 4b. Explain effect of moral hazard and its factors on the given type of policy with justification. 4c. Explain effects of physical hazards on renewal of the given type of insurance policy. 4d. Compare effects of various physical hazards and its factors on the given type of insurance policy.	4.1 **Insurance Renewal procedure:** Need and definition and suitable examples 4.2 **Moral Hazard:** Age, acceptation, litigiousness, meaning and examples. 4.3 **Physical Hazard:** Driver-Age and physical conditions, driving history; Vehicle – power, capacity, weight, age, maintenance, design, load used, district garage, forfeiture of custom duty (Meaning and examples)
Unit –V Motor Insurance Surveying and Claim Processing	5a. Interpret legal aspects of surveying from surveyor's perspective in the given situation. 5b. Prepare accident investigation report for the given situation. 5c. Describe duties and responsibilities of Surveyors and loss assessors for the given situation. 5d. Propose the claim documents for the given claim. 5e. Describe loss minimization technique for the given claim.	5.1 Insurance Surveyor – license, jobs functions, opportunity of career mobility, work ethics 5.2 Legal aspects 5.3. Investigation and assessment 5.4 Surveyors and loss assessors 5.5 Claim document 5.6 Arbitration 5.7 Settlement 5.8 Loss minimization, Salvage and Recoveries

***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	Motor vehicle insurance	08	02	04	06	12
II	Insurance proposal and policy form	10	02	04	10	16
III	Underwriting an insurance	10	02	04	08	14
IV	Insurance renewal procedure and hazards	10	02	04	08	14
V	Motor insurance surveying and claim Processing	10	02	04	08	14
Total		**48**	**10**	**20**	**40**	**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 Insurance proposal form
b. Prepare certificate of insurance.
c. Prepare survey assessment report for 2 –wheeler, Private car, Commercial vehicle.
d. Prepare report on role and responsibility of IRDAI and IIISLA
e. Undertake project on accidental repair assessment parameters.

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

a. For insurance company--- Prepare proposal forms
b. For vehicle user - Compare and suggest appropriate insurance cover.
c. For claimant- Suggest insurance claim procedure with required documents..
d. For surveyor- Prepare survey assessment report.
e. Case study of a major claim settlement.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	General Insurance in India: Principles and Practices	Sharma, K. C	Regal Publications. ISBN 13: 9788184842241.
2	Indian motor tariff	Insurance Regulatory and Development Authority of India	IRDAI- Government of India Publication
3	Motor vehicle Act	Govt.of India	Lawman; ISBN: 9789384668792, 9384668796
4	The Motor vehicle Act 1988	Govt.of India	Asia Law House SBN: 9789385556845, 9385556843
5	General Insurance Underwriting - IC 45	Agrawal, Rakesh.	The insurance times education series ISBN-13: 978-9381489000

14. SOFTWARE/LEARNING WEBSITES

a. http://www.iiisla.co.in/locate_surveyor.php
b. https://www.irdai.gov.in/ADMINCMS/cms/frmGeneral_NoYearList.aspx?DF=frm|=9.4.1
c. https://www.insuranceinstituteofindia.com/web/guest;jsessionid=BA55BA90D9590B4ECDFB7C0AB93AA25D

Program Name : **Diploma in Automobile Engineering**

Program Code : **AE**

Semester : **Fifth**

Course Title : **Automobile Body Engineering and Safety (Elective)**

Course Code : **22561**

1. RATIONALE

As a supervisor or self-employed, the diploma technician is supposed to fabricate and repair various vehicle bodies. The knowledge and skills of vehicle body technology and safety is required to manage vehicle body fabrication and repair. In the automotive field auto body repair is experiencing a faster growth compared to other service areas. Collision repair plus the normal up-keep of the automobile body requires increasing numbers of well-trained auto body technicians. This course is designed to provide students the required level of knowledge and skills of vehicle body technology. There are lots of employment opportunities in car dealerships as well as body building workshops.

2. COMPETENCY

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

- **Follow safe practices in production and maintenance of auto bodies.**

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. Select relevant auto body for different applications.
b. Check the streamlining/profiling of auto body.
c. Use relevant materials for automobile body and refinishing work.
d. Maintain tools and equipment for body repair.
e. Repair the damaged auto bodies.
f. Maintain security systems of vehicles.

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 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.

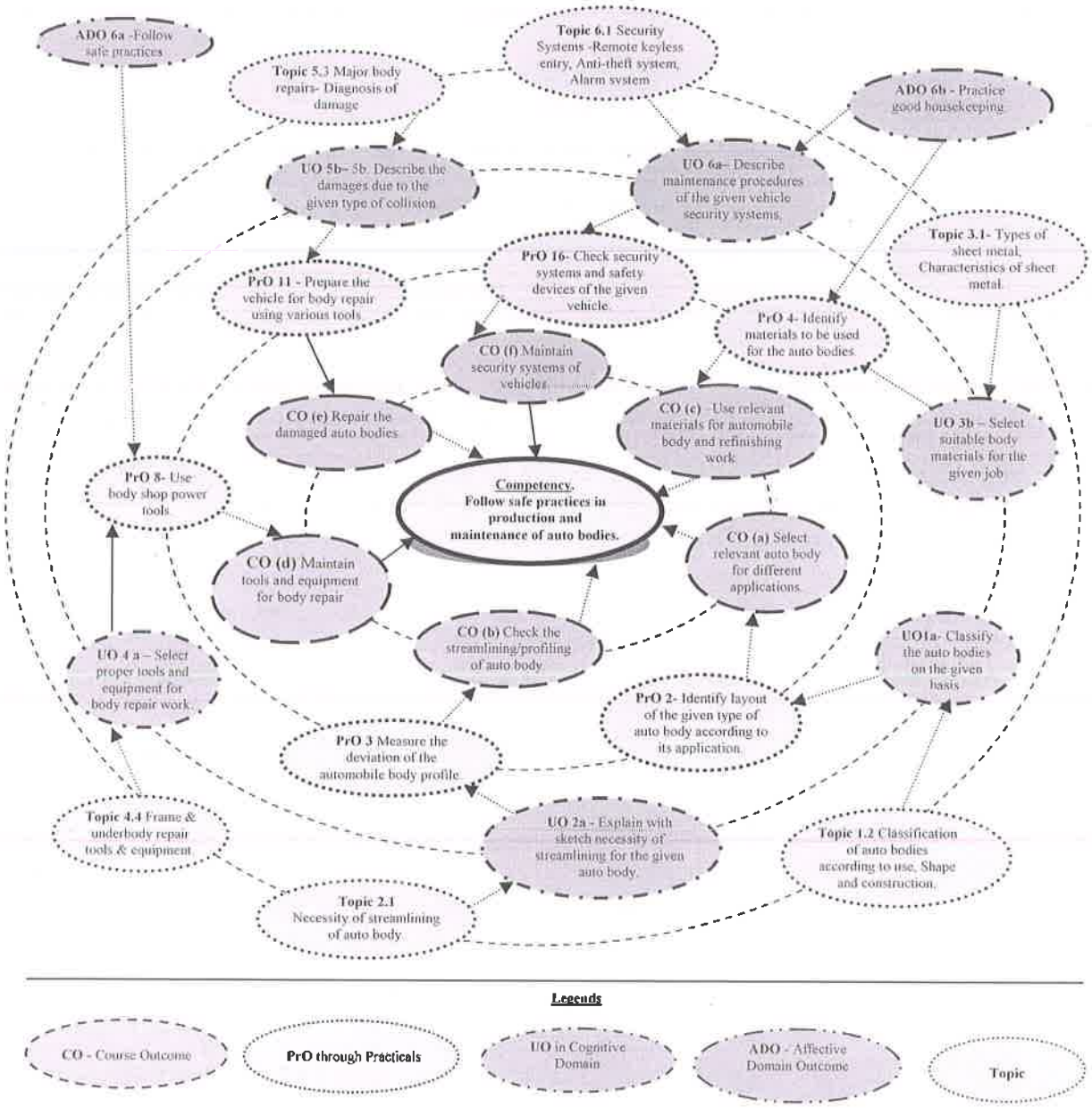

Figure 1 - Course Map

6. SUGGESTED 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 the components of the given auto body.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
2.	Identify layout of the given type of auto body according to its application (e.g car body, LMV- Passenger and transport vehicle body, Bus body).	I	02*
3.	Measure the deviation of the automobile body profile.	II	02*
4.	Identify materials to be used for the auto bodies and justify their application.	III	02*
5.	Use of the refinishing materials in the body repair shop and record their specifications.	III	02
6.	Identify the types of fasteners used in auto body manufacturing and justify their application.	III	02*
7.	Use of basic hand tools available in body shop and write their specification.	IV	02*
8.	Use body shop power tools.	IV	02
9.	Use denting tools.	IV	02*
10.	Use painting tools and equipment and record their specifications.	IV	02
11.	Prepare the vehicle for body repair using various tools.	V	02
12.	Restore the damaged body using various tools	V	02*
13.	Prepare repaired body for refinishing using various tools	V	02*
14.	Replace the damaged body panel using various tools	V	02*
15.	Restore the Interior/Exterior trim, Upholstery, Body insulation and sealing.	V	02
16.	Check the security systems and safety devices of the given vehicle.	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 '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.	Follow safety rules and adopt standard practices for handling tools and equipment's.	30
b.	Refer workshop manual and include relevant data in the journal.	20
c.	Sketching layouts, components and conclusion.	20
d.	Answer to sample questions	20
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.

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.	Body of Car: A used Car Body of any model (above 1000 cc) and make like Maruti, TATA along with all relevant accessories in good working condition.	All
2.	Body of Light Motor Vehicle – Body of hard top Jeep of any model (minimum 1400 cc) and make like TATA Motors Ltd., Mahindra and Mahindra Ltd., Force Motors Ltd., etc. along with all relevant accessories in good working condition.	All
3.	Denting tools and equipment- Basic denting tools like 1. Hammers (Weight ¼ kg to 2 kg): General purpose pick hammer, Bumping hammer, Cross-Peen hammer, Cross-Chisel hammer, Pick Fin hammer, Cross Chisel shrinking hammer, Dinging hammer, Door Skin hammer, Trim hammer. 2. Dolly blocks: Long handle spoon dolly, Caulking Iron, General Purpose Dolly, Shrinking Dolly, Anvil Dolly, Dome Dolly, Round Forming Dolly, Oblong Dolly, Heel Shaped Dolly, Curved Dolly, Toe-shaped Dolly, Shrinking Body dolly, Wedge Shaped Dolly, Egg Shaped Dolly. 3. Dent Pullers: Pneumatic type (Vacuum based) or Spot - weld type. 4. Spoons: Light dinging spoon, Slapping spoon, General purpose fender spoon 5. Pick bars: Medium short curved picks. 6. Chisels: Metal Chisel - **Blade Width (mm)**: 6-7mm, **Surface Treatment**: Polished, **Size (Inch)**: 4 Inch, **Structure**: Straight, **Finish**: Mat., 7. Files: Simple flat & round metal files, Special flexible Vixen files. 8. Blow Lamp: Material Used: Brass & Iron Steel, Additional Name: Brass Pressure Kerosene Blow Lamp, Application/Use: Heating 9. Soldering equipment: Voltage:110V, Wattage:60W, Wire Capacity:0.8 to 2mm or any other suitable specifications. 10. Buffing and Polishing machines: For sanding, polishing and buffing.	11, 12

S. No.	Equipment Name with Broad Specifications	Pro. S. No.
	Variable speed control. Large loop handle for operator control. Output shaft M14 male. Pad size 180 mm. No load speed 600-3,000 rpm.	

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 Vehicle Body Construction	1a Classify the auto bodies on the given basis. 1b Sketch a labeled auto body for the given application. 1c Select an auto body for the given application with justification. 1d Describe with sketch the constructional details of the given auto body.	1.1 Introduction to Auto body- Purpose and requirements of auto body. 1.2 Classification of auto bodies according to use (e.g Car body, Bus body, Truck body, Oil/Milk Tanker etc.), Shape (Sedan, convertible, Hatch back, Nose back) and construction (Conventional and Unitized). 1.3 Body structure – Major parts and constructional details of car body. 1.4 Layout and constructional details of bus body and truck body according to type of chassis.
Unit– II Body Aerodynamics	2a Explain with sketch necessity of streamlining of the given auto body with justification. 2b Calculate the aerodynamic drag and lift forces acting on the given auto body with the given data. 2c Explain with sketch the effect of aerodynamic drag on performance of the given type of vehicle. 2d Describe with sketch the process of auto body test for the given condition.	2.1 Necessity of streamlining of auto body. 2.2 Concept of aerodynamic drag, drag coefficient, Formation of eddies. 2.3 Effects of aerodynamic drag on vehicle performance. 2.4 Body testing – Collision test, NVH test, Roll over test, Impact test, Wind tunnel testing.
Unit III Body Materials	3a. Select the relevant sheet metal for the given body with justification. 3b. Select suitable body materials for the given job with justification. 3c. Select relevant body refinishing materials with justification.	3.1 Types of sheet metal, Characteristics of sheet metal. 3.2 Timber 3.3 Types of glass. 3.4 Types of Resins, Characteristics of resins. 3.5 Plastic parts 3.6 Composite materials GRP (Glass reinforced plastic), FRP (Fiber

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	3d. Identify the fasteners used in the given body with justification.	reinforced plastic). 3.7 Types of paints. 3.8 Body refinishing materials – Fillers, Primers, Sealers, Additives, Sand Paper and other compounds common to body shop. 3.9 Fasteners.
Unit-IV Body Repair Tools and Equipments	4a. Select proper tools and equipment for body repair work with justification. 4b. Describe the procedure to maintain the given equipment required for repair and refinishing of auto body. 4c. State the specifications of the the tools and equipment required for the given job. 4d. State safety precautions to be taken while handling body shop equipments with justification.	4.1 Basic hand tools 4.2 Power tools. 4.3 Body shop equipment's 4.4 Frame & underbody repair tools & equipment. 4.5 Electronic straightening & measurement system. 4.6 Denting tools and equipments. 4.7 Painting equipment and accessories.
Unit –V Minor and Major Body Repairs	5a. Select relevant method for the given minor body repairing with justification. 5b. Describe the damages due to the given type of collision. 5c. Describe the repair method for the given material with justification. 5d. Describe the procedure for panel replacement of the given vehicle body. 5e. Suggest the relevant surface preparation/preventive treatment for refinishing of the given body condition with justification. 5f. Select relevant painting method for the given job with justification. 5g. Describe repair method of trims, insulation and upholstery for the given body.	5.1 Types of minor body repairs-repair with washer welder, repair with hammer & dolly, panel filling with plastic body and filler –forming with solder, panel shrinking (drawing operation). 5.2 Repairing of rusted body panels. 5.3 Major body repairs- Diagnosis of damage, Front end collision, Rear end collision, Side swipe collision. 5.4 Roll-over damage. 5.5 Fibre glass repairs & replacement. 5.6 Body aligning. 5.7 Panel replacement. 5.8 Preventive and anti-corrosive treatments. 5.9 Painting methods and techniques. 5.10 Painting defects and their diagnosis. 5.11 Miscellaneous Body services - Interior trim and upholstery, Glass and door service, Body insulation and sealing, Exterior trim.
Unit –VI Safety	6a. Describe maintenance procedures of the given vehicle	6.1 Security Systems -Remote keyless entry, Anti-theft system, Alarm

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Features and Devices	security systems. 6b. Describe utility and functions of GPS system for the given vehicle. 6c. Explain the necessity and types of seat belts for the given vehicle application. 6d. Explain with sketches the working of the given type of Air bag.	system. 6.2 Entertainment and peripheral systems – Integrated communications, Proximity sensors. 6.3 Global positioning satellites (GPS). 6.4 Seat Belts, Seat Belts pre-tensioners, Smart seatbelt reminder. 6.5 Concepts of Crash test, Crash sensors. 6.6 Air bags - Introduction of air bags, Duel stage air bags, Side Airbags. 6.7 Tyre pressure monitoring system. 6.8 Pedestrian Protection & Night vision with pedestrian detection.

***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	Vehicle Body Construction	06	--	04	04	08
II	Body Aerodynamics	06	02	04	04	10
III	Body Materials	06	02	02	06	10
IV	Body Repair Tools and Equipments	06	02	02	06	10
V	Minor and Major Body Repairs	16	02	04	14	20
VI	Safety Features and devices	08	02	04	06	12
Total		**48**	**10**	**20**	**40**	**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.

d. Search latest advanced safety devices used in automobiles and collect their specifications.
e. Collect data regarding different tools and equipments used in body repair shop.
f. Collect data regarding different tools and equipments used in paint shop.
g. Sketch the body shapes as per aerodynamic requirements.

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 ***activities***.
e. Guide student(s) in No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular***
f. Undertaking micro-projects.
g. Demonstrate students thoroughly before they start doing the practice.
h. Encourage students to refer different websites to have deeper understanding of the subject.
i. 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. Body sketches and features: Sketch 10 different vehicle bodies for various applications. Specify relevant features of the same bodies. Suggest two body designs for given application (example- ambulance, milk van, garbage truck, petroleum carrier).
b. Case study of an automobile body aerodynamics: Drag reduction techniques, body profile, and aesthetics.
c. Clay model of a car: Prepare a clay model of a car. Carry out wind tunnel test of the model.

d. Body test and its interpretation: Refer standard procedure to conduct the relevant test and interpret the test result. Minimum two tests to be reviewed.
e. Body materials and their properties: Prepare a display board of collected samples of body material and their relevant properties; prepare a list of manufacturers for the same.
f. Body Preparation for paint work: Detailed procedure to carry out body preparations for painting- Surface preparation and primer application.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Vehicle body engineering	Pawlowski, J.; Tidbury, G.H.	Century Publications,Century,1970 ISBN-13: 978-0220689162
2	The Principles of Auto body repairing and Repainting	Andre, G. Deroche	Prentice Hall, Inc. London,1976 ISBN-13: 978-0134400334
3	Motor Auto Body Repair,	Robbert, Scharff; James E., Duffy	Delmar Publishers, (ITP company),1998 ISBN – 827368585
4	Automobile Engineering	Ramlingam, K.K.	Scitech Publication, Delhi, 2011 **ISBN-13:** 978-8188429486
5	Automobile Engineering Vol.5 Paint Techniques	Chikara, Anil	Satya Prakashan ,New Delhi, 2015, 1st Editon, **ISBN** 13 : 9788176840774
6	Automobile Engineering	Gupta, R.B.	Satya Prakashan, New Delhi, 2015 **ISBN**: 9788176848589,
7	Automotive Mechanics	William H, Crouse; Anglin, Donald L	McGraw- Hill Publication, 2017 SKU:-OBS/2017/02/18/684
8	Automobile Engineering	Narang, G.B.S.	Khanna Publication, Delhi,1989 **ISBN:** 1234567144518
9	Automobile Mechanics	Giri, N. K.	Khanna Publication, Delhi,2014, 8th Edition, ISBN 13: 9788174092168

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=Pgpawejpi6o – Wind Tunnel testing
b. https://www.youtube.com/watch?v=fKy9YwfLQ6U – Painting procedure of a car
c. https://www.youtube.com/watch?v=ru4JIZ-x8yo – Antilock braking system
d. https://www.youtube.com/watch?v=R4ekbB5EzZM – Air bag and seat belt operation
e. https://www.youtube.com/watch?v=gcKx2ZqhlcU
f. https://www.youtube.com/watch?v=ORFa_iPtAeY
g. https://www.youtube.com/watch?v=I3OIxtpWX7Y
h. https://www.youtube.com/watch?v=t4TdwcPbEiE
i. https://www.youtube.com/watch?v=u0IJjKh-dWE
j. https://www.youtube.com/watch?v=LtwX8rrcEUQ
k. https://www.youtube.com/watch?v=SnDCcnzQapo&list=PL91B84909AEC3F3E4
l. https://www.youtube.com/watch?v=A3Cw58U0I4Q&list=PL91B84909AEC3F3E4
m. https://www.youtube.com/watch?v=qUehclZVeIs


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

Assessment Manual

For

Micro Projects / Industrial Training

_____ Engineering Programme

(I Scheme Curriculum)

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO-9001-2008) (ISO/IEC 27001:2013)

Assessment Manual

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Preface

The primary focus of any engineering laboratory/ field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering diploma programmes with outcome-base education (OBE) as the focus and accordingly, relatively large amount of time is allotted for the practical work and micro project. This displays the great importance of micro project work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every course has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme micro project assessment manual development team designed the micro project outlines***focus*** on the ***outcomes***, rather than the traditional age old practice of conducting practicals to 'verify the theory' (which may become a byproduct along the way).

This micro project assessment manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at the beginning of term for all related courses s/he must finalized team members and title of micro project under the guidance of course faculty Every micro project in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the micro project. The students will then become aware about the skills they will achieve through procedure and end product in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each micro project by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

The micro project assessment manual development team wishes to thank NITTTR, Bhopal who work as consultant in the development of curriculum re-design project and also acknowledge the contribution of individual course experts who have been involved in laboratory manual as well as curriculum development (I scheme) directly or indirectly.

Although all care has been taken to check for mistakes in this micro projects assesment manual, yet it is impossible to claim perfection especially as this is the first edition. Any such errors and suggestions for improvement can be brought to our notice and are highly welcome.

Certificate of Completion

of Micro-Project Assessment at the end of the Diploma Programme

(by respective Head of the Department & Head of the Institute)

This is to certify that Mr./Ms……..with Enrollment No…… has successfully completed ……. Micro-projects as in the enclosed 'Portfolio' during his/her tenure of completing the Diploma programme in ……from ……. institute with institute code……..

Head of the Department **Seal** **Head of the Institute**

Certificate of Completion

Of Industrial – Training Assessment at the end of the 5th semester

(by respective Head of the Institute & hear of the Department)

This is to certify that Mr/Ms……with Enrollment No. ……Has successfully completed Industrial Training in ……..daily ……. To ……. his / her tenure of completing the Diploma Program in ……from …… Institute Code…….

Head of the Department **Seal** **Head of the Institute**

Summary Sheet of the Micro Projects Completed During the 3-year Engineering Diploma Programme

S. No.	Name and code of course	Title of the Micro Project	Name of Guide	Signature of Guide
Semester – I				
1				
2				
3				
4				
5				
6				
Semester – II				
7				
8				
9				
10				
11				
12				

Semester – III				
13				
14				
15				
16				
17				
18				
Semester – IV				
19				
20				
21				
22				
23				
24				

Semester – V				
25				
26				
27				
28				
29				
30				
Semester – VI				
31				
32				
33				
34				
35				
36				

GUIDELINE DOCUMENT FOR MICRO-PROJECTS OF 'I' - SCHEME

1.0 INTRODUCTION

Project work is the activity that is intended to integrate all the domains of learning i.e. cognitive, psychomotor and affective domains wherever applicable, the hence it is very important from the teacher and student point of view. Any project work is *not a research*, but an experience of doing some complex work by students on their own, or 'work-based learning' Project can be of micro, mini, minor and major levels depending on at what stage of learning (from first semester to the last semester) it is incorporated; but all these categories will have the same characteristics. Only the amount of effort put in and time required will be changing. Therefore, the project work is defined as *'A purposeful student activity planned, designed and performed by a student or group of students to solve the identified problems (or complete a relatively complex task) which requires them to integrate the various types of skills acquired over a period to help them to accomplish higher level of cognitive and affective domain outcomes and sometimes the psychomotor domain outcomes as well'. (Earnest, Joshua and S. K. Gupta).* This definition means that the project work leads to the integration of knowledge, skills and attitudes of the three domains of learning acquired over a period of time. It would field-based, classroom-based, lab-based, internet based, library-based or home-based. Therefore, for a micro-project also, which is related to a single course, it is not purely laboratory or field based. It is decided by pre-defined competency and course outcomes of the particular course. It could of one particular type or a combination of different types, but the efforts by the student need to be of 16 weeks duration during the whole semester i.e. about 1 hour per week outside the classroom, in the home, in the library, laboratory, workshop or field and is intended to integrate the three domains of learning, wherever applicable. Micro-project is also intended to develop the so called *'soft skills'* in the student. Therefore the choice of the micro-project is also crucial.

2.0 SALIENT FEATURES OF MICRO-PROJECT

Every micro-project is basically intended to integrate more than course outcome i.e .more than one unit of the theory and the related practicals stated in the course along with the affective domain skills mentioned over there. Since it is a micro-project for a single course, it is not intended to be very complex and report is not expected to be voluminous. But, every student is expected to devout about 16 hours work for a micro-project in a group or individually duringthe whole semester. The micro-project report is the end product which need to be given about 25% weightage. The *'process'* is the key which the teacher has to monitor regularly through seminars and other activities typically every fortnight online or otherwise, so that the skills are gradually built up in the students over the period of time.

One of the main purpose of micro-project is to develop the ability to work in real life settings individually or collectively as the situation may be**.** Following are some of the salient features of the micro-project.

a) Micro-projects are introduced in each course to take advantage of project method of learning.
b) The course teacher would be the guide for all groups of his/her class for that course.
c) Micro-project is a small project which requires about 16 hours of work by students in whole semester. (i.e. about one hour each week)
d) Students can choose micro-projects other than the sample list after consultation with their teacher.

e) Micro-project would be given to students as a group work. (Group size should not be more than 6 students).

3.0 ABILITIES INTENDED TO BE DEVELOPED THROUGH MICRO-PROJECT

Following are the major abilities that are expected to be developed in the student through the work of 25 -30Micro-projectsintroduced in this outcome-based curriculum not through one course alone, but during the entire the diploma programme of 3 years duration. It is not necessary that every micro-project should develop all the following abilities. *However, some of the abilities mentioned below may be common in many of the micro-projects.*

a) Show the attitude of enquiry.
b) Identify the problems in the area related to their branch of the of their diploma programme.
c) Identify the information suggesting the cause of the problem and possible solutions.
d) Prepare project proposals before starting the project.
e) Derive different possible solutions creatively.
f) Assess the financial implication and feasibility of different solutions based on preliminary studies.
g) Collect relevant data from different sources (books/internet/market/suppliers/experts and others through surveys/interviews).
h) Analyse the collected data and to generate useful information from it.
i) Present generated information visually in form of appropriate charts/graphs.
j) Prepare required drawings and detailed plan for execution of the work.
k) Work persistently to achieve the targets.
l) Attempts alternative solutions/revise aims/execute alternative plans, in case of failures.
m) Use relevant machines and equipment/instruments safely.
n) Develop the prototype/model/ of the desired equipment/instrument/machine part and such others.
o) Show concern for material and cost reduction.
p) Incorporate safety features in products.
q) Work independently for the responsibility undertaken.
r) Participate effectively in group work.
s) Ask for help from others including guide, when required.
t) Prepare the technical reports.
u) Prepare presentations.
v) Present findings/features of the projects in seminars.
w) Confidently, answer the questions asked about the project.
x) Acknowledge the help rendered by others in success of the project.

It is obvious from the above, that it is not necessary to have very innovative idea or to produce something new with the help of micro-project. The main purpose is to develop above skills/attitudes in the students. ***Thus micro-projects should not be very complex or research oriented, they should be such that students can complete it on their own without much help of teacher or from outside the institute.***

4.0 REPORT FOR THE MICRO-PROJECT

The micro-projectreport has two parts (format is attached as Annexure I). First part is 'Project Proposal' about two pages in 12 point calibri font of 1.2 spacing with margins of 2.5 centimeters, top, bottom, right and left in the format given in the Annexure- I. This is related to the planning, which should be submitted by the end of fourth week of the semester. The purpose of this part is to teach the student to plan and also to ensure that students finalise their title and start working by the fourth week.

The second part is the micro-project report (Annexure II) which is to be submitted after the completion of the projectprepared inblack and white(no colour printing) of 8 to 15of A4 size pages depending upon nature of the project (excluding the cover page and initial pages) written in preferably in 12 point calibri font of 1.2 spacing with margins of 2.5 centimeters, top, bottom, right and left of each page.

The sample evaluation of the micro-project has to be undertaken throughout the semester once in a fortnight , section-by-section of the Report format in accordance with Annexure IV to ensure the quality of the ongoing micro-project work to attain the desired COs aimed towards the development of the competency.

5.0 COST OF MICRO-PROJECT

As far as possible, no cost need to be incurred by the student for the micro-project. Since students are supposed to do one micro-project in every course, in case it becomes necessary to incurred expenditure of Micro-Project the total cost should not exceed Rs.1000 per project.

Teacher should ensure that the Micro-Project should not become financial burden on students

6.0 ASSESSMENT OF MICRO-PROJECT

Purpose of Micro-project is to not only to give the marks but to give the qualitative feedback to the students and hence rubrics would be used for assessment of the Micro-project. Rubrics are given in Annexure II. Qualitative feedback on project work would be given by teacher by ticking appropriate cells in the rubrics shown in the teacher evaluation sheet. Teachers should make it very clear to the students that marks for the project would be awarded based on the efforts put in by the students and not based on the project report only. **Students who have worked on their own and tried their best but are not able to complete the project should get more marks in comparison to students who got their work completed with the help of others.**Photocopy of evaluated sheet has to attached by every student with his/her project report.

The following assessment methodology of the micro-project

a) For each Micro-project 10 Marks is earmarked for progressive Assessment.
b) A Micro-Project Evaluation format is given in Annexure III.
c) In this sheet assessor would also mention the Course Outcomes, Practical Outcomes, Unit Outcomes and Affective Domain Outcomes achieved by the project.
d) Out of 10 Marks 6 marks would be based on the project work. All group members would receive same marks out of 6 Marks
e) Remaining 4 marks would be based on individual contribution to be decided by teacher by taking viva - voce.

f) The teacher needs fill only one teacher evaluation sheet for each group and then make multiple copies of the filled teacher evaluation sheet according to the number of students in that group. Then the teacher can give marks out of 4 for after the presentation/viva of each student.

7.0 MICRO-PROJECTS PORTFOLIO:

a) It is a collection of all the micro-projects completed by the student in the whole diploma programme
b) Student would go on filling the reports of micro-projects in a portfolio (a kind of folder) along with the 'Teacher Evaluation Sheet' of that project.
c) In inner page of the initial pages of compiled portfolio there will be a summary sheet of all the micro-projects done by a student through all the three year diploma programme.
d) Students can use this portfolio in job interviews to show proudly about 30 micro-proj*ects completed by them in their diploma programme.*

Annexure –I

Part – A Micro-Project Proposal

(Format for Micro-Project Proposal A about 2-3 pages)

Title of Micro-Project

1.0 Aims/Benefits of the Micro-Project (minimum 30-50 words)

2.0 Course Outcomes Addressed

a) ……

b) ……

c) ……

3.0 Proposed Methodology

(Procedure in brief that will be followed to do the micro-project) in about 100 to 200 words)**.**

5.0 Action Plan (Sequence and time required for major activity)

S. No.	Details of activity	Planned Start date	Planned Finish date	Name of Responsible Team Members
1				
2				

6.0 Resources Required (major resources such as raw material, some machining facility, software etc.)

S. No.	Name of Resource/material	Specifications	Qty	Remarks
1				
2				

Names of Team Members with Roll Nos.

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……

****

Annexure – II

Part – B Micro-Project Report

(Outcomes after Execution) Format for Micro-Project Report (Minimum 6 pages)

Title of Micro-Project

1.0 Rationale

(Importance of the project, in about 30 to 50 words. This is a modified version of the earlier one written after the work)

2.0 Aims/Benefits of the Micro-Project

3.0 Course Outcomes Addressed (Add to the earlier list if more COs are addressed)

a) .....

b) .....

4.0 Literature Review

5.0 Actual Methodology Followed.

Write step wise the work was done, including which team member did what work and how the data was analysed (if any)**.**

6.0 Actual Resources Used (Mention the actual resources used)**.**

S. No.	Name of Resource/material	Specifications	Qty	Remarks
1				
2				

7.0 Outputs of the Micro-Projects

(Drawings of the prototype, drawings of survey, presentation of collected data, findings etc.)

8.0 Skill Developed / Learning outcome of this Micro-Project

9.0 Applications of this Micro-Project

****

Annexure – III

Suggested Rubric for Assessment of Micro Project

*(The rubric given below may be modified depending on the type of micro-project. Consider the **SIX most relevant** characteristics for evaluating the microproject)*

(Allot the marks in the appropriate cell given below each criteria)

S. No.	Characteristic to be assessed	Poor (Marks 1-3)	Average (Marks 4 - 5)	Good (Marks 6 - 8)	Excellent (Marks 9- 10)
1	**Relevance to the course**	Related to very few LOs	Related to some Los	Addressed at-least one CO	Addressed more than one CO
2	**Literature Review/information collection**	Not more than two sources (primary and secondary), very old reference	At-least 5 relevant sources, at least 2 latest	At –least 7 relevant sources, most latest	About 10 relevant sources, most latest
3	**Completion of the Target as per project proposal**	Completed less than 50%	Completed 50 to 60%	Completed 60 to 80%	Completed more than 80 %
4	**Analysis of Data and representation**	Sample Size small, data neither organized nor presented well	Sufficient and appropriate sample, enough data generated but not organized and not presented well. No or poor inferences drawn	Sufficient and appropriate sample, enough data generated which is organized and presented well but poor inferences drawn	Enough data collected by sufficient and appropriate sample size. Proper inferences drawn by organising and presenting data through tables, charts and graphs.
5	**Quality of Prototype/Model**	Incomplete fabrication/assembly.	Just assembled/fabricated and parts are not functioning well. Not in proper shape, dimensions beyond tolerance limit. Appearance/finish is shabby.	Well assembled/fabricated with proper functioning parts. In proper shape, within tolerance dimensions and good finish/appearance. But no creativity in design and use of material	Well assembled/fabricated with proper functioning parts. In proper shape, within tolerance dimensions and good finish/appearance. Creativity in design and use of material
6	**Report Preparation**	Very short, poor quality sketches, Details about methods,	Nearly sufficient and correct details about methods, material,	Detailed, correct and clear description of methods, materials,	Very detailed, correct, clear description of methods, materials,

S. No.	Characteristic to be assessed	Poor (Marks 1-3)	Average (Marks 4 - 5)	Good (Marks 6 - 8)	Excellent (Marks 9- 10)
		material, precaution and conclusions omitted, some details are wrong	precautions and conclusion, but clarity is not there in presentation. But not enough graphic description.	precautions and Conclusions. Sufficient Graphic Description.	precautions and conclusions. Enough tables, charts and sketches
7	**Presentation of the Micro project**	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
8	**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 most of the questions properly
	Total Marks				

Teacher Evaluation Sheet

Name of Student: ..... **Enrollment No.**.....
Name of Programme..... **Semester:** .....
Course Title ..... **Code:**.....

Title of the Micro-Project: .....

Course Outcomes Achieved

.....
.....
.....

Evaluation as per Suggested Rubric for Assessment of Micro Project

Sr. No.	Characteristic to be assessed	Poor (Marks 1 - 3)	Average (Marks 4 - 5)	Good (Marks 6 - 8)	Excellent (Marks 9- 10)
1	Relevance to the course				
2	Literature Review/information collection				
3	Literature Review/information collection				
4	Analysis of Data and representation				
5	Completion of the Target as per project proposal				
6	Report Preparation				
7	Presentation of the Micro project				
8	Presentation of the Micro project				

MIcro-Project Evaluation Sheet

Process and Product Assessment (6 marks) *(Note: The total marks taken from the above Rubrics is to be converted in proportion of '6' marks)*	Individual Presentation/Viva (4 marks)	Total Marks 10

Comments/Suggestions about team work/leadership/inter-personal communication (if any)

……

…….

……

…….

Name and designation of the Teacher…….

Dated Signature……

Assessment Manual

For

Industrial Training
(Part B)

_____ Engineering Programme

(I Scheme Curriculum)

Maharashtra State
Board of Technical Education, Mumbai

(Autonomous) (ISO-9001-2008) (ISO/IEC 27001:2013)

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION (MSBTE)

"I" Scheme Curriculum (Launched in 2017)

6 -Week Industrial Training **Common to all programmes**

Name of Course: **Industrial Training *(6 weeks duration)***

1. RATIONALE

Industrial training course is introduced to all diploma programmes with the aim to imbibe the industry culture in the students before they enter into world of work. By exposing and interacting with the real life industrial setting, student will appreciate and understand the actual working of an industry, best practices adopted in industry and other requirements in the industry. The industrial needs such as the soft skills, life skills and hands-on practices is intended to be inculcated in the students through this training. This short association with the industry will be instrumental in orienting the students in transforming them to be industry ready after completion of diploma programme.

2. COMPETENCY

This course is intended to develop the following competencies:

a) **Soft Skills i.e. Communication, Presentation and others.**
b) **Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others**
c) **Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.**

3. COURSE OUTCOMES

The industrial training is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to fourth semester of the program:

a) Communicate effectively (verbal as well as written) the execute work.
b) Prepare the industry report of the executed work.
c) Exercise time management and safety in the work environment.
d) Work in teams for successful completion of projects assuring quality.

4. TEACHING & EXAMINATION SCHEME

Teaching scheme (In hours)			Total Credits (L+ T+ P)	Examination Scheme				
				Theory Marks		Practical Marks		Total marks
L	T	P		ESE	PA	ESE	PA	
--	--	6	6	--	--	75#	75#	150

Note: Both ESE and PA part of assessment will be carried out by institute faculty and industry training supervisor as explained in table no. 2, 3 and 4

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

The Industries/Organizations can be Government/Public limited/or Private family enterprises.

a) **Duration of Industrial Training:** Between 4th and 5th semester (Summer Vacation).

b) **Duration of the training:** Six weeks

c) **Training Area:** Students should be trained in large and medium scale Industry / Organization. However, despite the best efforts by the institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in small scale Industry / Organization.

For ***Civil engineering,*** it can be public works department, irrigation department, public health engineering, municipal corporations, town and country planning, highway and roads authorities, railways, large and medium scale civil contractors, rural engineering departments, environment corporations, large and medium scale private construction companies, mining companies.

For ***Mechanical Engineering,*** it can be manufacturing, fabrication, foundry or processing industry which may include compressors, boilers, engines, heat exchangers, air conditioning and refrigeration plants, conveyors etc are either manufactured or used. Power plants, Railways, process plants, ordinance factories, textile factories, automobile manufacturers or major automobile workshops.

For ***Electrical engineering,*** it can be electricity transmission and distribution companies, power generating stations, sub stations, railways, industries manufacturing electrical products which may include industry where large motors/transformers etc. are used, process plants, electrical contractors.

For ***Electronics engineering,*** it can be telecommunication companies, post and telegraph department, manufacturer of telecommunication product, manufacturers of control equipments, manufacturer of CNC machines, any manufacturing industry where electronic controls are used either in production process or in its products, computer hardware manufacturers, signal divisions of railways, etc.

For ***Computer and IT*** industries, it can be any software developers, cyber security companies, web page developers, networking companies, data base management companies, telecommunication companies or IT division of any other industries/finance/retail companies or organisations where software are used and maintained for various applications.

6. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

Sl. No.	Activity	Schedule
1	Collecting information about Industry / Organization available for training along with capacity (Format - 1)	Before completion of 3rd semester
2	Student and mentor allocation as per the slots available for in-plant training (Desirable mentor- student ratio is 1:15)	Before commencement of 4th semester
3	Communication with Industry / Organization available for training along with capacity and its confirmation	Before first Unit Test of the 4th semester
4	Obtaining consent letter from parents / guardian	Before second Unit Test

Sl. No.	Activity	Schedule
	(Format - 2)	of the 4th semester
5	Student enrollment for In-plant training (Format - 3)	Before commencement of 4th semester examination
6	Issue letter to the Industry / Organization for the training along with details of students and mentors. (Format - 4)	During 4th semester examination
7	Mentors to carry out progressive assessment of the students during the in-plant training (Format - 5)	Each week of training
8	End of training assessment by mentor along with Industry / Organization expert as external examiner(Format - 6)	Before 5th semester ESE

Suggestions

a) Departments can take help of alumni or present students (if they or their parents or relatives have some contact in different industries) for securing placement.

b) The students would normally be placed as per their choices, in case of more demand for a particular Industry / Organisation students would be allocated place based on their relative merit. However, if some students have arranged training placement in some companies with the help of their parents/relatives etc. then they will be given preference for placement in those companies.

c) Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry / Organisation during the training before relieving students for training.

d) The faculty member during the visit to Industry / Organisation will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.

7. EXPECTATIONS FROM INDUSTRY

Helping institute in developing the following competencies among students

a) **Soft Skills i.e. Communication, Presentation and others.**
b) **Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others**
c) **Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.**

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

a) Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.

b) Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.

c) He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
d) Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and sent back the students.
e) It is the responsibility of the student to collect information from Industry / Organization about manufacturing processes / testing and quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/organizational structure etc.
f) During the training period students have to keep record of all the useful information in Log book
g) Maintain the weekly diary as provided and get it signed from mentor as well as Industry / Organization training in-charge.
h) In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
i) Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organisation. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1. Organizational structure of Industry / Organisation and General Lay Out
Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)
Chapter 3. Types of major equipment/instruments/ machines used in industry with their specification, approximate cost and specific use and their routine maintenance.
Chapter 4. Manufacturing Processes along with production planning and control methods.
Chapter 5. Testing of raw materials, components and finished products along with quality assurance procedures.
Chapter 6. Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 7. Safety procedures followed and safety gear used (includes Preventive maintenance schedule and breakdown maintenance procedures).
Chapter 8. Particulars of Practical Experiences in Industry / Organisation if any in Production/ Assembly/ Testing/Maintenance.
Chapter 9. Short report/description of the project (if any done during the training)
Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

References /Bibliography

10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and testing manuals used in the industry. Students may also visit websites related to other industries wherein similar products are being manufactured as their learning resource.

11. TENTATIVE WEEK-WISE SCHEDULE OF INDUSTRIAL TRAINING

The industrial training is a common course to all programmes; therefore the industry / Organisation selection will depend upon the nature of programme and its related industry. The training activity may vary according to nature and size of Industry / Organisation. The following table details suggestive schedule for industrial training for all programmes.

Table - 2 Detail week schedule and Marks distribution

S. No.	Week No.	Details of activities to be completed during Industrial training	Marks distribution/ week for PA
1	Week No. 1	Induction to industry and its departments	05
2	Week No. 2	Study of layout and specifications of major machines, equipment and raw materials / components / software used.	05
3	Week No. 3	Study of setup and processes/execute project.	25
4	Week No. 4	Study of QA/QC procedures.	10
5	Week No. 5	Study safety and maintenance procedure in an industry/organization	05
6	Week No. 6	Report Writing	00
PA marks to be given by industry supervisor			25
PA marks to be given by polytechnic faculty based on report			25
		Total PA marks for training	**75**

Table - 3 ASSESSMENT SCHEME FOR INDUSTRIAL TRAINING

Training duration	PROGRESSIVE ASSESSMENT (*Weekly report of all 6 week and attendance)*		END SEMESTER ASSESSMENT (*Seminar and Oral)*		Total marks	
Six weeks	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
	#75	--	75**	30	150	60

**assessed by external examiner based on report (25 Marks), presentation (25 Marks) and Viva-Voce (25 Marks)

Table - 4 Distribution of End-Semester-Examination (ESE) marks of Industrial Training

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE marls
25	25	25	75

Format1 : Collecting Information about Industry/Organisation available for training alongwith capacity

1) Name of the industry/organisation:
2) Address/communication details(incl email):
3) Contact person details:
   a) Name:
   b) Designation:
   c) Email
   d) Contact number/s:

4) Type:
   Govt / PSU / Pvt /
   Large scale / Medium scale / Small scale …..

5) Products/services offered by industry:

6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: Yes / No.
   b) If yes, whether you offer 6 weeks training : YES/NO
   c) Internship capacity possible:

Programme	Civil Engg	Mechanical Engg	Electrical Engg	……	Total
Male					
Female					
Total					

7) Whether accommodation available for interns Yes / No.
   If yes capacity:_____

8) Whether internship is charged or free:
   If charged please specify amount per candidate: _____

Signature of responsible person:

Format2 : Obtaining Consent Letter from parents/guardians

(Undertaking from Parents)

To,

The Principal,

_____,

Subject: Consent for Industrial Training.

Sir/Madam,

I am fully aware that -

i) **My ward studying in _____ semester at your _____ institute has to undergo six weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.**

ii) **For this fulfillment he/she has been deputed at _____ industry, located at _____ for internship of ____ weeks for the period from _____ to _____ .**

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

a) **My ward will undergo the training at his/her own cost and risk during training and/or stay.**
b) **My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.**
c) **My ward is NOT entitled to any leave during training period.**
d) **My ward will submit regularly a prescribed weekly diary ,duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.**

I have explained the contents of the letter to my ward who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :
Name : _____
Address :_____
_____
Phone Number:_____

Format 4: Issue Letter to the Industry/Organisation for the training alongwith details of students and mentors

To,

The HR Manager,

_____

Subject: Placement for Industrial training of ___ weeks in your organization….

Reference: Your consent letter no: ….

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Kindly do the needful and oblige.
Thanking you in anticipation

Yours sincerely,

(Principal)

Name of the Institute:
with Seal

PA of Industrial training

Academic year : 20 -20

Name of the industry:

Sr. No	Enrolment Number	Name of student	Marks (5 marks for each week)						PA Marks by Industry Supervisor	PA based on Report by mentor faculty	Total
			Week 1	Week 2	Week 3	Week 4	Week 5	**Total (A)**	**Out of 25 (B)**	**Out of 25 (C)**	**Out of 75 (A)+(B)+(C)**

Marks for PA are to be awarded out of 5 for each week considering the level of completeness of activity observed, from the daily diary maintained and feedback from industry supervisor.

Name of mentor:

Signature of mentor