



Maharashtra State Board of Technical Education, Mumbai

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

Program Name : Diploma in Artificial Intelligence and Machine Learning

Program Code : AN

Duration of Program : 6 Semesters

With Effect From Academic Year: 2021 - 22

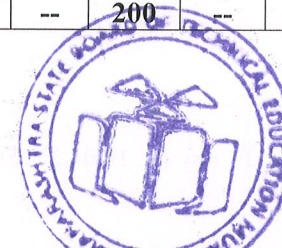
Semester : Sixth

Duration : 16 Weeks

Pattern : Semester - Full Time

Scheme : I

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme														Grand Total		
				L	T	P		Theory								Practical								
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total					
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
1	Management	MAN	22509	3	--	--	3	90 Min	70* #	28	30*	0	100	40	--	--	--	--	--	--	100			
2	Mobile Application Development	MAD	22617	3	--	4	7	3	70	28	30*	0	100	40	25#	10	25	10	50	20	150			
3	Advanced Algorithms in AI-ML	AAM	22683	3	--	2	5	3	70	28	30*	0	100	40	25@	10	25	10	50	20	150			
4	Big Data Analytics	BDA	22684	3	--	2	5	3	70	28	30*	0	100	40	25@	10	25	10	50	20	150			
Elective (Any One)																								
5	Network and Information Security	NIS	22620	3	--	2	5	3	70	28	30*	0	100	40	25@	10	25	10	50	20	150			
	Data Warehousing with Mining Techniques	DWM	22621																					
6	Entrepreneurship Development	EDE	22032	2	--	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100			
7	Capstone Project-Execution & Report Writing	CPE	22060	--	--	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100			
Total				17	--	16	33	--	350	--	150	--	500	--	200	--	200	--	400	--	900			



Student Contact Hours Per Week: **33 Hrs.**

Theory and practical periods of 60 minutes each.

Medium of Instruction: **English**

Total Marks : 900

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

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

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

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

- **If Candidate not securing minimum marks for passing in the “PA” part of practical of any course of any semester then the candidate shall be declared as “Detained” for that semester.**



Program Name : Diploma in Computer Engineering Group / Diploma in Mechanical / Chemical Engineering / Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing / Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data

Program Code : CO/CM/CW/DC/EJ/ET/EN/EX/EQ/IE/ME/CH/AN/HA/TE/BD

Semester : Sixth

Course Title : Entrepreneurship Development

Course Code : **22032**

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

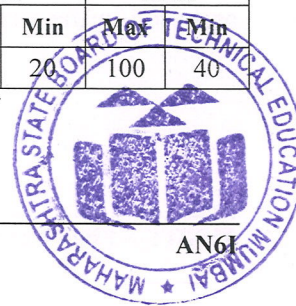
The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

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

4. TEACHING AND EXAMINATION SCHEME

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

@ : Internal examination



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

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

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

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

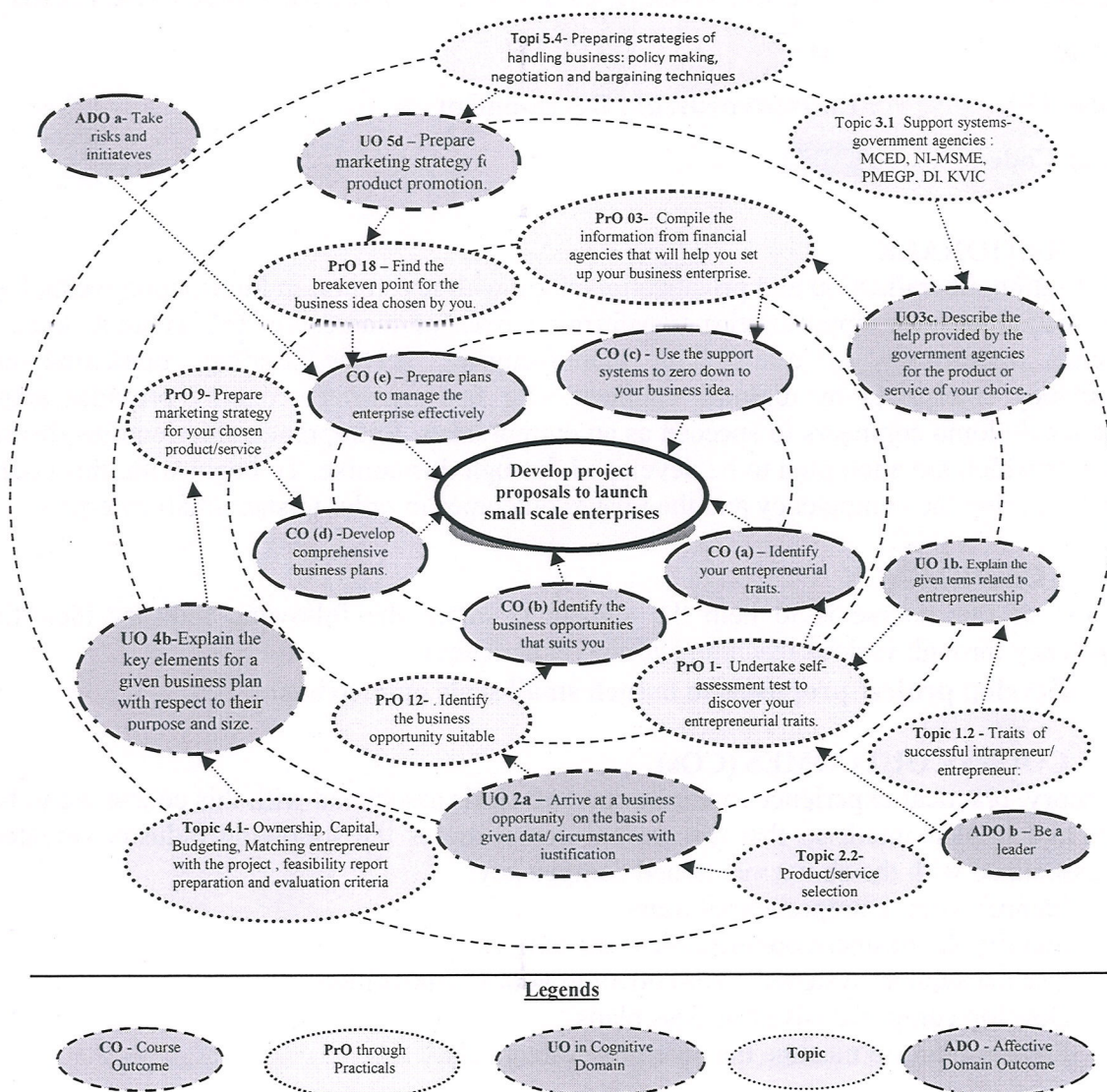


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

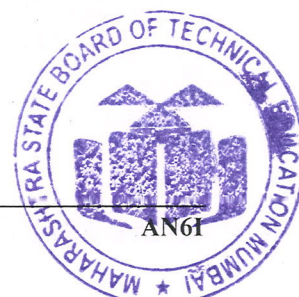
- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' 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, envelopes, Ice-cream cup, paper cup and saucers and paper Plates
41. Pickles, Chutney and Pappads
42. Pouches for various purposes

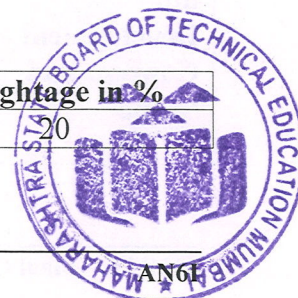


43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces
47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

Sample Services that can be offered under SME

1. Marketing Consultancy
2. Industrial Consultancy
3. Equipment Rental & Leasing
4. Typing Centres
5. Photocopying Centres (Zeroling)
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:

- Follow safe practices
- Practice good housekeeping
- Practice energy conservation
- Demonstrate working as a leader/a team member
- Maintain tools and equipment
- 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

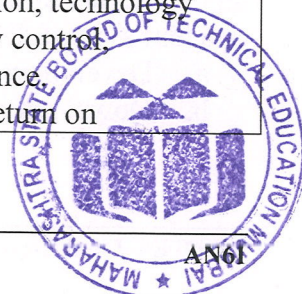
8. UNDERPINNING THEORY COMPONENTS

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 Entrepreneurs hip 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, handling business communication.



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.	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 Industries 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	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



Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
	product/service. 3d. Compute the breakeven point for the specified business enterprise, stating the assumptions made.	investment and return on sales.
UNIT IV Business Plan Preparation	4a. Justify the importance of the business plan for the given product/service. 4b. Explain the key elements for the given business plan with respect to their purpose/size 4c. Prepare the budget for the given venture. 4d. Prepare the details of the given component of the given startup business plan.	4.1 Sources of Product for Business : Feasibility study 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project , feasibility report preparation and evaluation criteria 4.3 Business plan preparation
Unit –V Managing Enterprise	5a. Justify the USP of the given product/ service from marketing point of view. 5b. Formulate a business policy for the given product/service. 5c. Choose the relevant negotiation techniques for the given product/ service with justification. 5d. Identify the risks that you may encounter for the given type of business/enterprise with justification. 5e. Describe the role of the incubation centre for the given product/service.	5.1 Unique Selling Proposition [U S P]· Identification, developing a marketing plan. 5.2 Preparing strategies of handling business: policy making, negotiation and bargaining techniques. 5.3 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.

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

9. SUGGESTED STUDENT ACTIVITIES

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

- Develop two products from household waste (attach photographs).
- Download product development and innovative films from internet.

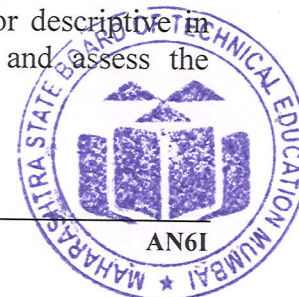


- c. Prepare a collage for 'Traits of successful entrepreneurs'.
- d. Invite entrepreneurs, industry officials, bankers for interaction.
- e. Identify your hobbies and interests and convert them into business idea.
- f. Convert your project work into business.
- g. Choose a product and design a unique selling proposition, 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).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
 - Use Flash/Animations to explain various maintenances techniques.
 - Guide student(s) in undertaking micro-projects.
 - 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.
 - 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.
 - They must be encouraged to surf on net and collect as much information as possible.
 - Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
 - Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
 - Alumni should be frequently invited for experience sharing, guiding and rewarding students.
 - 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.

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

12. SUGGESTED LEARNING RESOURCES

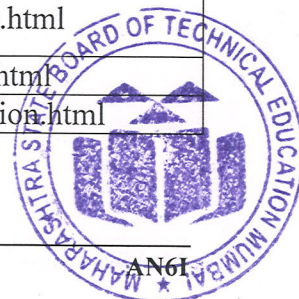
S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R.	McGraw-Hill Education, New



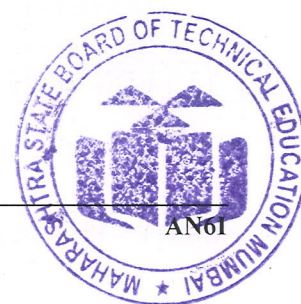
S. No.	Title of Books	Author	Publication
		D.	Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, 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 Business Management	Khanka, S.S.	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S, Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

13. SUGGESTED SOFTWARE/LEARNING WEBSITES

1	MCED Books links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The National Institute for Entrepreneurship and Small Business Development Publications	http://niesbud.nic.in/Publication.html
4	Courses : The National Institute for Entrepreneurship and Small Business Development	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	https://www.entrepreneur.com/lists
6	GOVT. SPONSORED SCHEMES	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD - Information Centre	https://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we Do	http://www.nabard.org/content1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businesstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdf/file.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/TEQUPD etail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20thinking-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/Indus try_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/ / Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data

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/AN/HA/TE/BD

Semester : Sixth

Course Title : Capstone Project – Execution & Report Writing

Course Code : **22060**

1. RATIONALE

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

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

2. COMPETENCY

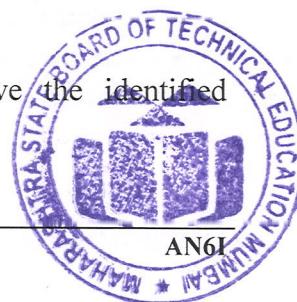
The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

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

3. COURSE OUTCOMES (COs)

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

- a) Implement the planned activity individually and/or as team.
- b) Select, collect and use required information/knowledge to solve the identified problem.



- c) Take appropriate decisions based on collected and analysed information.
- d) Ensure quality in product.
- e) Incorporate energy and environment conservation principles.
- f) Consider the ethical issues related to the project (if there are any).
- g) Assess the impact of the project on society (if there is any).
- h) Communicate effectively and confidently as a member and leader of team.
- i) Prepare project report after performing due plagiarism check using appropriate tools.

4. TEACHING AND EXAMINATION SCHEME

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

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

5. Course details

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

5.1 Guidelines for Capstone Project–Execution and Report Writing

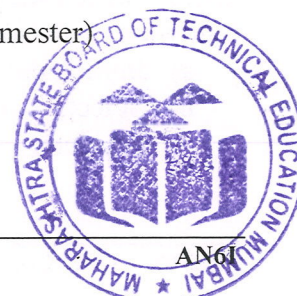
- a) The students would like to revise the ‘Capstone Project – Plan’ based on the feedback received in the fifth semester examination.
- b) This revised ‘Capstone Project – Plan’ would be again approved by the project guide. As soon as the revised plan is approved by the teacher, the student will begin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

6. Project report

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

Suggested contents of the Project report

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



Chapters

1. Chapter–1 Introduction (background of the Industry or User based Problem/Task)
2. Chapter–2 Literature Survey (to finalise and define the Problem Statement)
3. Chapter–3 Scope of the project
4. Chapter–4 Methodology
5. Chapter-5 Details of designs, working and processes
6. Chapter-6 Results and Applications
7. Chapter-7 Conclusions And future scope
8. Appendix (if any)
9. References and Bibliography

Note:

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

7. ASSESSMENT OF PROJECT WORK

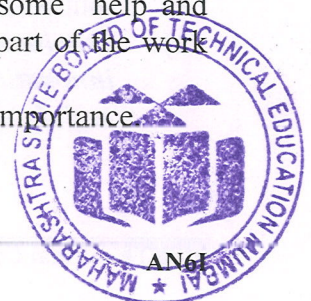
Project work has two components, first is Progressive Assessment (PA), while another is End Semester Examination (ESE).

7.1. Progressive Assessment (PA) Guidelines and Criteria

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

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

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



- g) The Project Guide will assure the quality of project done by his group.

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

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

7.2 END SEMESTER EXAMINATION (ESE)

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

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

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

8. SPECIAL TEACHING STRATEGIES (If any)

- 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
- Teachers should help students in selecting a topic which is relevant and challenging (but within capacity) for students according to their abilities.
- Teachers should come out of the mindset that there should be compulsorily some innovation and novelty in the project work. Because as discussed earlier, project is mainly opportunity for work based or experiential learning, the aim of which is to*



develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation. The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete on their own without getting it done from market.

- d) Teachers should ensure that students prepare the project plan in as much detail as possible, since this way only they would learn the importance of planning and how to do the detail planning. Teachers should allow students to proceed ahead only when they have detailed plan with them.
- e) Teachers should motivate students to maintain project document project diary and project report. They should explain benefits of these activities to students and also train them in these activities, because most of them may be doing this first time.
- f) Project Guide should ensure that students submit chapter of report one by one to him/her as per schedule and should check the content of the chapters. The Project guide should monitor that schedule is maintained and report writing is not left till last few weeks. It should not be a problem since first three chapters of the report should have been written in fifth semester itself.
- g) Teachers should also encourage students to openly discuss their weaknesses and shortcomings. Teachers should develop confidence in students that admitting mistakes and weaknesses helps in improving them.
- h) Teachers should continuously discuss with students about working of group and progress in the project and from this discussion should identify their personal qualities (both strengths and weaknesses) and suggest to them ways for improving those qualities.
- i) Internal as well as external examiners should reward students for original work and efforts of students even if they are not fully successful or not able to complete the project in comparison to those students who have taken paid help from others to complete their project.

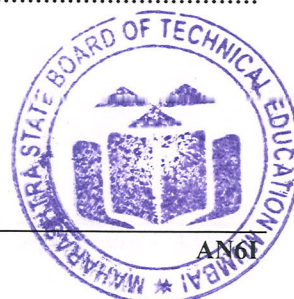
Appendix-A

CERTIFICATE

This is to certify that Mr./Ms.....
fromInstitute having Enrolment No:
has completed project of final year having title during the
academic year 20__-20__. The project completed by individually/ in a group consisting
of..... persons under the guidance of the Faculty Guide.

.....
.....
Name & Signature of Guide:

Telephone:.....



Appendix-B**PROGRESSIVE ASSESSMENT (PA) OF CAPSTONE PROJECT – EXECUTION
AND REPORT WRITING****Evaluation Sheet for Internal Assessment**

Name of Student:

Name of Programme..... Semester: Sixth

Course Title: Capstone Project : Execution and Report Writing

Code:22060.

Title of the Capstone Project:

.....

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

- a)
- b)
- c)
- d)

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

- a)
- b)
- c)
- d)

C. OTHER LEARNING OUTCOMES ACHIEVED THROUGH THIS PROJECT**1. Unit Outcomes (Cognitive Domain)**

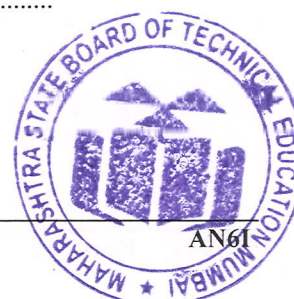
- a)
- b)
- c)
- d)

2. Practical Outcomes (in Psychomotor Domain)

- a)
- b)
- c)
- d)

3. Affective Domain Outcomes

- a)
- b)
- c)
- d)

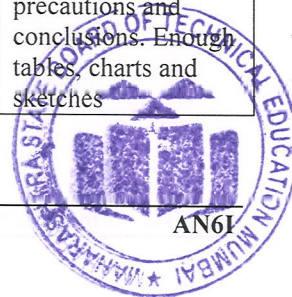


PROGRESSIVE ASSESSMENT (PA) Sheet		
S. No.	Criteria	Marks
1	Project Proposal /Identification	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Plan during sixth semester	20
5	Project Report including documentation	15
6	Presentation	05
Total		50

Appendix-B

Suggested Rubric for Capstone Project – Execution and Report Writing

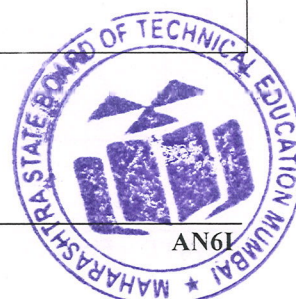
S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	Problem/Task Identification (Project Title)	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific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



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

Appendix C Suggestive Project Diary format

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



Program Name : Diploma in Automobile Engineering / Civil Engineering Group / Electronics Engineering Group / Diploma in Plastic Engineering / Diploma in Production Engineering / Diploma in Fashion & Clothing Technology/ Computer Engineering Group Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data

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

Semester : Sixth

Course Title : Management

Course Code : 22509

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

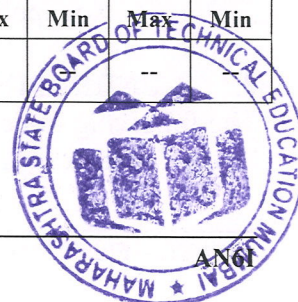
The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

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

4. TEACHING AND EXAMINATION SCHEME

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

(*#) Online Theory Examination.

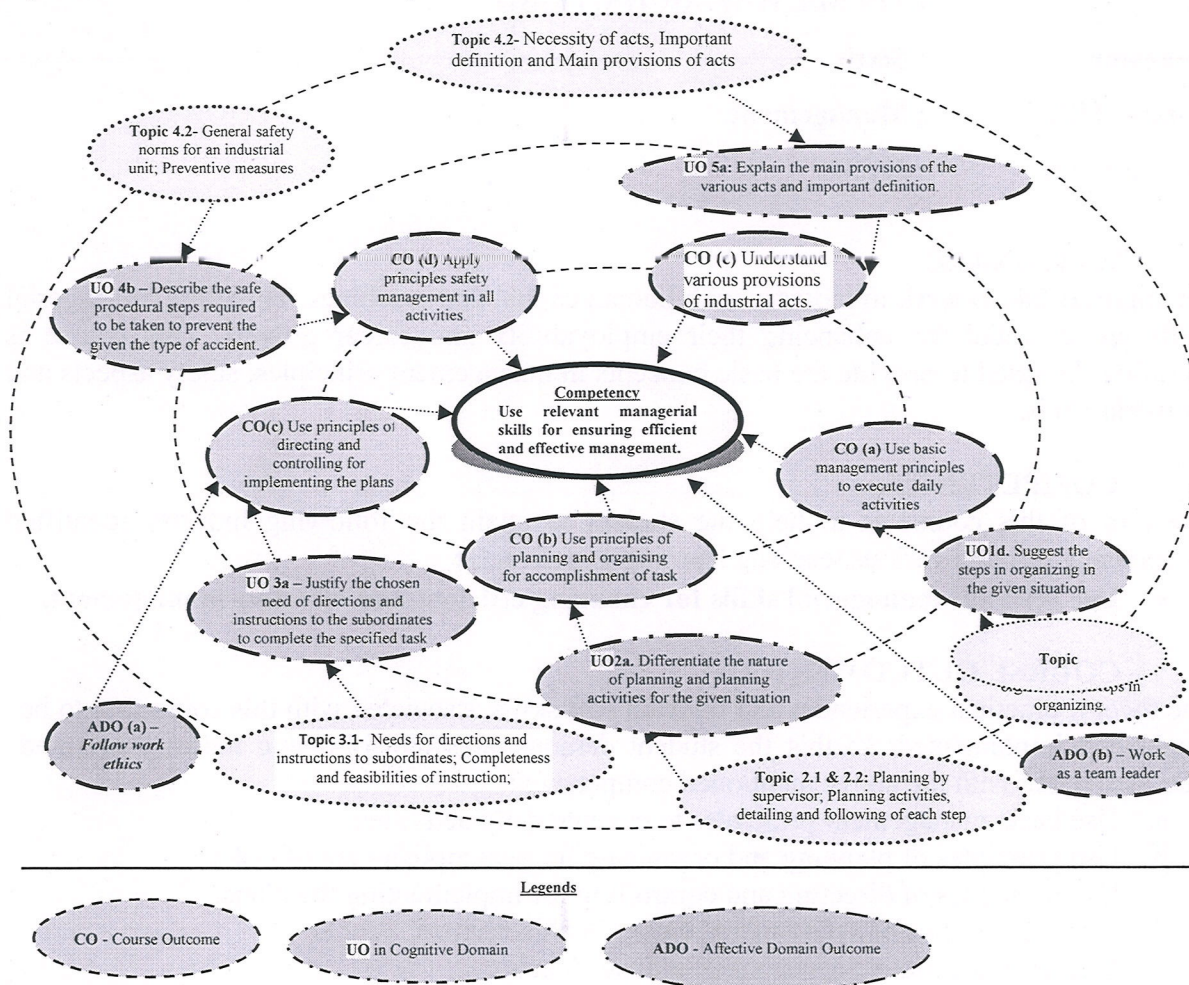


(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos. (*#): Online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

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

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

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



6. SUGGESTED PRACTICALS/ EXERCISES

- Not applicable -

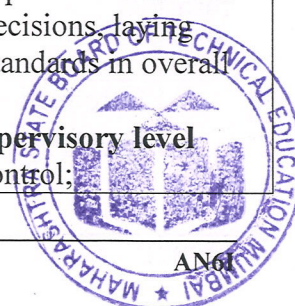
7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to management concepts and managerial skills	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II Planning and organizing at supervisory level	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	Planning at supervisory level 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. Organizing at supervisory level 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III Directing and Controlling at supervisory level	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control actions and remedial measures	Directing at supervisory level 3.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions 3.2 Personal counselling advanced predictions of possible mistakes. 3.3 Elaborating decisions, laying disciplinary standards in overall working Controlling at supervisory level 3.4 Managerial control;



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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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



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

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

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

10. SUGGESTED STUDENT ACTIVITIES

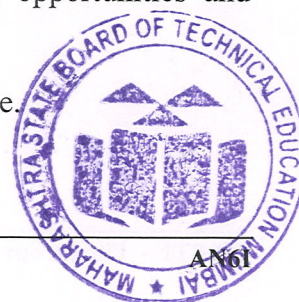
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '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.
- 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).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.



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

12. SUGGESTED MICRO-PROJECTS

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

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

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

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

13. SUGGESTED LEARNING RESOURCES

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

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

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



Program Name : Computer Engineering Program Group/ Diploma in Artificial Intelligence and Machine Learning / Diploma in Cloud Computing and Big Data / Diploma in Computer Hardware & Maintenance

Program Code : CO/CM/IF/CW/AN/BD/HA

Semester : Sixth

Course Title : Mobile Application Development

Course Code : 22617

1. RATIONALE

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

2. COMPETENCY

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

- **Create simple Android applications.**

3. COURSE OUTCOMES (COs)

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

- Interpret features of Android operating system.
- Configure Android environment and development tools.
- Develop rich user Interfaces by using layouts and controls.
- Use User Interface components for android application development.
- Create Android application using database.
- Publish Android applications.

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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



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

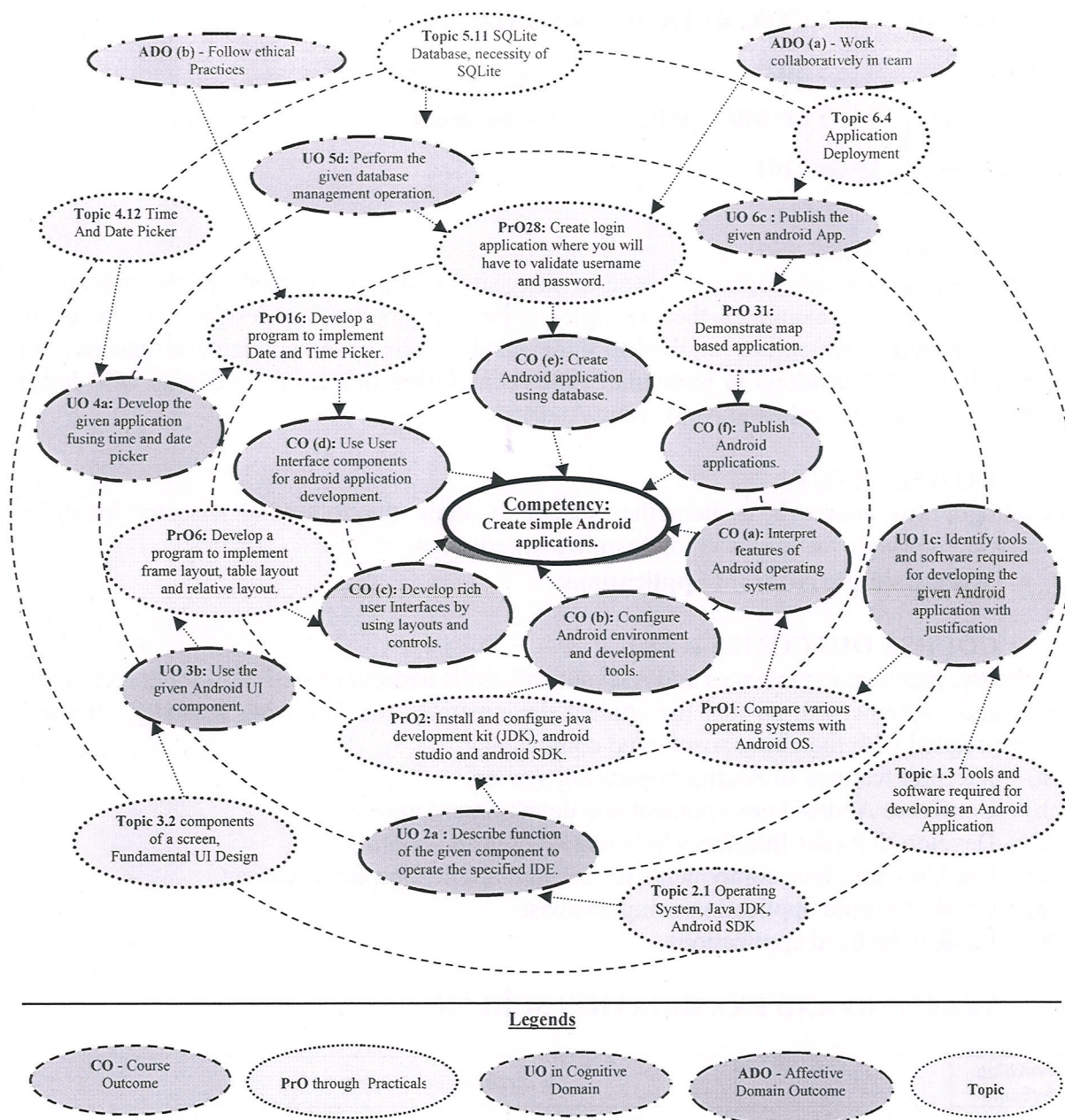


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

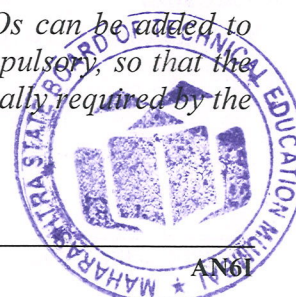
The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the above stated competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Compare various operating systems with Android OS.	I	
2	Install /configure java development kit (JDK), android studio and android SDK.	II	

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

Note

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



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

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

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

- Work collaboratively in team
- Follow ethical practices.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

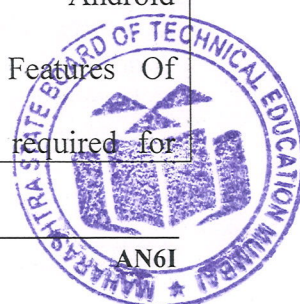
The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

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

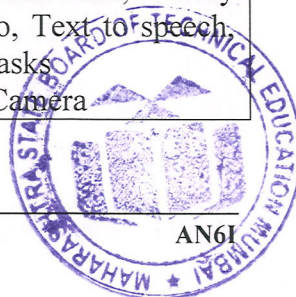
8. UNDERPINNING THEORY COMPONENTS

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

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



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	required for developing the given Android application with justification. 1d. Explain significance of the given component in Android architecture.	developing an Android Application 1.4 Android Architecture
Unit- II Installation and configuration of Android	2a. Describe function of the given component to operate the specified IDE. 2b. Explain the given term related to virtual machine. 2c. Explain the given basic term related to Android development tools. 2d. Describe the features of given android emulator. 2e. Describe the steps to configure the given android development environment	2.1 Operating System, Java JDK, Android SDK 2.2 Android Development Tools(ADT) 2.3 Android Virtual Devices(AVDs) 2.4 Emulators 2.5 Dalvik Virtual Machine, Difference between JVM and DVM 2.6 Steps to install and configure Android Studio and SDK
Unit- III UI Components and Layouts	3a. Explain with relevant analogy the given Directory Structure. 3b. Describe the steps to use the given Android rich UI component. 3c. Describe the steps to use the given type of Layout. 3d. Develop the given basic Android application.	3.1 Control Flow, Directory Structure 3.2 Components of a screen, Fundamental UI Design 3.3 Linear Layout; Absolute Layout; Frame Layout; Table Layout; Relative Layout
Unit-IV Designing User Interface With View	4a. Develop rich user Interfaces for the given Android application. 4b. Develop Android application using the given view. 4c. Explain the significance of the given display Alert. 4d. Develop the given application using time and date picker.	4.1 Text View, Edit Text; Button, Image Button; Toggle Button; Radio Button And Radio Group; Checkbox; Progress Bar 4.2 List View; Grid View; Image View; Scroll View; Custom Toast Alert 4.3 Time And Date Picker
Unit -V Activity And Multimedia with databases	5a. Apply the given Intents and service in Application development. 5b. Use Fragment to generate the given multiple activities. 5c. Develop programs to play the given multimedia. 5d. Write the query to perform the given database management operation.	5.1 Intent, Intent Filter 5.2 Activity Lifecycle; Broadcast Lifecycle 5.3 Content Provider; Fragments 5.4 Service: Features Of service, Android platform service, Defining new service, Service Lifecycle, Permission, example of service 5.5 Android System Architecture, Multimedia framework, Play Audio and Video, Text to speech, Sensors, Async tasks 5.6 Audio Capture, Camera



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		5.7 Bluetooth, Animation 5.8 SQLite Database, necessity of SQLite, Creation and connection of the database, extracting value from cursors, Transactions.
Unit –VI Security and Application Deployment	6a. Explain the given location based service. 6b. Write the steps to customize the given permissions for users. 6c. Explain features of the given android security service. 6d. Write the steps to publish the given android App.	6.1 SMS Telephony 6.2 Location Based Services: Creating the project, Getting the maps API key, Displaying the map, Displaying the zoom control, Navigating to a specific location, Adding markers, Getting location, Geocoding and reverse Geocoding, Getting Location data, Monitoring Location. 6.3 Android Security Model, Declaring and Using Permissions, Using Custom Permission. 6.4 Application Deployment: Creating Small Application, Signing of application, Deploying app on Google Play Store, Become a Publisher, Developer Console

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

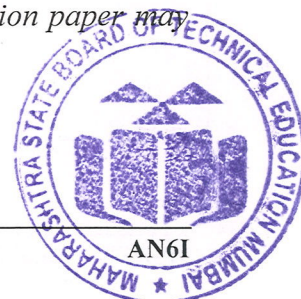
9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

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

10. SUGGESTED STUDENT ACTIVITIES



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

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

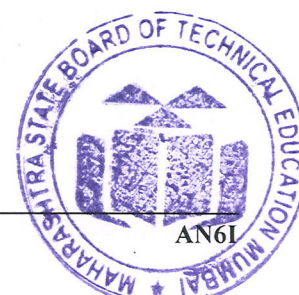
12. SUGGESTED MICRO-PROJECTS

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

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

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

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



Guidelines For Developing Micro Projects:

(Implement Following Relevant Guidelines For Micro Projects)

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

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

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



Program Name : Computer Engineering Program Group/ Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data

Program Code : CO/CM/IF/CW/AN/BD/HA/TE

Semester : Sixth

Course Title : Network and Information Security

Course Code : 22620

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

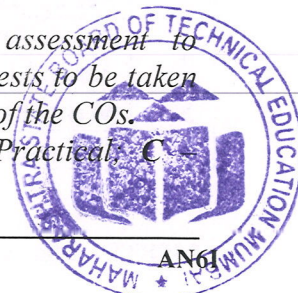
- Identify risks related to Computer security and Information hazard in various situations.
- Apply user identification and authentication methods.
- Apply cryptographic algorithms and protocols to maintain Computer Security.
- Apply measures to prevent attacks on network using firewall.
- Maintain secured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

4. TEACHING AND EXAMINATION SCHEME

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

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

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



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

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

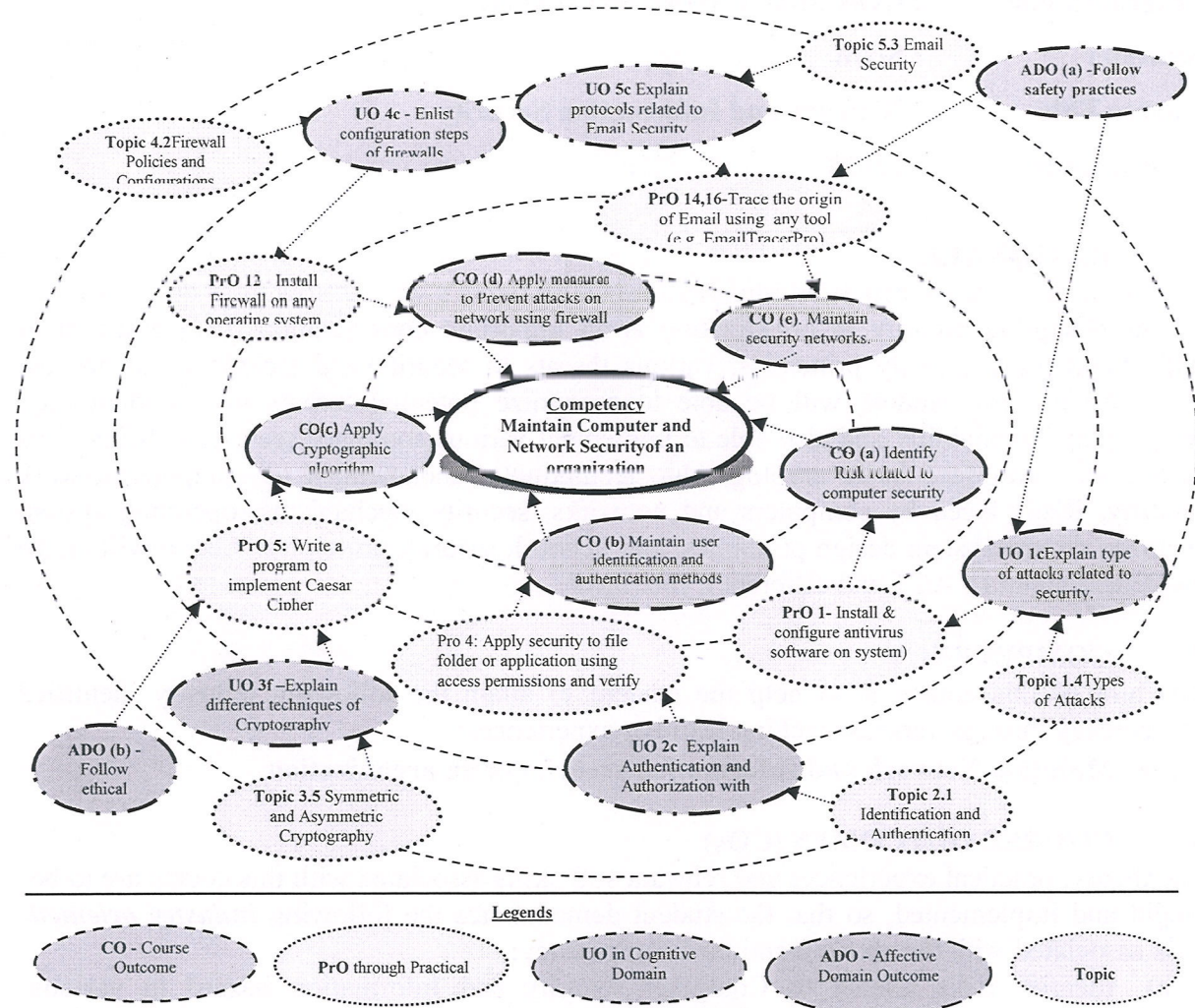


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Install and configure Antivirus software on system (any).	I	2
	b. Set up operating system Updates.		
2	Perform Backup and Restore of the system.	I	2
3	Set up passwords to operating system and applications.	II	2
4	Apply security to file folder or application using access permissions and verify.	II	2
5	Write a program to implement Caesar Cipher	III	2
6	Write a program to implement Vernam Cipher	III	2

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

Note

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

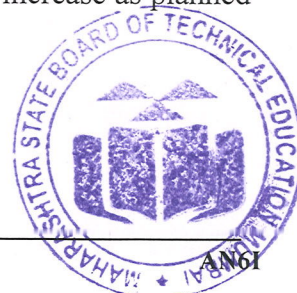
S. No.	Performance Indicators	Weightage in %
1	Correctness of the flow of procedures.	40
2	Debugging ability.	20
3	Quality of input and output displayed (messaging and formatting)	10
4	Answer to sample questions	20
5	Submission of report in time	10
Total		100

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

- Work collaboratively in team
- Follow ethical Practices.

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

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



7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

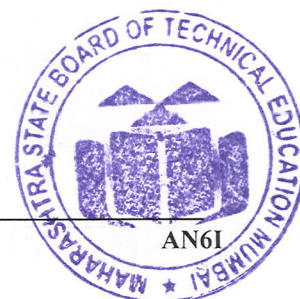
The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

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

8. UNDERPINNING THEORY COMPONENTS

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

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



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

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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

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

10. SUGGESTED STUDENT ACTIVITIES

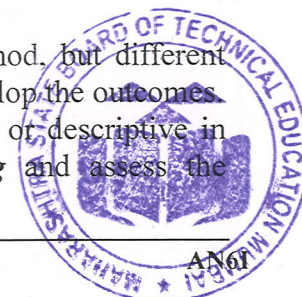
Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5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

- Prepare journal of practicals.
- 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:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '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.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the



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

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

12. SUGGESTED MICRO-PROJECTS

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

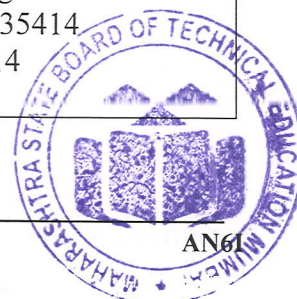
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual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

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

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

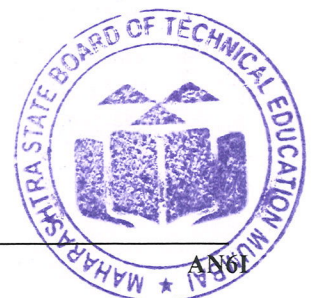
13. SUGGESTED LEARNING RESOURCES

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



14. SOFTWARE/LEARNING WEBSITES

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



Program Name : Computer Engineering Program Group/ Diploma in Artificial Intelligence and Machine Learning / Diploma in Cloud Computing and Big Data

Program Code : CO/CM/CW/AN/BD

Semester : Sixth

Course Title : Data Warehousing with Mining Techniques

Course Code : 22621

1. RATIONALE

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

2. COMPETENCY

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

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

3. COURSE OUTCOMES (COs)

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

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

4. TEACHING AND EXAMINATION SCHEME

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

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

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

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



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

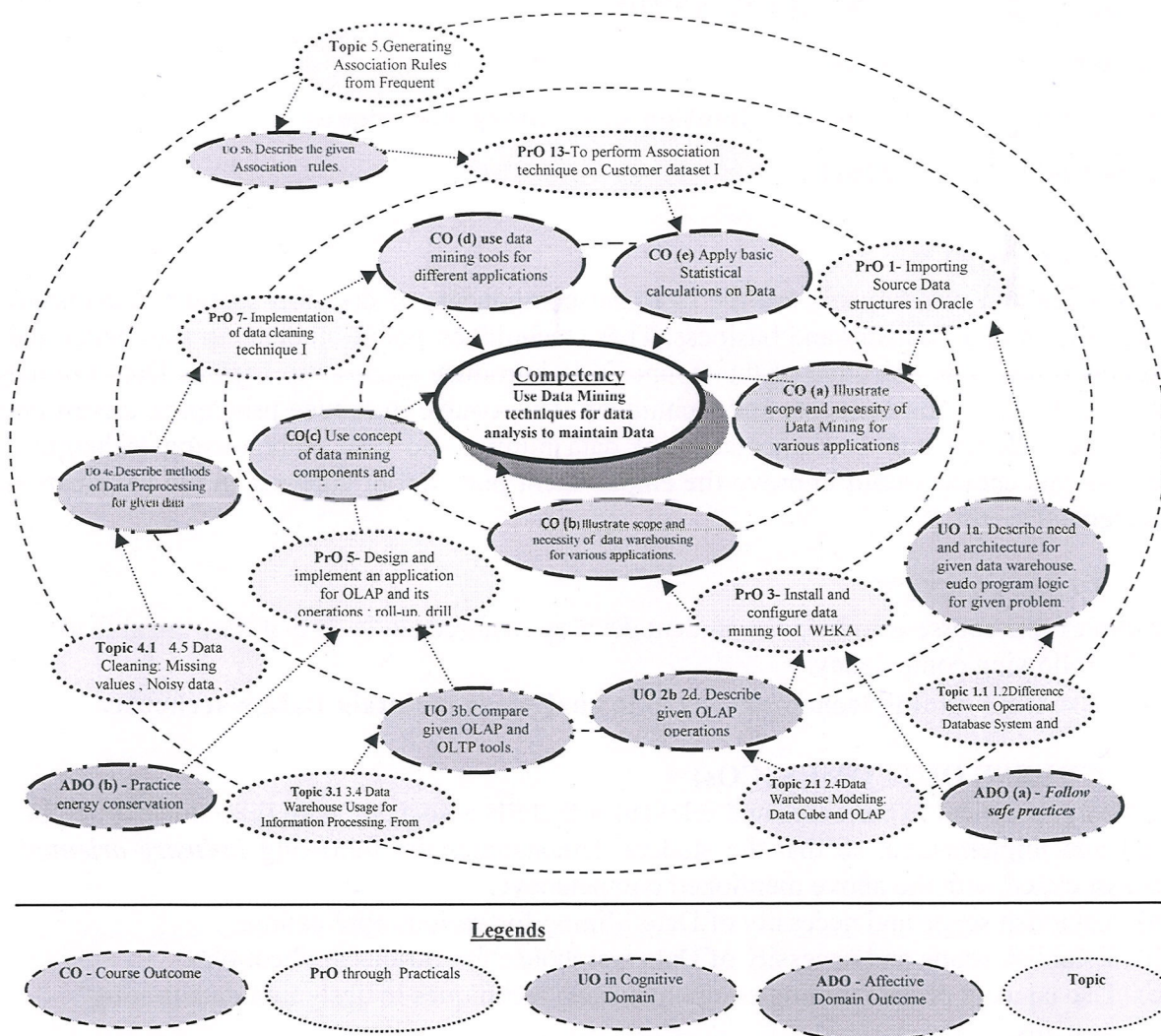


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

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

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

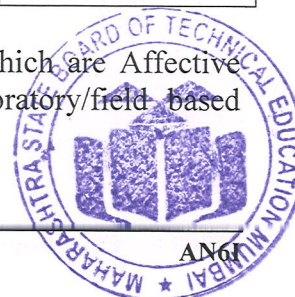
Note

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

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

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

- Work collaboratively in team



b) Follow ethical practices.

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

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

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

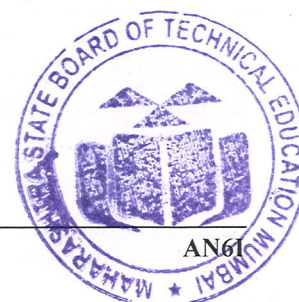
The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

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

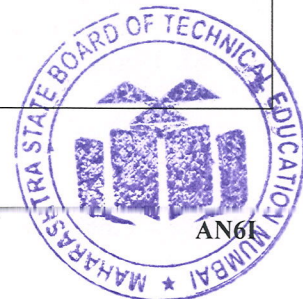
8. UNDERPINNING THEORY COMPONENTS

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

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



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



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

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

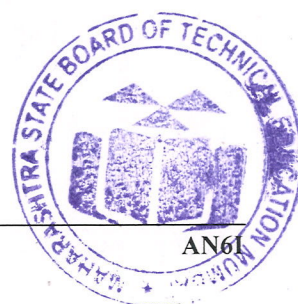
Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

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

10. SUGGESTED STUDENT ACTIVITIES

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

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



11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

12. SUGGESTED MICRO-PROJECTS

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

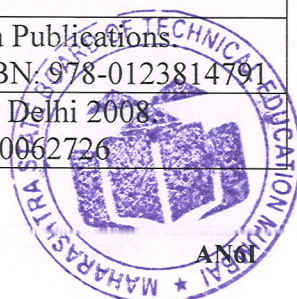
The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual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

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

- a) Perform Association technique on Customer dataset /Agriculture dataset /
- b) Weather dataset.
- c) Create the data warehouse for any medical shop having 2 or more branches.
- d) Predict traffic conditions for allocating more buses on various routes by bus controller.
- e) Predict Job opportunities in Computer /IT field looking into the work generated last year.
- f) Design a data mart or data warehouse for any organization.

13. SUGGESTED LEARNING RESOURCES

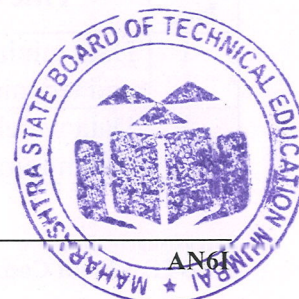
S. No.	Title of Book	Author	Publication
1	Data mining concepts and techniques	Han, Jiawei and Micheline Kamber.	Morgan Kaufmann Publications Elsevier, 2012, ISBN: 978-0123814791
2	Data warehousing, data mining and OLAP	Berson, Alex	McGraw Hill New Delhi 2008. ISBN-13: 978-0070062726



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

14. SOFTWARE/LEARNING WEBSITES

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



Program Name : Diploma in Artificial Intelligence and Machine Learning
Program Code : AN
Semester : Sixth
Course Title : Advanced Algorithms in AI & ML
Course Code : 22683

1. RATIONALE

Machine Learning is a branch of Computer Science that uses algorithms to imitate the way in which humans learn. It uses statistical methods to train algorithms and make predictions. Machine learning is one of the most in-demand Data Science skills, which allows data scientists to increase the accuracy of predictions of software applications, without explicitly programming them to do so. These algorithms make use of historical data to predict output values and these insights and predictions enable businesses to make smart decisions

2. COMPETENCY

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

- **Implement AI-ML algorithm using Python.**

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:

- Implement preprocessing steps on data to make it ready for analysis
- Implement Naive Bayes and Random Forest algorithm.
- Describe Support Vector Machines and K Nearest Neighbors.
- Apply clustering algorithm and Dimensionality Reduction.
- Describe ANN and basic hyper parameters of Deep Learning.
- Classify Sequential and Image Data of Deep Learning.

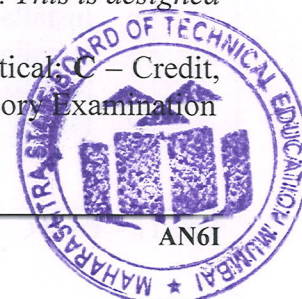
4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)				Examination Scheme												
				Theory						Practical						
L	T	P	Credits (L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	0	2	5	3	70	28	30*	0	100	40	25@	10	25	10	50	20

(**) marks should be awarded on the basis of internal end semester theory exam of 50 marks based on the specification table given in S. No. 9.

(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment, ‘#’: No Theory Examination



5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.

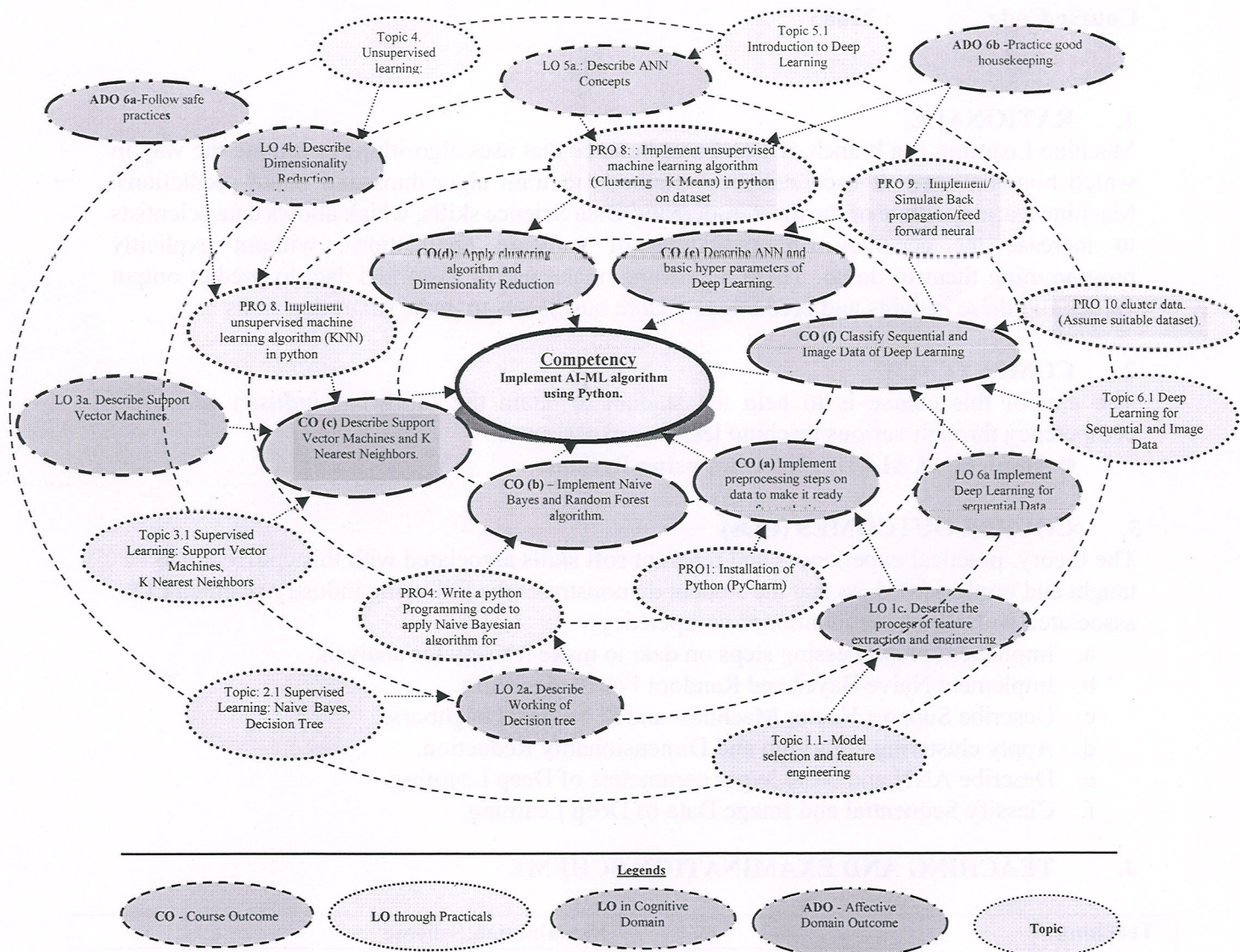


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotor domain LOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No.	Practical Exercises (Learning Outcomes to be achieved through practicals)	Unit No.	Approx. Hrs. Required
1	a. Installation of Python (PyCharm) b. Installation of Python scikit learn for ML c. Installation of Tools and Libraries (Jupyter Notebook/Matplotlib/Numpy/Pandas) d. Use of google colab (https://colab.research.google.com/)	I	

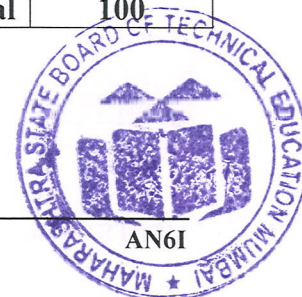
Sr. No.	Practical Exercises (Learning Outcomes to be achieved through practicals)	Unit No.	Approx. Hrs. Required
2	Study Different datasets such as Iris dataset ,Titanic dataset,Imdb Movies dataset	I	02
3	Perform following operations :(Assume suitable data/dataset if needed). a. Write program to read dataset (Text,CSV,JSON,XML) b. Which of the attributes are numeric and which are categorical? c. Performing Data Cleaning, Handling Missing Data, Removing Null data d. Rescaling Data v. Encoding Data e. Feature Selection	I	04*
4	Write a python Programming code to apply Naive Bayesian algorithm for classification using suitable data/dataset	II	04*
5	Write a python Programming code to implement decision tree for classification using suitable data/dataset.	II	02*
6	Implement the Random Forest Algorithm using following Steps a. Data Preprocessing Step b. Fitting the Random Forest Algorithm to the Training Set c. Predicting the Test Set Result d. Creating the confusion Matrix e. Visualizing the training set result f. Visualizing the test set result	II	04
7	Implement unsupervised machine learning algorithm (KNN) in python on dataset to cluster data. (Assume suitable dataset)	III	02
8	Implement unsupervised machine learning algorithm (Clustering – K Means) in python on dataset to cluster data. (Assume suitable dataset).	IV	04*
9	Implement/Simulate Back propagation/feed forward neural network.	V	04
10	Study of Classification of Dog images and Cat images categories using suitable dataset (foe ex imagenet dataset)	VI	04
Total			32

*: compulsory practicals to be performed.

Note

- Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.
- Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:

S.No.	Performance Indicators	Weightage in %
1	Import packages and Libraries of Python.	20
2	Use Python to create, edit, assemble and link the programs.	40
3	Debug, test and execute the programs	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
Total		100



Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Handle command prompt environment.
- Experiment with Python
- Plan, develop, assemble, link, debug and test the programs.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

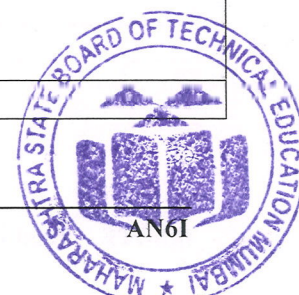
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. Sr. No.
1	Hardware: Personal computer, (i3 preferable), RAM minimum 4 GB onwards.	For all Experiments
2	Operating system: Windows 7 onward	
3	Libraries of Python	

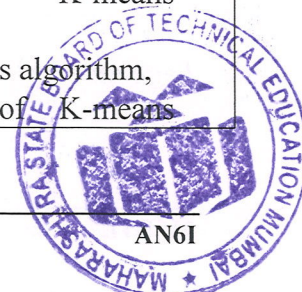
8. UNDERPINNING THEORY COMPONENTS

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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit I Model selection and feature engineering	1a. Select a suitable model for the given data with justification. 1b. Describe the process of using supervised learning on the given data. 1c. Describe the process of feature extraction and engineering on the given data. 1d. Compare Feature Engineering for the given type of data. 1e. Select feature scaling, feature selection, dimensionality reduction in the given situation with justification.	1.1. Introduction: Selecting a model 1.2. Training a model for supervised learning Features – understand your data better, Feature extraction and engineering, 1.3. Feature engineering on – numerical data & categorical data & text data 1.4. Feature scaling, Feature selection
Unit-II	2a. Classify the given data	2.1 Naive Bayes



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Supervised Learning: Naive Bayes, Decision Tree	using Bayesian method with stepwise justification. 2b. Describe Working of Decision tree algorithm 2c. Enlist application of Random Forest Algorithm.	<ul style="list-style-type: none"> • Bayes Theorem, Working of Naive Bayes • Bayes classifier, Applying Bayes Theorem, • Advantages and Disadvantages of Naive Bayes classifier, • Application of Naive Bayes, • Implementation of Naive Bayes classifier 2.2 Decision Tree <ul style="list-style-type: none"> • Decision Tree Diagram, Why Used decision tree? • Working of Decision tree algorithm, attributes selection Measures (ASM), • Advantages and Disadvantages of Decision tree, • Implementation of Decision Tree 2.3 Random Forest <ul style="list-style-type: none"> • Why use Random Forest? • Working of Random Forest Algorithm, • Application of Random Forest Algorithm, • Advantages and Disadvantages of Random Forest algorithm, • Implementation of Random Forest algorithm
Unit-III Supervised Learning: Support Vector Machines, K Nearest Neighbors	3a. Describe Support Vector Machines. 3b. Enlist advantages and disadvantages of KNN algorithm.	3.1 Support Vector Machines: <ul style="list-style-type: none"> • Types of SVM, • How does SVM work? • Advantages and Disadvantages of Decision tree, • Implementation of SVM 3.2 K Nearest Neighbors: <ul style="list-style-type: none"> • Need of KNN algorithm, • Working of KNN Algorithm, • Advantages and Disadvantages of KNN algorithm, • Implementation of KNN algorithm
Unit- IV Unsupervised learning: Clustering Algorithms	4a. Describe the performance analysis of clustering for the given situation. 4b. Describe Dimensionality Reduction	4.1 K-Means Clustering: <ul style="list-style-type: none"> • What is K-means Clustering? • Working of K-means Algorithm, • Failure of K-means algorithm, • Implementation of K-means



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		algorithm 4.2 Dimensionality Reduction: <ul style="list-style-type: none"> • Introduction to Dimensionality Reduction, Subset Selection, • Introduction to Principal Component Analysis.
Unit V Introduction to Deep Learning	5a. Describe ANN Concepts 5b. Learn Hyper parameter basics.	5.1 Introduction <ul style="list-style-type: none"> • Artificial Neural Network, • Perceptron EX-OR problem, • Feed Forward and Back Propagation, Losses • Activation Function, GPU Training 5.2 Basics Hyper parameter <ul style="list-style-type: none"> • Selecting number of Neurons, • Activation Functions, • Layers using Greedy Search and Random Access
Unit VI Deep Learning for Sequential and Image Data	6a. Implement Deep Learning for sequential Data 6b. Implement Deep Learning for Image Data	6.1 Sequential Data: <ul style="list-style-type: none"> • RNN, LSTM, LSTM-GRU, • Introduction to Transformers, GPT 6.2 Image Data : <ul style="list-style-type: none"> • CNN, (Resnet , VGG) Pre-trained • Neural Networks, Transfer Learning, • Fine Tuning

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) 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	Model selection and feature engineering	06	4	4	--	08
II	Supervised Learning: Naive Bayes, Decision Tree	08	4	4	6	14
III	Supervised Learning: Support Vector Machines, K Nearest Neighbors	10	2	4	6	12
IV	Unsupervised learning: Clustering Algorithms	10	2	4	6	12
V	Introduction to Deep Learning	08	2	4	6	12
VI	Deep Learning for Sequential and Image Data	06	2	6	4	12
Total		48	16	26	28	70

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



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

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

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:

- Prepare journals based on practical performed in laboratory.
- Library/E-Book survey regarding Advanced Algorithm in AI & ML used in Computer industries.
- Prepare power point presentation for showing different types of Advanced Algorithm in AI & ML Applications.

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:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '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.
- 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 LOs/COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- No. of practical's selection to be performed should cover all units.

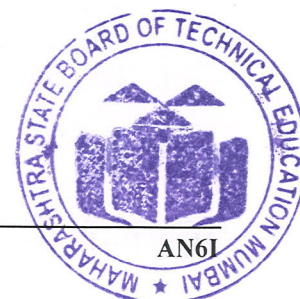
12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should 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.

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

- Credit Card Fraud Detection Using Classification Algorithm
- Anomaly detection Using KNN Machine learning
- Image Classification using Support Vector machine
- Classification based on Decision Tree
- Application of SVM algorithm for Cancer detection

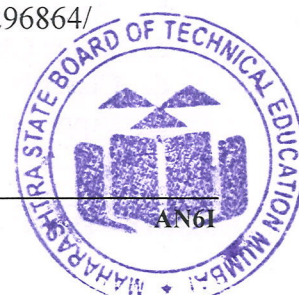


13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Introduction to Machine Learning with Python	Andreas C. Müller & Sarah Guido	O'Reilly Media, Inc
2	Machine Learning in Action	Peter Harrington,	DreamTech, First Edition, 2012 13: 978- 1617290183
3	Machine Learning	Tom M Mitchell,	McGraw Hill, First edition, 1997 13: 978- 0070428072
4	Machine Learning Step-by-Step Guide To Implement Machine Learning Algorithms with Python	Rudolph Russell	CreateSpace Independent
5	Mastering Machine Learning with Python in Six Steps A Practical Implementation Guide to Predictive Data Analytics Using Python	Manohar Swamynathan	Apress Publication ISBN-13 (pbk): 978-1-4842-2865-4
6	Practical Machine Learning with Python A Problem-Solver's Guide to Building Real-World Intelligent Systems	Dipanjan Sarkar, Raghav Bali, Tushar Sharma	Apress publication ISBN-13 (pbk): 978-1-4842-3206-4 ISBN-13 (electronic): 978-1-4842-3207-1
7	Machine Learning using Python	Manaramjan Pradhan, U Dinesh Kumar	Wiley India ISBN: 978-81-265-7990-7
8	Deep Learning with Python	FRANÇOIS CHOLLET	Manning Publications ISBN 9781617294433
9	Python Deep Learning Second Edition	Ivan Vasilev, Daniel Slater	Packt Publishing ISBN 978-1-78934-846-0

14. SOFTWARE/LEARNING WEBSITES

- <https://www.pdfdrive.com/machine-learning-for-absolute-beginners-e188007429.html>
- <https://www.geeksforgeeks.org/ml-fuzzy-clustering/>
- <https://www.pdfdrive.com/machine-learning-step-by-step-guide-to-implement-machine-learning-algorithms-with-python-d158324853.html>
- <https://www.pdfdrive.com/machine-learning-for-absolute-beginners-e188007429.html>
- <https://www.geeksforgeeks.org/ml-fuzzy-clustering/>
- <https://www.pdfdrive.com/machine-learning-step-by-step-guide-to-implement-machine-learning-algorithms-with-python-d158324853.html>
- <https://machinelearningmastery.com/classification-as-conditional-probability-and-the-naive-bayes-algorithm/> (Practical)
- [https://www.geeksforgeeks.org/naive-bayes-classifiers/\(Practical\)](https://www.geeksforgeeks.org/naive-bayes-classifiers/(Practical))
- <https://www.javatpoint.com/machine-learning-naive-bayes-classifier> (Practical)
- <https://www.javatpoint.com/machine-learning-random-forest-algorithm> (Random Forest)
- <https://learning.oreilly.com/library/view/deep-learning-with/9781617296864/>
- <https://www.deeplearningbook.org/>



Program Name : Diploma in Artificial Intelligence and Machine Learning/
Diploma in Cloud Computing and Big Data

Program Code : AN/BD

Semester : Sixth

Course Title : Big Data Analytics

Course Code : 22684

1. RATIONALE

Data analytics techniques enable a business to take raw data and uncover patterns to extract valuable insights. Data analysis helps companies make informed decisions, create a more effective marketing strategy, improve customer experience and streamline operations.

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 Big data analytic technologies to process large amount of heterogeneous raw data to retrieve information.

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:

- Describe Big data and Big Data Analytics.
- Apply the Big data Analytics procedure to work on datasets.
- Describe Hadoop Distributed File System.
- Analyze structured data using HIVE.
- Analyze structured, semi structured and unstructured data using SPARK.

4. TEACHING AND EXAMINATION SCHEME

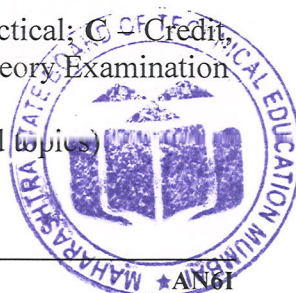
Teaching Scheme (In Hours)			Credits (L+T+P)	Paper Hrs.	Examination Scheme											
					Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	0	2	5	3	70	28	30*	0	100	40	25@	10	25	10	50	20

(**) marks should be awarded on the basis of internal end semester theory exam of 50 marks based on the specification table given in S. No. 9.

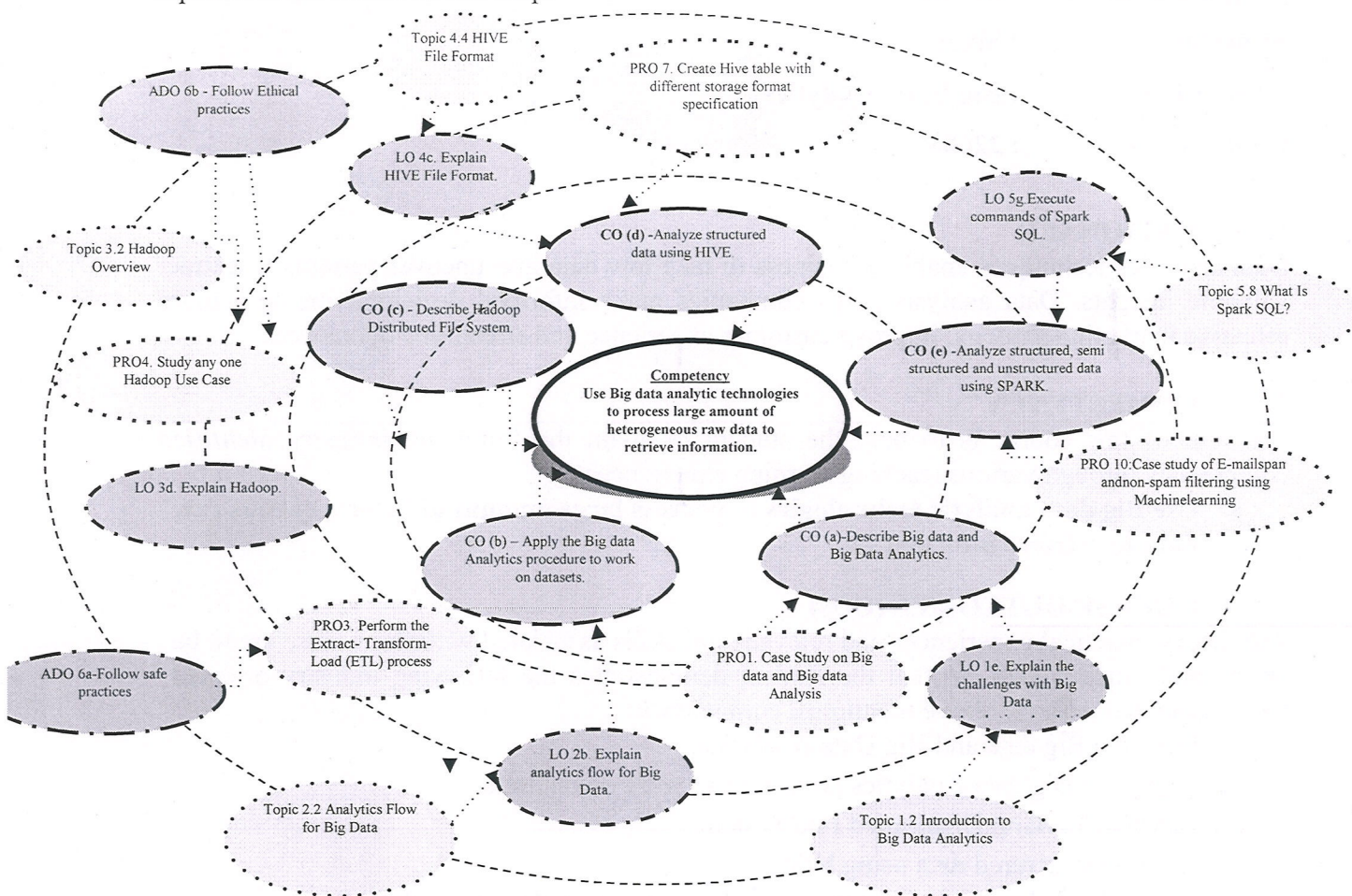
(~2): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit; ESE -End Semester Examination; PA - Progressive Assessment, ‘#’: No Theory Examination

5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs 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.



Legends

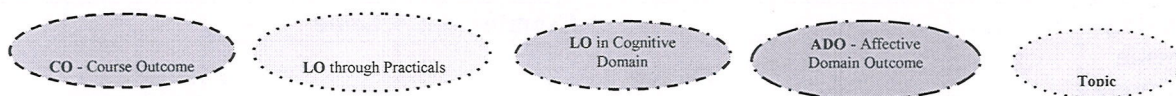


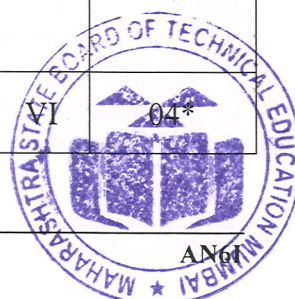
Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotor domain LOs (i.e. sub-components of the COs) are to be developed and assessed in the student to lead to the attainment of the competency.

Sr. No.	Practical Exercises (Learning Outcomes to be achieved through practical)	Unit No.	Approx. Hrs. Required
1.	Case Study on Big data and Big data Analysis. (Walmart, Uber Netflix, eBay etc.)	I	02*

Sr. No.	Practical Exercises (Learning Outcomes to be achieved through practical)	Unit No.	Approx. Hrs. Required
2.	Write a Pandas program a. To import given excel data into a Pandas Dataframe. b. To get the data types of the given excel data fields. c. To read specific columns from a given excel file. d. To find the sum, mean, max, min value of a specific column of a given excel file. e. To import some excel data skipping some rows or columns. f. To select the specified columns and rows from a given data frame. g. To Delete Rows and Columns from DataFrame.	II	04*
3.	Perform the Extract- Transform-Load (ETL) process a. Import the functions and required modules b. Download the source file c. Extract the zip file d. Set the path for the target files e. Use the extract() function to extract data from multiple sources f. Transform the data as per the given requirement using transform() function g. Load the data into the target file h. Call the log function for each phase	II	04*
4.	Study any one Hadoop Use Case.	IV	02*
5.	Create Hive table: a. Create Hive External Table. b. Load data into Hive table. c. Create Hive Internal Table.	V	02*
6.	Load the data into Hive Table: a. Load data from Local file system b. Load data from Hdfs file system c. Copy data to Hive table Location d. Sqoop Hive import to import table data	V	04*
7.	Create Hive table with following storage format specification: a. Hive Text File Format b. Hive Sequence File Format c. Hive RC File Format d. Hive AVRO File Format e. Hive ORC File Format f. Hive Parquet File Format	V	02*
8.	Consider the sample logs.txt shown in figure. Write a	VI	04*

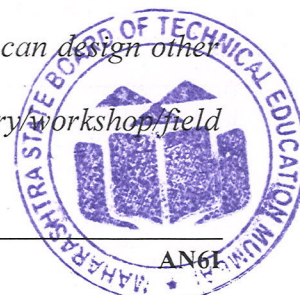


Sr. No.	Practical Exercises (Learning Outcomes to be achieved through practical)	Unit No.	Approx. Hrs. Required
	<p>Spark application to count the total number of WARN lines in the logs.txt file. (Implement using Scala / Python Programming)</p> <p><i>Sample logs.txt</i></p> <pre>WARN This is a warning message ERROR This is an error message WARN This is a warning message ERROR This is an error message ERROR This is an error message WARN This is a warning message WARN This is a warning message</pre>		
9.	<p>Implement using Scala / Python Programming:</p> <p>a. Create the following data as logdata.log with comma delimiters as shown.</p> <pre>10:24:25,10.192.123.23,http://www.google.com/searchString,ODC1 10:24:21,10.123.103.23,http://www.amazon.com,ODC1 10:24:21,10.112.123.23,http://www.amazon.com/Electronics,ODC1 10:24:21,10.124.123.24,http://www.amazon.com/Electronics/storagedevices,ODC1 10:24:22,10.122.123.23,http://www.gmail.com,ODC2 10:24:23,10.122.143.21,http://www.flipkart.com,ODC2 10:24:21,10.124.123.23,http://www.flipkart.com/offers,ODC1</pre> <p>The schema for these data is Time, IP Address, URL and Location</p> <p>b. Create a DataFrame of the created log file using spark.read.csv.</p>	VI	02*
10.	<p>Write and run SparkSQL queries programmatically for the following requirements. (Implement using Scala / Python Programming)</p> <p>a. How many people accessed the Flipkart domain in each location?</p> <p>b. Who accessed the Flipkart domain in each location?</p> <p>c. List their IpAddress.</p> <p>d. How many distinct Internet users are available in each location?</p> <p>e. List the unique locations available</p>	VI	04*
11.	<p>Read and Write data stored in Apache Hive through Spark SQL. (Implement using Scala / Python Programming)</p>	VI	02*
Total			32

*: compulsory practicals to be performed.

Note

- Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.
- Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:



Sr. No.	Performance Indicators	Weightage in %
1	Import packages and Libraries of Python / Scala /Hive / Spark.	20
2	Use Python / Scala /Hive / Spark to create, edit, assemble and link the programs.	40
3	Debug, test and execute the programs	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
Total		100

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Work with various libraries to handle data.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

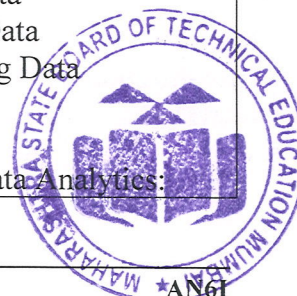
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Expt. S.No.
1.	Hardware: Personal computer, (i3 preferable), RAM minimum 4 GB onwards.	For all Experiments
2.	Operating system: Windows 10 onward	
3.	Software: Editor: Python setup	
	Apache Hadoop and Hive	Practical 5 to 11
4.	Software: Editor: Scala setup	Practical 8 to 11

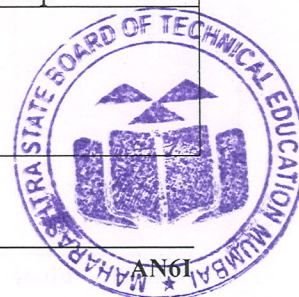
8. UNDERPINNING THEORY COMPONENTS

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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Big Data Analytics	1a. Describe the characteristics of data.	1.1 Introduction: <ul style="list-style-type: none"> Characteristics of Data Evolution of big data Definition of Big Data Challenges with Big Data What is Big Data Why Big Data 1.2 Introduction to Big Data Analytics:
	1b. Define Big Data. 1c. Explain the challenges with Big Data. 1d. Define Big Data Analytics. 1e. Explain the challenges with Big Data Analytics.	



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	1f. Explain Data Science. 1g. Write down responsibilities of a Data Scientist. 1h. Explain Terminologies Used in Big Data Environment.	<ul style="list-style-type: none"> What is Big Data Analytics Classification of Analytics Why is Big Data Analytics Important Data Science Responsibilities of a Data Scientist Terminologies Used in Big Data Environments
Unit-II Data Analytics Process	2a. Explain any one Domain specific example of Big Data. 2b. Explain analytics flow for Big Data. 2c. State different Big Data Stack. 2d. Describe mapping analytics flow to Big Data Stack. 2e. State different analytics patterns.	2.1 Domain Specific Examples of Big Data <ul style="list-style-type: none"> Web Financial Healthcare Internet of Things Environment Logistics & Transportation Industry Retail 2.2 Analytics Flow for Big Data <ul style="list-style-type: none"> Data Collection Data Preparation Analysis Types Analysis Modes Visualizations 2.3 Big Data Stack <ul style="list-style-type: none"> Raw Data Sources Data Access Connectors Data Storage Batch Analytics Real-time Analytics Interactive Querying Serving Databases, Web & Visualization Frameworks 2.4 Mapping Analytics Flow to Big Data Stack 2.5 Case Study: Genome Data Analysis 2.6 Case Study: Weather Data Analysis 2.7 Analytics Patterns
Unit-III The Big Data Technology: Hadoop	3a. State the features of Hadoop. 3b. Enlist key advantages of Hadoop. 3c. Compare RDBMS versus Hadoop. 3d. Explain Hadoop. 3e. Describe HDFS.	3.1 Introduction to Hadoop: <ul style="list-style-type: none"> Features of Hadoop Key Advantages of Hadoop Why Hadoop RDBMS versus Hadoop 3.2 Hadoop Overview 3.3 Use Case of Hadoop 3.4 HDFS 3.5 Processing Data with Hadoop
Unit-IV Introduction to HIVE	4a. State the use of HIVE. 4b. Describe HIVE Architecture. 4c. Explain HIVE File Format. 4d. Execute HIVE Query	4.1 What is HIVE? 4.2 HIVE Architecture 4.3. HIVE Data Types 4.4 HIVE File Format



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	Language commands. 4e. Explain SERDE. 4f. Describe User Defined Functions.	4.5 HIVE Query Language 4.6 RCFile Implementation 4.7 SERDE 4.8 User Defined Functions
Unit-V Introduction to SPARK	5a. State the use of Apache Spark. 5b. Compare Spark and Hadoop MapReduce. 5c. Describe Apache Spark Architecture. 5d. State the Spark Components. 5e. Define RDD. 5f. State the RDD Operations. 5g. Execute commands of Spark SQL. 5h. Describe DataFrame Operations. 5i. Describe Generic Load and Save Functions. 5j. Write a code for Building Spark SQL Application with SBT. 5k. Explain Spark Real-Time Use Case.	5.1 What Is Apache Spark? 5.2 Why Apache Spark? 5.3 Spark vs. Hadoop MapReduce 5.4 Apache Spark Architecture 5.5 Spark Components 5.6 Spark Shell 5.7 Spark Core: RDD <ul style="list-style-type: none"> • RDD Operations • Creating an RDD 5.8 What Is Spark SQL? 5.9 Spark Session 5.10 Creating DataFrames <ul style="list-style-type: none"> • DataFrame Operations • Dataset Operations 5.11 Different Data Sources: Generic Load and Save Functions 5.12 Building Spark SQL Application with SBT 5.13 Spark Real-Time Use Case <ul style="list-style-type: none"> • Data Analytics Project Architecture • Use Cases

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

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

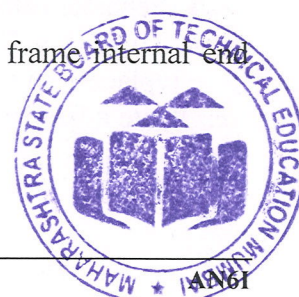
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Big Data Analytics	08	08	04	-	12
II	Data Analytics Process	10	06	06	02	14
III	The Big Data Technology: Hadoop	08	06	06	02	14
IV	Introduction to HIVE	10	02	06	06	14
V	Introduction to SPARK	12	06	04	06	16
Total		48	28	26	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 LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

10. SUGGESTED STUDENT ACTIVITIES



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

- a. Prepare journals based on practical performed in laboratory.
- b. Library/E-Book survey regarding assembly language programming used in Computer industries.
- c. Prepare power point presentation for showing different types of Assembly language Programming Applications.

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 LOs/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. No. of practical's selection to be performed should cover all units.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Study of Hadoop in the Financial Sector/ Healthcare Sector/ Retail Sector/for Telecom Industry/for Building Recommendation System.
- b. Load the data set and store it in a data-frame using Pandas and perform following operations.
 - Remove the missing data using List-wise deletion Remove the missing data using Pair-wise deletion
 - Remove the missing data using Forward filling
 - Check for duplicate value
 - Separate categorical and numerical data.
 - To work with Missing values using functions {isnull(), notnull(), dropna(), fillna(), replace(), interpolate()}.
- c. Write a Pandas program
 - To join the two given dataframes along columns.



- To join the two given dataframes along rows and merge with another dataframe along the common column.
 - To join the two dataframes using the common column of both dataframes.
- d. Create Hive table, load data into Hive table and Execute following Hive built-in functions
on given Hive Table (Simple Functions, Aggregate Functions, Date Function).
- e. Create an RDD:
- Use the parallelize method of SparkContext. Create Array of integers and pass that as an argument to the parallelize method.
 - Using an external data source.
 - Using an external datasource HDFS
 - Create an RDD of a numeric list. Then apply map(func) to multiply each element by 2.
- f. Implement Matrix algorithms in SparkSql programming.
- g. Perform Untyped Dataframe operations of SparkSQL (Select, Filter and Aggregate Operations) on a given dataset.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Big Data And Analytics Second Edition	Seema Acharya Subhashini Chellappan	Wiley India ISBN: 978-81-265-7951-8 ISBN: 978-81-265-8836-7(ebk)
2	Big Data Science & Analytics A Hands-On Approach	Arshdeep Bahga Vijay Madiseti	ISBN: 978-1-949978-00-1
3	Data Analytics Using Python First Edition	Bharti Motwani	Wiley India ISBN: 978-81-265-0295-0 ISBN: 978-81-265-8965-4(ebk)
4	Practical Apache Spark - Using the Scala API	Subhashini Chellappan Dharanitharan Ganesan	Apress ISBN-13 (pbk): 978-1-4842-3651-2 ISBN-13 (electronic): 978-1-4842-3652-9

14. SOFTWARE/LEARNING WEBSITES

- a. <https://spark.apache.org/docs/latest/rdd-programmingguide.html> (For practicals on
- b. Spark) (As on 18 April 2023)
- c. <https://www.simplilearn.com/what-is-big-data-analytics-article> (As on 18 April 2023)
- d. <https://www.analyticsvidhya.com/blog/2021/06/implementing-python-to-learn-data-engineering-etl-process/> (As on 18 April 2023)

