Maharashtra State Board of Technical Education, Mumbai
Teaching and Examination Scheme for Post S.S.C. Diploma Courses

Program Name : Diploma in Electronics and Computer Engineering

Program Code : TE

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
									Theory							Practical						
				L	T	P		Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	Management	MAN	22509	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
2	Emerging Trends in Electronics	ETE	22636	3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--	100
3	Computer Network and Management	CNM	22685	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
Elective (Any One)																					
4	Network and Information Security	NIS	22620	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
	Optical networks and Satellite communication	ONS	22647	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
5	Entrepreneurship Development	EDE	22032	2	-	2	4	--	--	--	--	--	--	--	50@	20	50~	20	100	40	100
6	Capstone Project - Execution & Report Writing	CPE	22060	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100
7	Python Programming Practice	PPP	22089	2	-	2	4	--	--	--	--	--	--	--	25#	10	25~	10	50	20	50
	Total			16	-	12	28	--	280	--	120	--	400	--	175	--	175	--	350	--	750
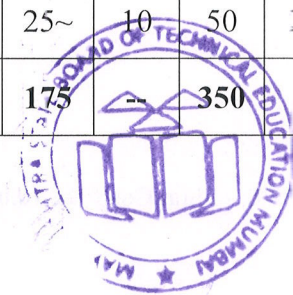
Student Contact Hours Per Week: **28 Hrs.**   Medium of Instruction: **English**

Theory and practical periods of 60 minutes each.   Total Marks : **750**

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 (5 marks each for Physics and Chemistry) 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.**
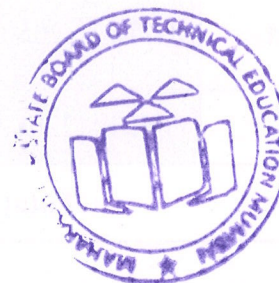
Program Name   : Diploma in Computer Engineering Group / Diploma in Mechanical / Chemical Engineering / Diploma in Electronics Engineering Group/ Diploma in Fashion & Clothing / Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics 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:

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

4.   TEACHING AND EXAMINATION SCHEME

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

@ : Internal examination
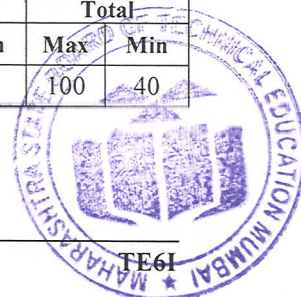
*(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 11) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*
Legends: L-*Lecture;* **T** – *Tutorial/Teacher Guided Theory Practice;* **P** - *Practical;* **C** – *Credit,* **ESE** - *End Semester Examination;* **PA** - *Progressive Assessment*

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

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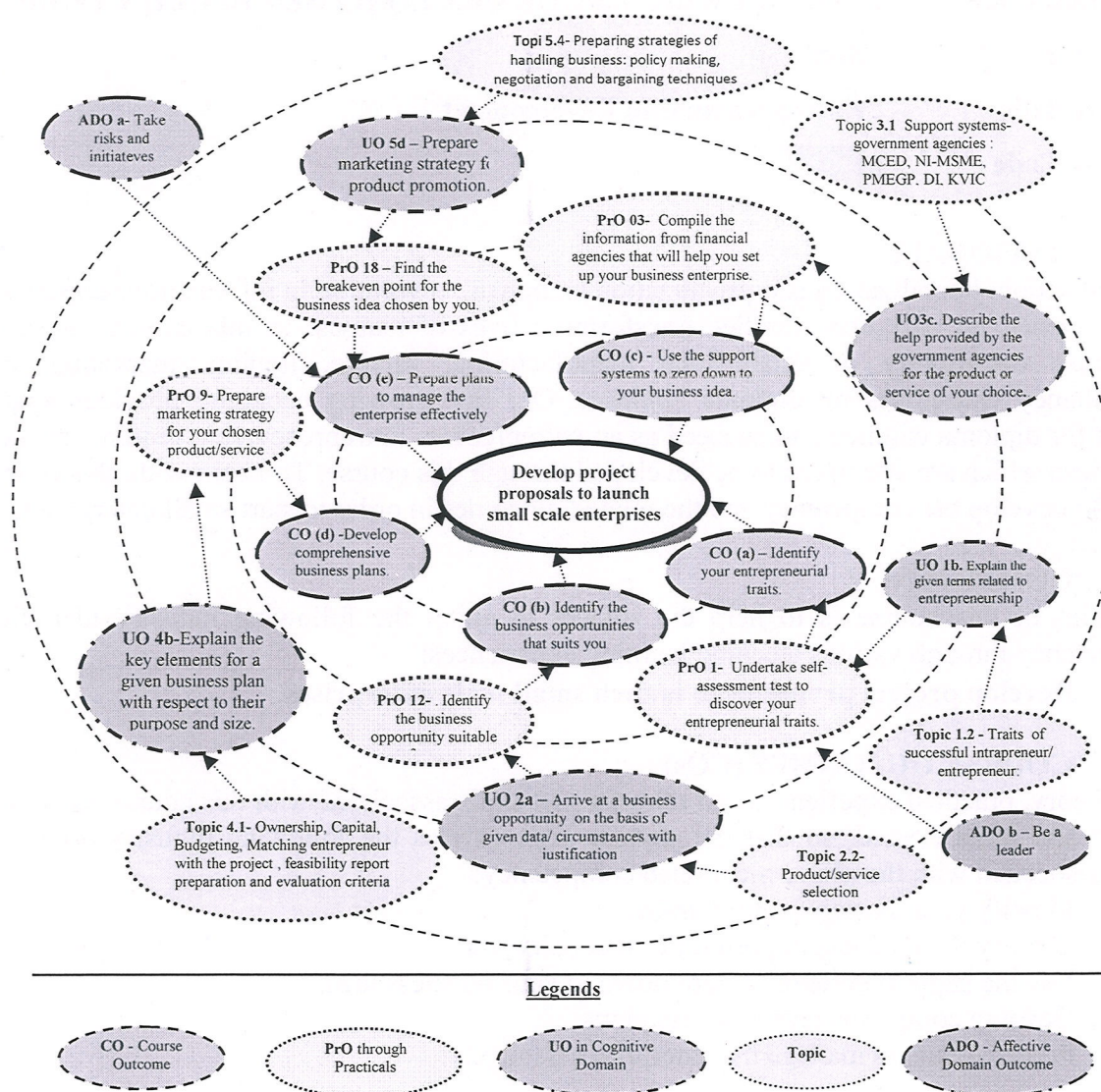

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Submit a profile summary(about500words) of a successful entrepreneur indicating milestone achievements.	I	02*
2	Undertake SWOT analysis to arrive at your business idea of a product/service.	I	02
3	Generate business ideas(product/service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02*
4	Undertake self-assessment test to discover your entrepreneurial traits.	II	02*
5	Identify the business opportunity suitable for you.	II	02
6	Arrange an exhibition cum sale of products prepared out of waste.	II	02
7	Survey industries of your stream, grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02*
8	Visit a bank/financial institution to enquire about various funding schemes for small scale enterprise.	III	02*
9	Collect loan application forms of nationalise banks/other financial institutions.	III	02*
10	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
11	Compile the information from the government agencies that will help you set up your business enterprise.	III	02*
12	Prepare Technological feasibility report of a chosen product/service.	III	02*
13	Prepare financial feasibility report of a chosen product/service.	III	02*
14	Craft a vision statement and enabling mission statements for your chosen enterprise.	III	02
15	Prepare a set of short term,medium and long term goals for starting a chosen small scale enterprise	III	02*
16	Prepare marketing strategy for your chosen product/service.	IV	02*
17	Compile information about various insurance schemes covering different risk factors.	IV	02
18	Organize a funfair of your class and write a report of profit/loss	V	02
19	Find the breakeven point for the business idea chosen by you.	V	02
20	Arrange a discussion session with your institute's pass out students who are successful entrepreneurs.	V	02
21	Prepare a business plan for your chosen small scale enterprise	V	02*
	Total		**42**

Note:

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*
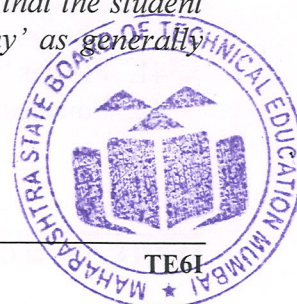
ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

Sample Products that can be manufactured under SME

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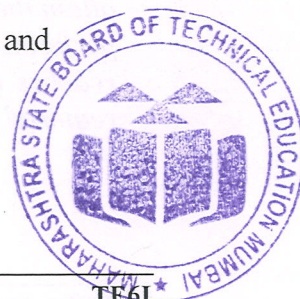
43. Safe meat and milk
44. Safety matches
45. Safety Pins (and other similar products like paper pins, staples pins etc.)
46. Shoe laces
47. Sign Boards painted
48. Soap Liquid
49. Spectacle frames
50. Steel Chair
51. Umbrellas
52. Utensils all types

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

S. No.	Performance Indicators	Weightage in %
1	Leadership skills	20
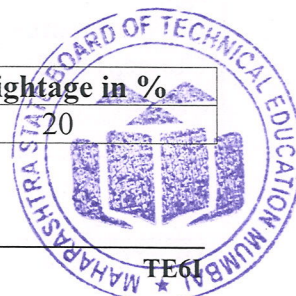
S. No.	Performance Indicators	Weightage in %
2	Team work	20
3	Lateral/creative thinking	10
4	Observations and recording	10
5	Self learning	20
6	Answer the sample questions	10
7	Submission of report in time	10
	Total	**100**

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

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

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

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.
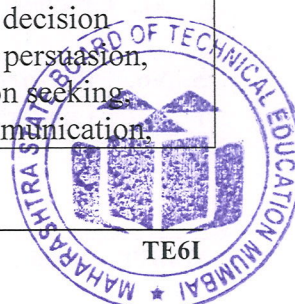
7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

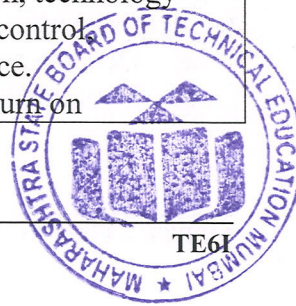| S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table,chairs and multimedia facilities	All
2	Modern desktop Computer with internet connection.	All

8.   UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (In cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept and Scope	1a. Describe the procedure to evaluate your entrepreneurial traits as a career option for the given product to be manufactured or services to be rendered.	1.1 Entrepreneurship as a career 1.2 Traits of successful intrapreneur/ entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, 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 Instries Commission[KVIC]
Unit – III Support Systems	3a. Describe the support system required for the specified enterprise. 3b. Describe the help provided by the government agencies for the specified product/service. 3c. Describe the help provided by the non-governmental agencies for the specified	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:

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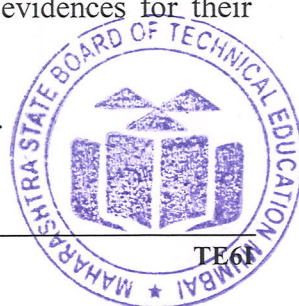
c. Prepare a collage for 'Traits of successful entrepreneurs'.
d. Invite entrepreneurs, industry officials, bankers for interaction.
e. Identify your hobbies and interests and convert them into business idea.
f. Convert you project work into business.
g. Choose a product and design a unique selling preposition,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

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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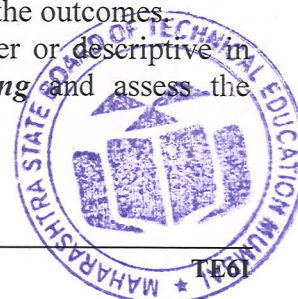
development of the COs/UOs through classroom presentations (see implementation guideline for details).

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

e. Use Flash/Animations to explain various maintenances techniques.

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

g. Instructors should emphasise more on deductive learning. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.

h. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.

i. They must be encouraged to surf on net and collect as much information as possible.

j. Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.

k. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.

l. Alumni should be frequently invited for experience sharing, guiding and rewarding students.

m. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

11. SUGGESTED MICRO-PROJECTS

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

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

12. SUGGESTED LEARNING RESOURCES

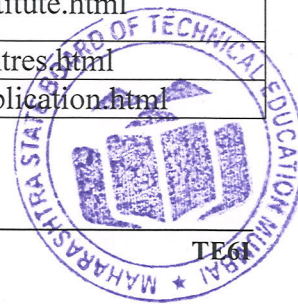| S. No.	Title of Books	Author	Publication
1	The Entrepreneurial Instinct : How Everyone Has the Innate Ability to Start a Successful Small Business	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich, R.	McGraw-Hill Education, New
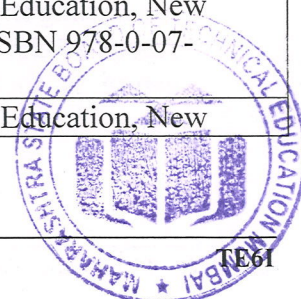
S. No.	Title of Books	Author	Publication
		D.	Delhi, 2013 ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen, S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029196 ..
4	Reading Material of Entrepreneurship Awareness Camp	Gujral, 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/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About - Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII - Centres	http://www.ediindia.org/centres.html
13	EDII - Publications	http://www.ediindia.org/publication.html

14	Business Plans: A Step-by-Step Guide	https://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.htm
16	NSTEDB - Training	http://www.nstedb.com/training/training.htm
17	Tata Exposures	http://www.tatasocial-in.com/project-exposure
18	Ministry Of Micro, Small And Medium EnterpriseS	http://www.dcmsme.gov.in/schemes/TEQUPDetail.htm
19	List of Business Ideas for Small Scale Industry	https://smallb.sidbi.in/%20/thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	https://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of services for Small Scale Industry	http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP
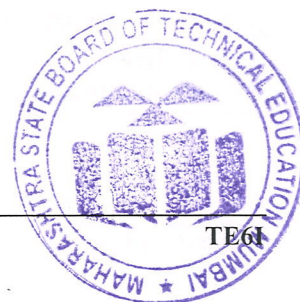
Program Name	: **All Branches of Diploma in Engineering and Technology/ / Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data**
Program Code	: **CE/CR/CS/CH/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE 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												
				Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			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
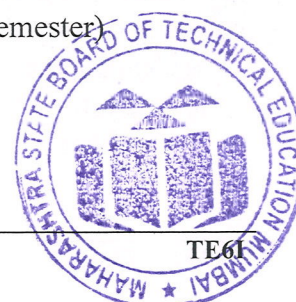
Chapters

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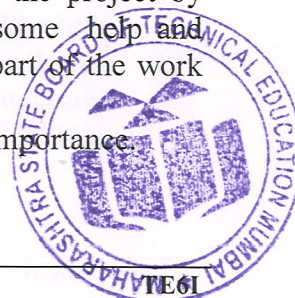
g) The Project Guide will assure the quality of project done by his group.

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

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

8. SPECIAL TEACHING STRETAGIES (If any)

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

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

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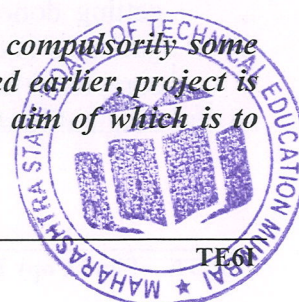
develop higher order cognitive skills and attitudes. Project at diploma level is not research or innovation. The main thing teachers have to ensure is that students choose a task or problem for their project work which is challenging but according to their capability i.e. a task which they can complete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

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

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

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

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

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

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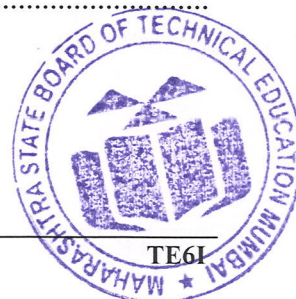
Appendix–A

CERTIFICATE

This is to certify that Mr./Ms..

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

has completed project of final year having title ....,....   during the

academic year20__-20__.   The project completed by individually/ in a group consisting

of........................ persons under the guidance of the Faculty Guide.

....

....

Name & Signature of Guide: ....

Telephone:...

<u>Appendix–B</u>

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) ....

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

Appendix–B

Suggested Rubric for Capstone Project – Execution and Report Writing

S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
1	**Problem/Task Identification (Project Title)**	Relate to very few POs Scope of Problem not clear at all	i. Related to some POs ii. Scope of Problem/Task vague	i. Take care of at-least Three POs ii. Scope of Problem/task not very specific	• Take care of more than three POs ii. Scope of problem/task very clear
2	**Literature Survey /Industrial Survey**	Not more than ten sources (primary and secondary), very old reference	At-least 10 relevant sources, at least 5 latest	At –least 15 relevant sources, most latest	About 20 relevant sources, most latest
3	**Project proposal**	Methods are not appropriate, All steps not mentioned, Design of prototype not started (if applicable).	Appropriate plan but not in much detail. Plan B for critical activities not mentioned. Time line is not developed. Design of Prototype is not complete. (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, but clarity is not there in methods, time line is given but not appropriate. Design of prototype is not detailed (if applicable)	Appropriate and detailed plan with Plan B for critical activities mentioned, clarity in methods with time line, Detailed design of prototype (if applicable)
4	**Project Diary**	Entries for most weeks are missing. There is no proper sequence and details are not correct.	Entries for some weeks are missing, details are not appropriate, not signed regularly by the guide.	Entries were made every week but are not in detail. Signed and approved by guide every week	Entries were made every week in detail, signed and approved by guide every week
5	**Final Report Preparation**	Very short, poor quality sketches, Details about methods, material, precaution and conclusions 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
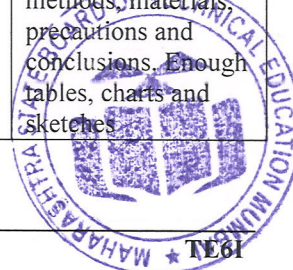
S. No.	Characteristic to be assessed	Poor	Average	Good	Excellent
		details are wrong			
6	Presentation	Major information is not included, information is not well organized .	Includes major information but not well organized and not presented well	Includes major information and well organized but not 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
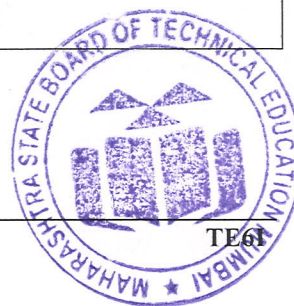
Program Name	: Diploma in Electronics and Computer Engineering
Program Code	: TE
Semester	: Sixth
Course Title	: Python Programming Practice
Course Code	: 22089

1.   RATIONALE

Python is a popular, general-purpose, high-level, interpreted, interactive, object-oriented, open-source programming language. Python code is simple, short, readable, intuitive, and powerful, and thus it is effective for computing and problem solving. The course starts with the basics of Python programming and deals with lists, dictionaries, functions, exceptions, files and all the necessary code elements to develop the code for solving the given problem. The course curriculum will enable the students to develop the application code using the concepts of Python.

2.   COMPETENCY

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

- **Develop code for given application using concept of 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:

a) Develop Python code to perform basic operations using Control Structures.
b) Perform Operations on Data Structures using Python.
c) Develop Functions, Modules, Packages for given problem using Python.
d) Develop Python code to demonstrate use of File I/O operations and Handle Exceptions.
e) Develop Application code for Arduino using Python.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
					Theory						Practical				
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	4	--	--	--	--	--	--	--	25#	10	25~	10	50	20

*(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assesment of practicals (seen in section 6) has a weightage of 60% (i.e. 15 marks) and microproject assesment (seen in section 12) has a weightage of 40% (i.e. 10 marks). This is designed to facilitate attainment of COs holistically , as there is no theory ESE.*
#:External Assesment
Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5.   COURSE MAP

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

| CO - Course Outcome | PrO through Practicals | UO in Cognitive Domain | ADO - Affective Domain Outcome | Topic |
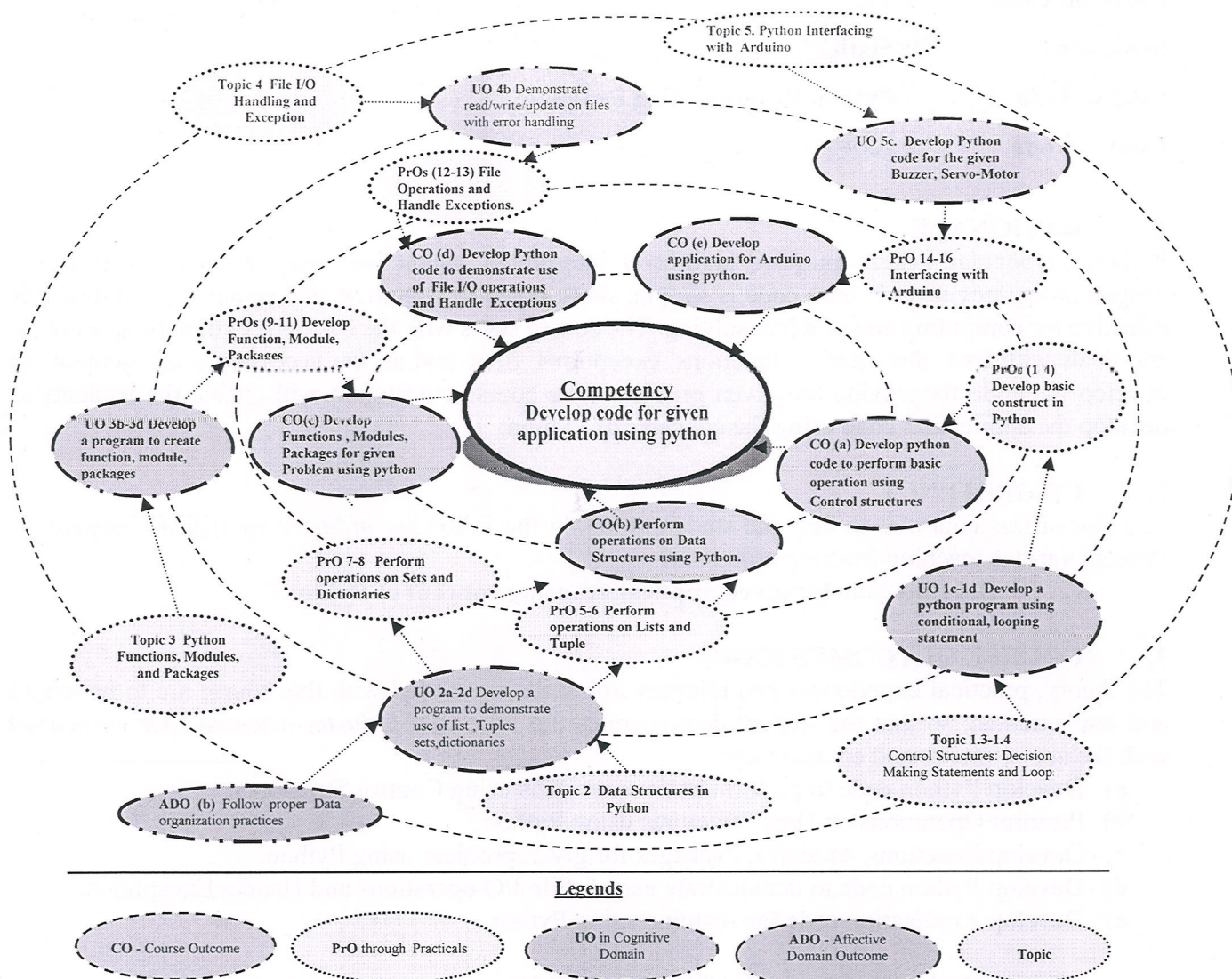
6.   SUGGESTED PRACTICALS

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	After installation of Python IDE, develop a program to display given message on screen (using interactive and script mode).	I	02*
2	Develop Python program to demonstrate use of following operators: a) Arithmetic Operators b) Logical Operators c) Bitwise Operators	I	02
3	Develop Python program to demonstrate use of conditional statements: a) 'if' statement b) 'if … else' statement	I	02*
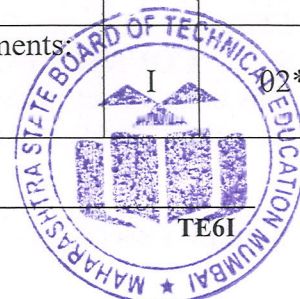
S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	c) 'if ....elif' statement / match case		
4	Develop Python program to demonstrate use of looping statements: a) 'while' loop b) 'for' loop c) Nested loops (pattern printing)	I	02
5	Develop Python program to perform following operations on Lists: a) Create list b) Access list c) Modify list (Add item, Change item, Remove item) d) Delete list	II	02*
6	Develop Python program to perform following operations on Tuples: a) Create Tuple b) Access Tuple c) Delete Tuple	II	02
7	Develop Python program to perform following operations on Set: a) Create Set, Access Set elements b) Modify Set c) Delete Set d) Operations like Union, Intersection, Difference etc.	II	02
8	Develop Python program to perform following operations on Dictionaries: a) Create Dictionary b) Access Dictionary elements c) Modify Dictionary d) Delete Dictionary	II	02*
9	Develop Python program to demonstrate : a) Use of Built- in functions (math, string). b) User defined functions.	III	02*
10	Develop Python program to demonstrate: a) Use of Built-in module (e.g. keyword, math, number, operator) b) User defined module.	III	02*
11	Develop Python program to demonstrate: a) Use of Built-in packages at least two (e.g. NumPy, Pandas Scipy, Seaborn, time, serial etc.) b) User defined packages	III	02*
12	Develop Python program to handle user defined exception for given problem.	IV	02
13	Develop Python program to perform File I/O operations.	IV	02*
14	Develop Python program to operate LED interfaced with Arduino	V	02*
15	Develop Python program to control Servo-motor interfaced with Arduino	V	02
16	Develop Python program to operate Buzzer interfaced with Arduino	V	02

Note:

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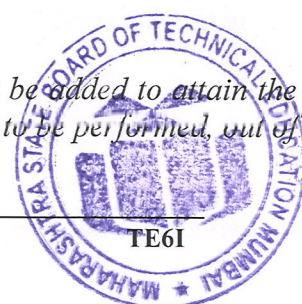
which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

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

S. No.	Performance Indicators	Weightage in %
a.	Building programming blocks	20
b.	Logic building ability	20
c.	Debugging ability	20
d.	Correctness of desired output	10
e.	Answer to sample questions	15
f.	Submit report in time	15
	Total	**100**

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

    a. Follow safety practices.
    b. Follow proper Data organization practices
    c. Demonstrate working as a leader/a team member.
    d. Follow Ethical Practices.

The ADOs are not specific to any one PRO, but are embedded in many PROs. Hence the acquisition of ADOs takes place gradually in the student as s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievemnet 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 practicals, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Personal Computer System (i3 series /AMD Ryzen3 equal to or higher series), 8GB RAM , 512 GB SSD/HDD), LCD/LED Monitor or (Any Computer System with basic configuration) Internet Connectivity	All
2	Operating System: Windows 8/10/11 or above, Linux, MAC OS (any One)	
3	'Python' Interpreter/ IDE, Anaconada	
4	Arduino board with Arduino IDE, USB cable, LED, Servo-Motor, Buzzer	14-16

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.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Constructs in Python Programming	1a. Develop Python code to demonstrate use of variables, keywords, constants in Python. 1b. Develop Python code to use of basic Operators. 1c. Develop a python code using Conditional statement. 1d. Develop a python code using Looping statement.	1.1 Features of Python, Python environment setup-Installation and working of IDE, Interactive and Script mode, Python Data Types and uses, Indentation, Comments. 1.2 Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence 1.3 Conditional Statements (if, if … else, nested if) 1.4 Looping in python (while loop, for loop, nested loops), loop manipulation using continue, pass, break, else.
Unit-II Data Structures in Python	2a. Develop python program to use and manipulate Lists for the given problem 2b. Develop python program to use and manipulate Tuples for the given problem 2c. Develop python program to use and manipulate Sets for the given problem 2d. Develop python program to use and manipulate Dictionaries for the given problem	2.1 Lists: Defining lists, accessing values in list, deleting values in list, updating lists. List Indexing and Slicing, List build-in methods and functions. 2.2 Tuples: Creating tuples, Accessing values in Tuples, deleting values in Tuples, and updating Tuples. Basic Tuple operations. Built – in Tuple functions. 2.3 Sets: Accessing values in Set, deleting values in Set and updating Sets. Basic Set operations, Built – in Set functions. 2.4 Dictionaries: Accessing values in Dictionary, deleting values in Dictionary and updating Dictionary. Basic Dictionary operations, Built – in Dictionaries functions.
Unit-III Python Functions, modules, and Packages	3a. Use the Python standard functions for the given problem. 3b. Develop relevant user defined functions for the given problem using Python code. 3c. Develop Python module for the given problem 3d. Develop Python package for the given problem	3.1 Use of Python built – in functions (e.g. type/data conversion functions, math functions etc.) 3.2 User defined functions: Function definition, Function calling, function arguments and parameter passing, Return statement, Scope of Variables: Global variable and Local Variable. 3.3 Modules: Writing modules, importing modules, importing objects from modules, Python built – in modules (e.g. Numeric and mathematical module, Functional Programming Module) Namespace and Scoping. 3.4 Python Packages: Writing Python packages, Using standard (e.g. math, scipy, Numpy, matplotlib, pandas etc.) and user defined packages.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV File I/O Handling and Exception Handling	4a. Develop Python code to read different values from keyboard and display on terminal 4b. Develop Python code to read, write, update contents to the file. 4c. Develop Python code for the Handling the Exceptions.	4.1 I/O Operations: Reading keyboard input, Printing to screen 4.2 File Handling: Opening file in different modes, accessing file contents using standard library functions, Reading and writing files, closing a file, Renaming and deleting files, Directories in Python, File and directory related standard functions 4.3 Exception Handling: Introduction, 'try:except:' statement, 'raise' statement, User defined exceptions
Unit-V Python interfacing with Arduino	5a. Develop Python code to operate the LED for specific time interval 5b. Develop Python code to operate Buzzer, Servo-motor	5.1 Arduino Uno Board, installing Arduino IDE, Working with Arduino , Interfacing of various hardware components. 5.2 Arduino Programming: sketch 5.3 pySerial/pyfirmata for communication with Arduino.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	R Level	U Level	A Level	Total Marks
			Distribution of Theory Marks			
I	Basic Constructs in Python Programming	06				
II	Data Structures in Python	06				
III	Python Functions, Modules, and Packages	08	Not Applicable as No Theory ESE			
IV	File I/O handling and Exception Handling	06				
V	Python interfacing with Arduino	06				
	Total	32				

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

10.   SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
  a) Self prepared Quiz based on course unit contents
  b) Undertake the micro project.
  c) Participate/assist in organizing activities like Blind code Competition/ Code Debugging competition.
  d) Prepare chart/Poster to represent Python built-in functions, method(list, tuple, set, dictionary etc.), Python Libraries.
  e) Implement Problem Based Learning (PBL).

f) Design a game like Sudoku.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

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 related practical setup before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

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

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

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

a) Create an English dictionary which is able to perform following function.
    i)   Add a word and its meaning.
    ii) Delete a word and its meaning.
    iii) Update word or its meaning.
    iv) Print list of word and its meaning.
b) Develop student management system which will able to:
    i) Add ii) Delete iii) Update iv) Display student related information like Roll No, Name, Age, Address, Email-Id, Contact Number etc.
c) Develop Games using Python program like Tic-Tac-Toe Game, Sudoku Solver, Data Slicing, Number Guessing Game, Word Guessing Game, Alarm Clock, Calculator, Random Password Generator etc.
d) Develop Chatbot using Python program.
e) Develop Management System which will able to add, delete, update and display information i.e. Hotel Management System, Student Record System, Library Management System, Store Management System, Employee Management System
f) Design and Develop Arduino circuit interfacing with any type of sensor (Moisture, Temperature, Pressure, Light etc.) using Python.

g) Develop Arduino based application for Boiler System which maintains the Temperature in Industry.

h) Develop GUI Based Application using tkinter Library for Designing of Basic calculator using Button or Payroll Calculation using GUI or Form Generation or any similar type of form Designing)

i) Develop GUI Application with database connectivity for student record system or student feedback form and student feedback analysis or Consumer feedback system or similar type of applications)

(Student can Use functions, classes or any other features/library of 'Python' for microproject.)

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Python Programming	Rao, K. Nageswara Shaikh Akbar	Scitech Publications (India) Pvt. Ltd. ISBN: 9789385983450
2	Learning Python	Lutz, Mark	5th Edition, O'Reilly Publication ISBN-13: 978-1449355739
3	Python Essential Reference	Beazley, David	4th Edition, Addison-Wesley Professional, ISBN: 9780672329784
4	Python Programming for Arduino	Pratik Desai	PACKT Publishing Open Source, ISBN 978-1-78328-593-8
5	Head First Python	Paul, Barry	2nd Edition, O'Reilly Publication, ISBN: 1491919531
6	Python Crash Course, A Hands-On, Project-Based Introduction to Programming	Eric Matthes	3rd Edition, No Starch Press, Publication ISBN:978-1718502703

14.   SUGGESTED SOFTWARE WEBSITES

Following websites are suggested for Python Programming IDE. Any other equivalent open source software can be used if required.

Sr. No.	Keyword	QR Code	Website
1	Python IDE (for Windows)		https://www.python.org/downloads/
2	Python for MacOS		https://www.python.org/downloads/macos/
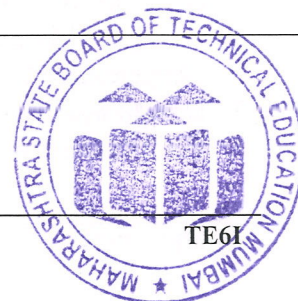
| Sr. No.	Keyword	QR Code	Website
3	Python online editor to execute python code		https://pynative.com/online-python-code-editor-to-execute-python-code/
4	Anaconda		https://www.anaconda.com/products/distribution

15. SUGGESTED ONLINE TEACHING/LEARNING RESOURCES

Following Learning websites are suggested to students to enhance their skills in specific learning domain. It helps student to visualize and demonstrate the concept easily using given online resources.

Sr. No.	Keyword	QR Code	WebLink
1	Python Tutorial		https://www.tutorialspoint.com/python/index.htm
2	Python-Programiz		https://www.programiz.com/python-programming
3	Python Tutorial		https://www.geeksforgeeks.org/python-programming-language/
4	Python Tutorial		https://www.w3schools.com/python/default.asp
5	Python Programming course		https://spoken-tutorial.org/
6	Python Exercise, Practice, solution		https://www.w3resource.com/python-exercises/
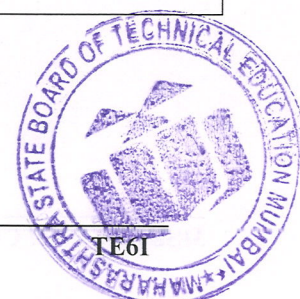
Sr. No.	Keyword	QR Code	WebLink
7	Python file I/O handling		https://www.javatpoint.com/python-files-io
8	Python Libraries		https://docs.python.org/3/library/
9	Python Programming by Dr. Rupesh Narse		https://ekumbh.aicte-india.org/userdiplomabook.php
10	Python Programming Lab		https://python-iitk.vlabs.ac.in/Objective.html
11	Python Crash Course by Eric Matthes		https://www.sarkarirush.com/python-crash-course-pdf/
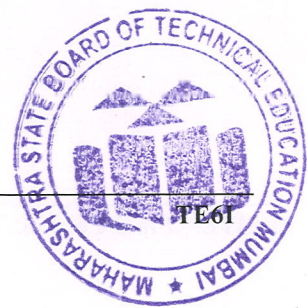
Program Name	: Diploma in Automobile Engineering / Civil Engineering Group / Electronics Engineering Group / Diploma in Plastic Engineering / Diploma in Production Engineering /Diploma in Fashion & Clothing Technology/ Computer Engineering Group Diploma in Artificial Intelligence and Machine Learning / 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:

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

4. TEACHING AND EXAMINATION SCHEME

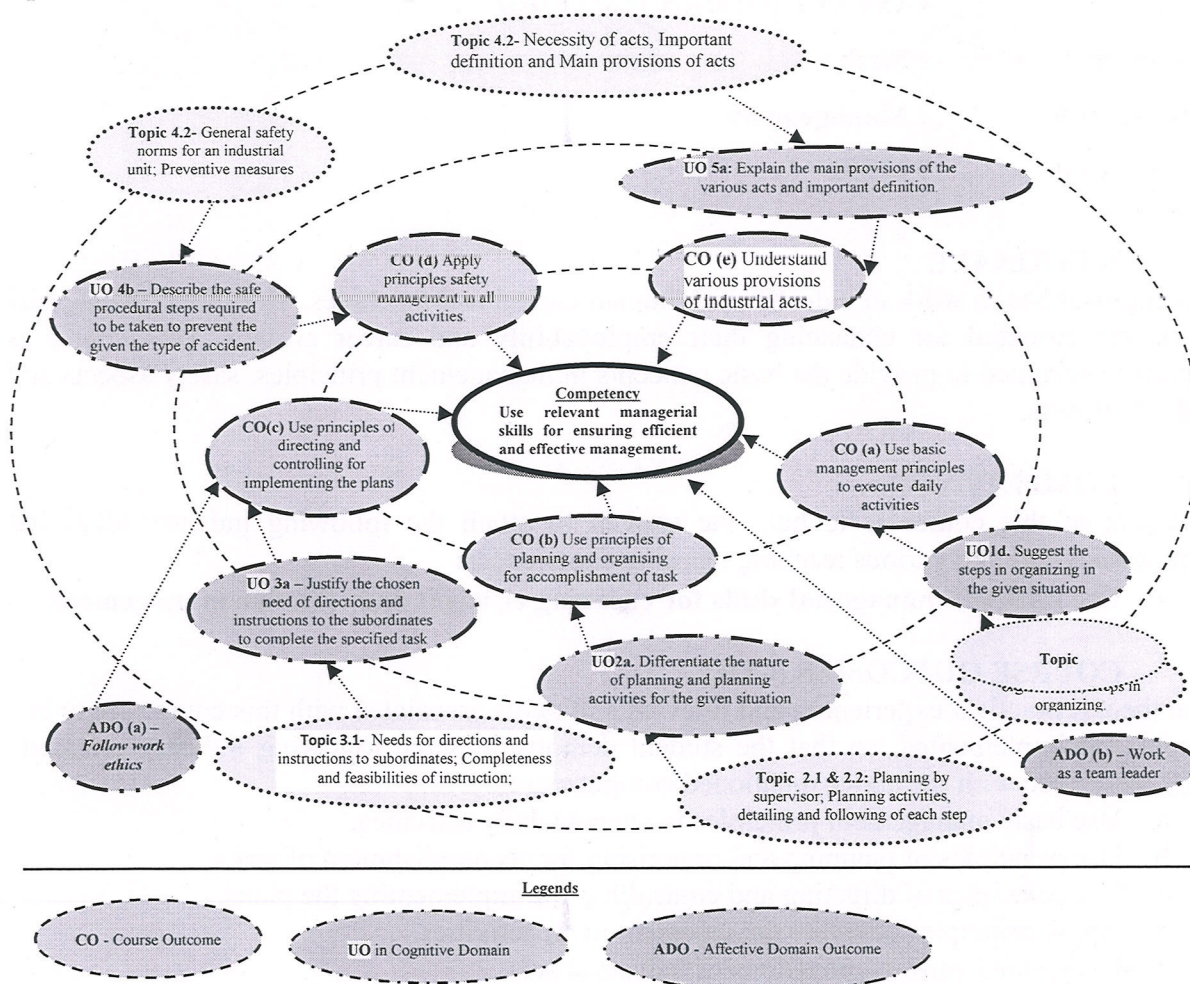| Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	90 Min	70*#	28	30*	00	100	40	--	--	--	--	--	--

(*#) Online Theory Examination.

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

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

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

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

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES
   -    Not applicable -

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED
   -    Not applicable -

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

| Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I **Introduction to management concepts and managerial skills**	1a. Differentiate the concept and principles of management for the given situation. 1b. Explain functions of management for given situation. 1c. Compare the features of the given types of planning 1d. Suggest the steps in organizing in the given situation. 1e. Suggest suitable type of organization for the given example. 1f. Identify the functional areas of management for the given situation 1g. Suggest suitable managerial skills for given situation with justification	1.1 Definitions of management, role and importance of management. 1.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 1.3 Functions of management: planning, organizing, leading/directing, staffing and controlling. 1.4 Types of planning and steps in planning 1.5 Types of organization, Steps in organizing 1.6 Functional areas of management. 1.7 Managerial skills.
Unit – II **Planning and organizing at supervisory level**	2a. Differentiate the nature of planning and planning activities for the given situation. 2b. Suggest the step wise procedure to complete the given activity in the shop floor. 2c. Prepare materials and manpower budget for the given production activity. 2d. Describe with block diagrams the organization of the physical resources required for the given situation. 2e. Describe the human needs to satisfy the job needs for the specified situation. 2f. List the tasks to be done by the concerned individuals for completing the given activity.	**Planning at supervisory level** 2.1 Planning by supervisor. 2.2 Planning activities, detailing and following of each step. 2.3 Prescribing standard forms for various activities. 2.4 Budgeting for materials and manpower. **Organizing at supervisory level** 2.5 Organizing the physical resources. 2.6 Matching human need with job needs. 2.7 Allotment of tasks to individuals and establishing relationship among persons working in a group
Unit– III **Directing and Controlling at supervisory level**	3a. Justify the chosen need of directions and instructions to the subordinates to complete the specified task. 3b. Select the feasible set of instructions to complete the given simple task, with justification 3c. Predict the possible mistakes for completing the given simple activity. 3d. Describe the managerial control 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
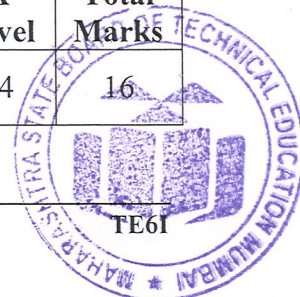
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
II	Planning and organizing at supervisory level	08	04	06	04	14
III	Directing and controlling at supervisory level	08	04	06	04	14
IV	Safety Management	08	04	06	04	14
V	Legislative Acts	12	02	06	04	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:

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

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

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

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

12.   SUGGESTED MICRO-PROJECTS

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

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

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

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

13.   SUGGESTED LEARNING RESOURCES

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

14.   SUGGESTED SOFTWARE/LEARNING WEBSITES
a. https://www.versesolutions.com/
b. https://www.books.google.co.in/books?isbn=817758412X
c. https://www. www.educba.com › Courses › Business › Management
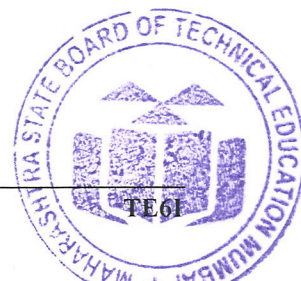
Program Name	: Computer Engineering Program Group/ Diploma in Artificial Intelligence and Machine Learning / Diploma in Computer Hardware & Maintenance / Diploma in Electronics and Computer Engineering / Diploma in Cloud Computing and Big Data
Program Code	: CO/CM/IF/CW/AN/BD/HA/TE
Semester	: Sixth
Course Title	: Network and Information Security (Elective)
Course Code	: 22620

1.   RATIONALE

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

2.   COMPETENCY

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

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

3.   COURSE OUTCOMES (COs)

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

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

4.   TEACHING AND EXAMINATION SCHEME

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

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

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

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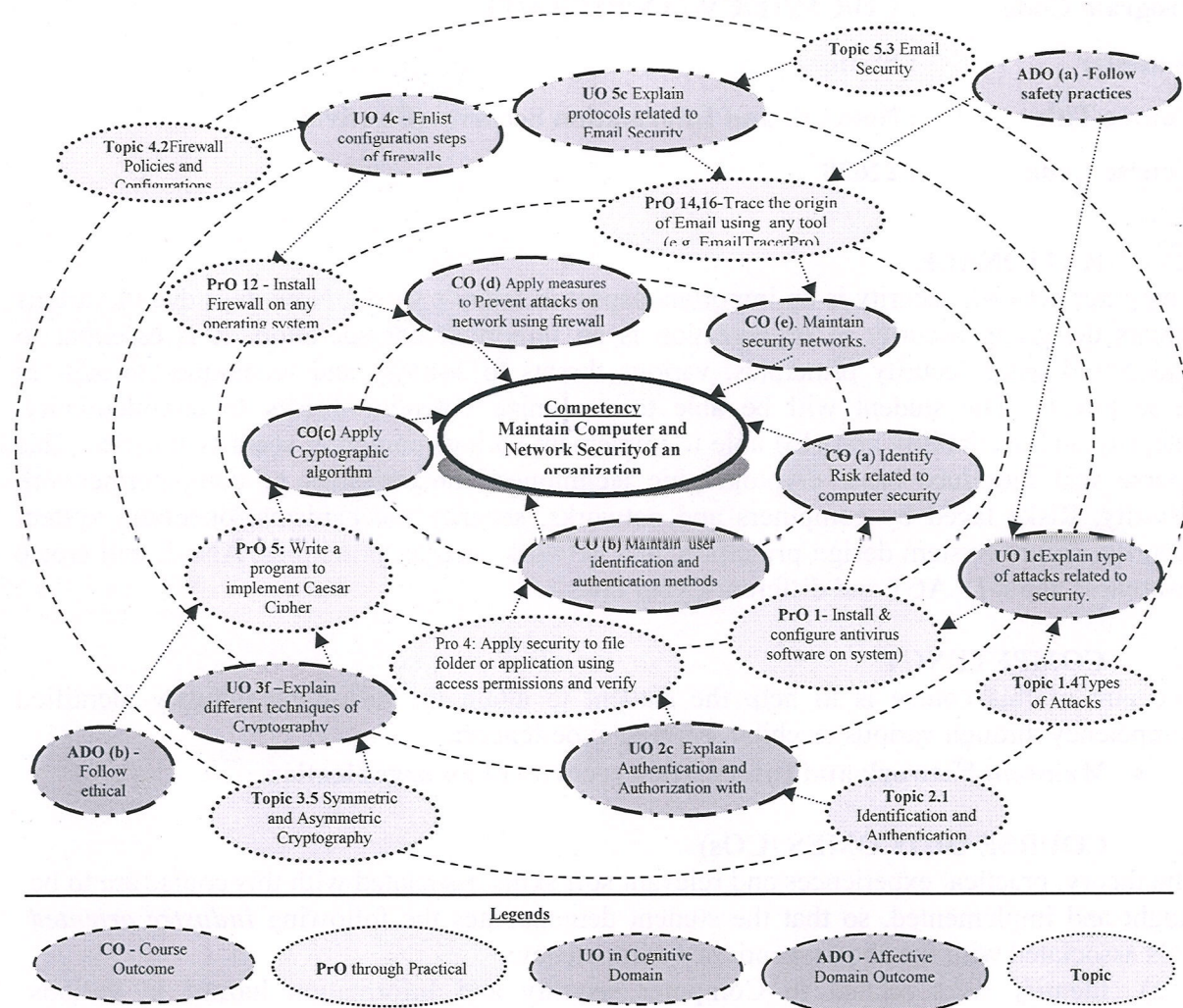

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

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

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

Note

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

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

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

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

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

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

   - 'Valuing Level' in 1st year
   - 'Organization Level' in 2nd year.
   - 'Characterization Level' in 3rd year.
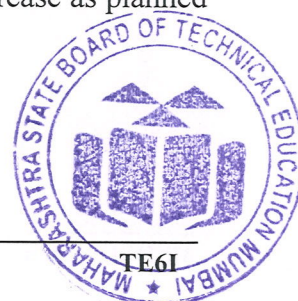
7.   MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

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

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

8.   UNDERPINNING THEORY COMPONENTS

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

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II User Authenticati on 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 Cryptograph y	3a. Encrypt/Decrypt the given text using different substitution techniques. 3b. Convert plain text to cipher text and vice versa using the given transposition technique. 3c. Convert the given message using steganography. 3d. Explain the given technique of cryptography using example.	3.1 Introduction: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption. 3.2 Substitution Techniques: Caesar's cipher, Modified Caesar's Cipher, Transposition Techniques: Simple Columnar Transposition. 3.3 Steganography : Procedure 3.4 Symmetric and Asymmetric cryptography: Introduction to Symmetric encryption, DES (Data encryption Standard) algorithm, Asymmetric key cryptography: Digital Signature.
Unit-IV Firewall and Intrusion Detection System	4a. Compare types of firewall on the given parameter(s). 4b. Explain function of the given type of firewall configuration. 4c. Compare various IDS techniques on the given parameter(s). 4d. Describe features of the given IDS technique.	4.1 Firewall : Need of Firewall, types of firewall- Packet Filters, Stateful Packet Filters, Application Gateways, Circuit gateways. 4.2 Firewall Policies, Configuration, limitations, DMZ. 4.3 Intrusion Detection System : Vulnerability Assessment, Misuse detection, Anomaly Detection, Network-Based IDS, Host-Based IDS, Honeypots
Unit –V Network Security, Cyber Laws and Compliance Standards.	5a. Explain the given component of Kerberos authentication protocol. 5b. Explain the given IP Security protocol with modes. 5c. Explain working of the given protocol for Email security. 5d. Describe the given component of Public Key Infrastructure. 5e. Classify the given Cyber crime.	5.1 Kerberos : Working, AS, TGS, SS 5.2 IP Security- Overview, Protocols- AH, ESP, Modes- transport and Tunnel. 5.3 Email security- SMTP, PEM, PGP. 5.4 Public key infrastructure (PKI): Introduction, Certificates, Certificate authority, Registration Authority, X.509/PKIX certificate format. 5.5 Cyber Crime: Introduction, Hacking , Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography , Identity Theft and Fraud , Cyber terrorism, Cyber Defamation. 5.6 Cyber Laws: Introduction, need,

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

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

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

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

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

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

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:
   a)   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
   b)   *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c)   About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the

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

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

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

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

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

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

12.   SUGGESTED MICRO-PROJECTS

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

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

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

a) Case Studies in Secure Computing: Achievements and Trends.

b) Implement Client/Server communication using cryptography tools in your laboratory.

c) Create digital certificate for your departmental/ personal communication.

d) Implement communication system using steganography. Encrypt image and message using any cryptography technique.

e) Implement communication system using steganography using audio files. Encrypt audiofile and message using any cryptography technique.

f) Implement Three Level Password Authentication System.

g) Any other micro-projects suggested by subject faculty on similar line.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Security	Dieter Gollmann	Wiley Publication, New Delhi, ISBN : 978-0-470-74115-3
2	Cryptography and Network Security	Atul Kahate	McGraw Hill Education, New Delhi ISBN: 978-1-25-902988-2
3	Cyber Laws And IT Protection	Harish Chander	PHI Publication,New Delhi, 2012 ISBN: 978-81-203-4570-6
4	Implementing Information Security based on ISO 27001 / ISO 27002 (Best Practice)	Alan Calder	Van Haren Publishing ISBN-13: 978-9087535414 ISBN-10: 9087535414
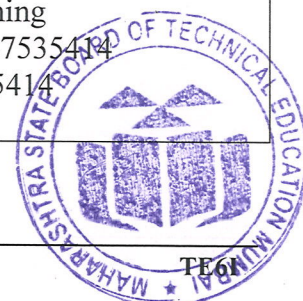
14.   **SOFTWARE/LEARNING WEBSITES**
  a)   http://nptel.ac.in/courses/106105162/
  b)   https://www.tutorialspoint.com//computer_security/computer_security_quick_guide.ht
        m
  c)   http://learnthat.com/introduction-to-network-security/
  d)   https://freevideolectures.com/course/3027/cryptography-and-network-security
  e)   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-
        computer-systems-security-fall-2014/video-lectures/
  f)   http://stylesuxx.github.io/steganography/
  g)   https://smartninja-pgp.appspot.com/
  h)   http://www.cyberlawsindia.net/cyber-india.html
  i)   https://www.upcounsel.com/cyber-law
  j)   http://cyberlaws.net/cyber-law/

Program Name	: Electronics Engineering Programme Group / Diploma in Electronics & Computer Engineering
Program Code	: DE/EJ/ET/EN/EX/EQ/IE/IS/IC/AO/TE
Semester	: Sixth
Course Title	: Emerging Trends in Electronics
Course Code	: 22636

1. RATIONALE

Every technological area is developing at an exponential rate. New applications are coming up and it is mandatory for all technologists to be well versed in these developments to survive and provide satisfactory and quality services to the society and industry. This course aims to prepare the diploma graduates to be conversant with such emerging trends. The main areas in which such developments encompassed are Electronic system manufacturing process, Smart systems, Digital factory and Telecom network. The course gives an introduction of these areas and helps the students to apply emerging trends.

2. COMPETENCY

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

- **Use the trending practices in Electronics fields.**

3. COURSE OUTCOMES (COs)

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

a) Suggest the relevant computing systems/processor for specific type of application.
b) Suggest the relevant techniques in electronic system manufacturing process .
c) Suggest different telecom network for given application.
d) Suggest the relevant IoT technologies for Digital Factory.
e) Suggest the different electronic systems for smart world.

4. TEACHING AND EXAMINATION SCHEME

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

(*): Under the theory PA, Out of 30 marks, 10 marks 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(*#): On Line ESE

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

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

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

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES: 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 Advance Processors	1a. Describe the given advancement in the processor architecture. 1b. Describe the given feature of the ARM7 processors. 1c. Describe the given features of Arduino board. 1d. Describe the given functions in Arduino IDE. 1e. Enlist features of GPU.	1.1 Advances in processor architecture: Introduction, Processor Selection Criteria. 1.2 ARM: Introduction, Features of ARM7 and ARM7TDMI, advantages, applications. 1.3 Arduino: Introduction, Compatible R2/R3 Uno boardFeatures, Atmega 328: Introduction, pin description. 1.4 Arduino IDE: Features, Sketch: C,C++ functions setup(), loop(), pinMode(), digitalWrite(), digital Read() and delay() 1.5 Arduino Interfacing: LED, Relay and DC motor 1.6 Graphical Processing Unit (GPU): Introduction, Features, Basic architecture of GPU, Architectural difference between GPU and CPU, GPU applications.
Unit – II Electronic System Manufacturing Processes	2a. Enlist the advantages of SMD. 2b. Explain end to end electronic system manufacturing process. 2c. Suggest specifications to select typical machines for electronic system manufacturing. 2d. Enlist environmental standards for Electronic Manufacturing process.	2.1 Surface Mount Devices: Introduction, need, advantages, applications. 2.2 Modern Electronic Assembly and Manufacturing process: Various machines used in End to End manufacturing process with their features and functions. Pick-n-Place machine and Automatic Component Insertion machine. Reflow soldering method. 2.3 Environmental standards for electronic manufacturing such as: EPEAT and RoHS Standards. 2.4 Battery [Li-ion, nuclear]:Concepts and Applications including E vehicles.
Unit– III Next Generation Telecom Network	3a. Explain the function of given Network components. 3b. Describe the Spectrum in Telecom sector. 3c. Compare given Mobile Network with respect to given parameter. 3d. Explain the Multi-Protocol Label Switching in NGN core. 3e. Explain the given	3.1 NGN architecture: Features, Functional block diagram, Network components: Media Gateway, Media Gateway Controller, and Application Server. 3.2 NGN Wireless Technology: Telecom network Spectrum: Types [licensed and unlicensed], Mobile Network Evolution (3G to 5G), Comparative features, 3.3 NGN Core: Features, Multi-Protocol Label Switching (MPLS): Concepts, Features and Advantages

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	component used in FTTH. 3f. Describe the features of Optical Transmission Technology.	3.4 Fiber to the Home (FTTH): Features, Architecture and Components: Optical Line Termination (OLT), Optical Network Unit (ONU) 3.5 Next generation transmission system: Optical Transport Network variants: Synchronous Transfer Module STM1, STM4, STM16, STM64 and STM256Features: bit rates and capacity, OTN Standards
Unit– IV **Digital Factory**	4a. Explain the principle of IoT used in given application. 4b. Explain the architecture of IoT 4c. Explain the importance of IoT in given application. 4d. Explain the importance of Industrial revolution I4.0. 4e. Suggest the suitable type of ML for given AI application.	4.1 Internet of Things IoT: Introduction, Functions of Cyber Physical system components 4.2 Architectures: IoT Sensor to cloud data routes: 4.3 Applications of IoT in Industries: Automotive, Discrete Manufacturing, Telecom and Agro- industries 4.4 I4.0/IIoT/ Smart Manufacturing: Introduction/ Evolution from I1.0 to I4.0, applications and benefits of I4.0, Compare I3.0 with I4.0, Architecture of I4.0 4.5 Artificial Intelligence/Machine Learning [AI/ML]: Definitions of AI, Applications and Advantages of AI, Definition and Types of ML such as Supervised, Unsupervised and Reinforcement. Relationship between DL, ML and AI. Agents in AI: Single Agent and Multi-Agent.
Unit– V **Smart World**	5a. Explain the working principle of given electronic system in smart home. 5b. Explain the relevant features of smart city. 5c. Explain the mechanism of city surveillance in smart city. 5d. Explain the given Network component functions.	5.1 Evolution of smart home. X10 Protocol for Home automation 5.2 Basic requirements and components for Smart Home: Video Monitoring, Security and Alarm, Door control, Smart lighting and Smart metering 5.3 Basic requirements for Smart City: Smart Transportation, Smart Healthcare, Smart physical safety/Security (IP based CCTV, Fire and Gas detection, Fire extinguishers) and Smart education. 5.4 IoT/M2M Network architecture: Conceptual diagram 5.5 Domains for operation: Application domain, Network domain, M2M device domain.
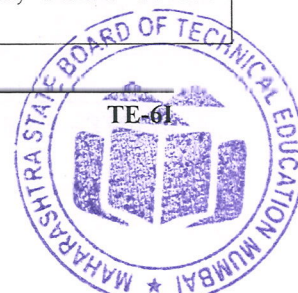
Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Advance Processors	10	02	06	08	16
II	Electronic System Manufacturing Process	08	02	04	04	10
III	Next Generation Telecom Network	12	04	04	08	16
IV	Digital Factory	10	04	06	06	16
V	Smart world	08	02	04	06	12
	Total	**48**	**14**	**24**	**32**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist 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 (one activity by each group), also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
   a.   Prepare a report on proposed features of Smart city.
   b.   Prepare a power point presentation on IoT/IIoT applications.
   c.   Prepare report on visit to nearby telecom exchange/industry.
   d.   Perform Group discussion on E vehicles/UMV.
   e.   Prepare a comparative chart of recent processors.
   f.   Prepare a report on AI used inday-to-day applications.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are suggested strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
   a.   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
   b.   *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c.   About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d.   With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
   e.   Guide student(s) in undertaking micro-projects.
   f.   Show video demonstration on safety precautions.
   g.   Demonstrate the actions and care to be taken.
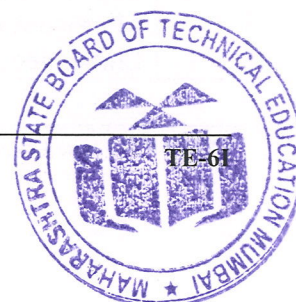
h. Arrange a visit/use relevant e-resources tounderstand Electronic system manufacturing process.
i. Arrange expert lecture of industry person.

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 year. In the first two years, the micro-project is group-based. In the third year 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 as applicable. 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. Prepare a report on existing automation in an industry and suggest improvements.
b. Prepare a report on Smart City.
c. Build Arduino based project for smart home.
d. Build Arduino based project for smart city.
e. Prepare a report on Smart city surveillance systems.
f. Prepare report on electronic systems in Disaster Management.
g. Present a power point presentation on upcoming 5G technology.
h. Prepare a report on automatic electronic components assembly machines.
i. Conduct a survey and prepare a report on various EDA tools.
j. Prepare anapplication report on AR VR Technologies.
k. Prepare a report on Artificial Intelligence.
l. Prepare a report on Machine Learning.
m. Prepare report on electronic home security systems.
n. Prepare report on fire and gas detection and deluge systems.
o. Prepare report on ATM security systems.

13.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Sustainable Smart Cities in India: Challenges and Future Perspectives	PoonamSharma, Swati Rajput,	Spinger; ISBN 978-3-319-47145-7
2	The ABC of Fiber Optics Communication	Sudhir Warier	Artech House Boston London ISBN 13: 978-1-63081-414-4
3	IoT Fundamentals: Networking Technologies Protocols and use cases for IoT	David Hanes, Gonzalo Salguein	Cisco Press. ISBN 13: 978-1-58714-456-1
4	The AVR Microcontroller and Embedded Systems using	MuhammadAli Mazidi	MicroDigitalEd.com ISBN-13:078-0997925968
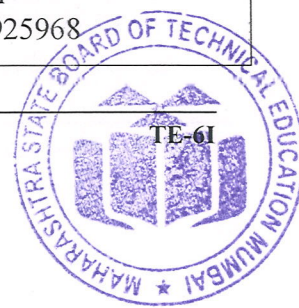
Sr. No.	Title of Book	Author	Publication
	Assembly and C.		
5	ARM Assembly Language Programming and Architecture	Muhammad Ali Mazidi, Sarmad Naimi	MicroDigitalEd.com ISBN-13: 978-0997925906
6	Artificial Intelligence	Saroj Kaushik	CENCAGE Learning ISBN-13:978-81-315-1099-5 ISBN-10:81-315-315-1099-9

14. SUGGESTED SOFTWARE/LEARNING WEBSITES:

Sr No	Theory topic /sub topic	Web site
1	Unit– IAdvance Processors (Advances in processor architecture)	https://slideplayer.com/slide/8290583/
2	Unit– IAdvance Processors (Arduino)	http://www.hobbytronics.co.uk/arduino-uno-r3
3	Unit– I Advance Processors (Arduino)	https://www.arduino.cc/en/Guide/HomePage
4	Unit I– Advance Processors(ARM)	http://www.microdigitaled.com
5	Unit I– Advance Processors (ARM)	https://en.wikipedia.org/wiki/ARM7
6	Unit II- Electronic Product Environmental Assessment Tool (EPEAT)	https://www.techopedia.com/definition/2107/electronic-product-environmental-assessment-tool-epeat#what-does-electronic-product-environmental-assessment-tool-epeat-mean
7	Unit II- Restriction of Hazardous Substances. RoHS	https://www.rohsguide.com/rohs-faq.htm
8	Unit– IIINext Generation telecom Network	TRAI official website: www.trai.gov.in
9	Unit– III Next Generation telecom Network	https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.2012-200609-S!!PDF-E&type=items
10	Unit– IVDigital Factory (IoT)	https://en.wikipedia.org/wiki/Internet_of_things
11	Unit– IVDigital Factory	http://dot.gov.in/sites/default/files/National%20Telecom%20M2M%20Roadmap.pdf
12	Unit– IVDigital Factory	http://www.tec.gov.in/technical-reports/
13	Unit– IVDigital Factory(I4.0/IIoT)	http://i40today.com/
14	Unit– VSmart World	http://tec.gov.in/pdf/M2M/Design%20Planning%20Smart%20Cities%20with%20IoT%20ICT.pdf
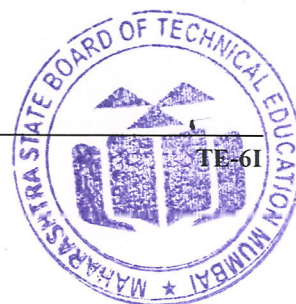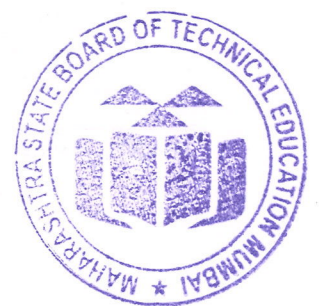
Program Name   : **Electronics Engineering Programme Group / Diploma in**
                       Electronics and Computer Engineering

Program Code   : **DE/EJ/ET/EN/EX/EQ/TE**

Semester   : **Sixth**

Course Title   : **Optical Network and Satellite Communication (Elective)**

Course Code   : **22647**

1.   RATIONALE

Optical communication technology is developing at very fast pace. Cost trends for fiber vs copper, better transmission quality, high data rate, large band width and reduction in fiber maintenance expense are the major reasons for fast adaptation of this mode of communication. Today in different communication scenarios satellite applications plays important role. The knowledge of satellite communication systems and equipment is very essential. This course will facilitate students to apply the basic principles of optical communication system and satellite communication system to maintain different types of applications based on it.

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 optical communication networks.**
- **Maintain satellite communication systems.**

3.   COURSE OUTCOMES (COs)

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

a) Interpret the functions of the various blocks of optical fiber communication system.
b) Measure the optical fiber cable parameters.
c) Select relevant architecture of optical networks for the given application.
d) Select uplink and downlink frequencies for various satellite services.
e) Maintain Satellite services.

4.   TEACHING AND EXAMINATION SCHEME

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

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

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

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

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

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

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

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify various layers and parts of an optical fiber cable.	I	02*
2	Test the performance of Pulse width modulator and demodulator (PWM) where optical fiber cable is used as transmission media.	I	02*
3	Test the performance of the given photo-diode (Detector) use LED as an optical source.	I	02
4	Test performance of given photo-diode (Detector) use LASER as optical source.	I	02*
5	Calculate bandwidth of optical fiber for Analog Link.	II	02
6	Observe the change in power level of optical fiber due to cleaning	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	effects in the fiber.		
7	Calculate Numerical Aperture (NA) and acceptance angle for the given optical fiber cable.	II	02*
8	Connect the given Optic cable with relevant optical connector and test the performance of cable.	II	02
9	Measure attenuation losses for the given length of optical fiber cable.	II	02
10	Measure bending losses of the given optical fiber optic cable.	II	02*
11	Demonstrate attenuation losses for the given length of optical fiber cable with the help of OTDR. (Virtual lab/ Demonstration in industry/videos can be used in case of non-availabity of the splicing machine in the lab)	II	02
12	Join optical fiber cables using Splicing machines. (Virtual lab/ Demonstration in industry/ videos can be used in case of non-availabity of the splicing machine in the lab)	II	02
13	Demonstrate the working of OTN. (Virtual lab/ Demonstration in industry/ videos can be used in case of non-availabity in the lab)	III	02*
14	Test the performance of audio satellite link for the specified uplink and downlink frequency.	IV	02*
15	Develop a program using a relevant simulation tool to calculate the time period of a satellite for the given velocity and altitude based on Kepler's third law.	IV	02
16	Detect the satellite link fail operations and re-establish the link.	V	02
17	Establish a link to transmit and receive three separate signals (audio, video, tone) simultaneously through satellite link.	V	02
	TOTAL		**34**

Note

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

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

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
	Total	**100**
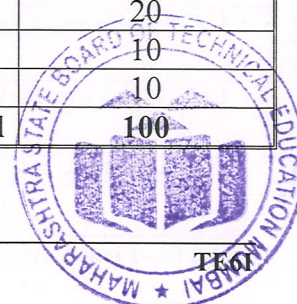
The above PrOs also comprise of the following social skills/ attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a) Follow safety practices.
b) Practice good housekeeping.
c) Practice energy conservation.
d) Work as a leader/a team member.
a) 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
- 'Organisation Level' in 2nd year
- 'Characterisation 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.	CRO/Digital storage oscilloscope: 60MHz/100MHz/200MHz bandwidth, 500MS/s to 1GS/s real-time sample rate, 50GS/s sample rate for repetitive waveforms, High resolution color LCD display	2,3,4,5
2.	DMM: DC, 0-1.5/3Amp, 0-2.5/5 Amp, 0-5/10Amp, 0-150/300V, 0-250/500V, 0-75/150V AC-0-1000V , 0-10A	2,3,4,5
3.	Power Supply Type: DC, 0- 30 V, 0 - 3A	2,3,4,5
4.	Fiber Optic Trainer kit	1,2,3,4,5,7
5.	Fiber optic cable tester	2,3,4,5
6.	Optical fiber Power meter	6,8,9
7.	Lux meter: Display: 3 1/2 digit 18mm (0.7") /LCD •Ranges: 1 to 50,000 LUX /Over-input: indication of " 1 " /Sampling Time: 0.5 second /Repeatability: ±2% /Temperature Characteristic: ±0.1%/? •Accuracy: ±4%rdg ±0.5%f.s	3,4,5
8.	OTDR-Attenuation resolution-0.001 dB, Attenuation measurement linearity 0.05 dB, Distance measurement accuracy ± (0.5 + resolution + 5 × 10-5 × L) m	8,9,10, 11,12
9.	PC - Processor - dual core @ 2.4 GHz (i5 or i7 Intel processor or equivalent AMD),RAM - 4 GB, Hard Drive - 320 GB 5400 RPM hard drive,OS- win7/10	11,12, 13
10.	Spectrum Analyzer- frequency range- 2.4 to 2.495GHz, Resolution – 26KHz to 3MHz, resolution BW-58.036 to812.500KHz	14,15,16,17
11.	Splicing, Cutting and trimming tool of plastic fiber optic cables	6,12
12.	Fiber optic cleaning kit .	6
13.	Satellite Trainer Kit (ST2272)/ (STC 24): Up linking frequency 2414	15,16,17,18
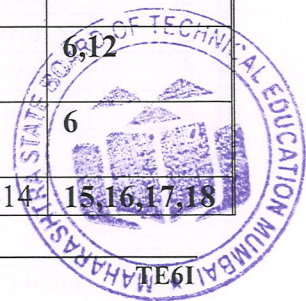
S. No.	Equipment Name with Broad Specifications	PrO. No.
	/2432/2450/2468 MHz, 4 MHz clock frequency, PIC16F84 - 8 Bit RISC processor based PLL, 16 MHz Bandwidth, FM Modulation of Audio and Video 5/ 5.5/ 8 MHz Audio and Video Modulation, Detachable Dish Antenna, Radiated Power output 25 mW (approx.), 4 downlink frequencies 2414 /2432/2450/2468 MHz	
14.	RF Signal Generator, 9 kHz to 3 GHz, Output Power @1 GHz, -127 dBm to +13 dBm AM, FM, PM Analog I/Q Input Pulse, Frequency Modulation-Maximum Deviation @1 GHz, 20 Hz to 100 kHz	2

8.   UNDERPINNING THEORY COMPONENTS

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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –I Fundamentals of Fiber Optic Communication	1a. Describe construction and features of Optical fiber. 1b. Compare working of optical fiber for given mode and index profile. 1c. Explain the block diagram of Optical fiber communication system. 1d. Explain the working principle of given optical source and detector.	1.1 Optical fiber communication: Advantages, Disadvantages, applications 1.2 Construction of fiber optic cable 1.3 Classification based on modes of propagation of light and index profile. 1.4 optical fiber communication system: Block diagram. 1.5 Optical components: Sources and Detectors
Unit– II Optical Losses	2a. Explain the given terms related to optical theory. 2b. Calculate acceptance angle, critical angle and numerical aperture of the given optical fiber cable. 2c. Explain the step by step procedure of given splicing techniques 2d. Describe the different types of Optical fiber losses. 2e. Explain the operation of ODTR.	2.1 Reflection, refraction, Total internal reflection (TIR), Snell's law, critical angle, numerical aperture, acceptance angle and acceptance cone - (numerical on above concepts) 2.2 Splicing techniques- Fusion splice, V-groove splice and elastic tube splice 2.3 Losses in optical fiber: Absorption loss, scattering loss, dispersion loss, radiation loss, coupling loss. 2.4 OTDR: Working Principle, Block diagram, Specification, Application
Unit-III Optical network.	3a. Describe working principle of the optical network components. 3b. Explain the concept of WDM. 3c. Explain the architecture of SONET/SDH. 3d. Describe the given type of Ethernet standard.	3.1 Optical Network Components Use and Features: Amplifiers, Splitter, Optical Switches, 3.2 WDM: Basic Concept, Features. 3.3 SONET/SDH: Architecture and Hierarchy. 3.4 Ethernet standards of Optical network features: IEEE 802.3j, 802.3y, 802.3z

Unit –IV Overview of Satellite Systems.	4a. Describe with sketches the working principles of the given type of satellite. 4b. Explain with sketches the given terms related to satellite and orbit. 4c. Explain the parameters with respect to the given type of satellite orbit. 4d. Explain Kepler's law of planetary motion with respect to the given criteria.	4.1 Working principle, concepts and basic components of Satellite system : Earth segment, Space segment, active and passive satellite, geostationary and geosynchronous satellites 4.2 Frequency allocations for satellite services, Uplink and downlink frequency, satellite frequency bands 4.3 Basic terminologies used in satellite communication: latitude, longitude, look angle, elevation angle, station keeping, propagation delay time, velocity, look angle and footprint 4.4 Communication Satellite orbits and its types: LEO, MEO, elliptical orbit and GEO, parameters and characteristics of various orbits 4.5 Kepler's law, Apogee and Perigee Heights, Orbit Perturbations, Effects of a non spherical earth, Atmospheric drag, effect of eclipse on satellite motion
Unit-V Satellite segments and Services	5a. Describe with sketches the functions of the given sub-system of the satellite earth station. 5b. Describe the given type of control systems associated with the Satellite. 5c. Describe with sketches given applications	5.1 Satellite earth station: Block diagram; Antenna subsystem, LNA, Power subsystem, Telemetry Tracking and Command (TTAC) subsystem, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal control Transponder: Single, double conversion and regenerative type 5.2 Space link: Equivalent Isotropic Radiated Power(EIRP), Transmission Losses : Free-space transmission loss, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionosphere losses 5.3 Satellite Applications: GPS: Global positioning system (GPS) : concept, working principle, transmitter and receiver VSAT: Overview, architecture, working principle, applications

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
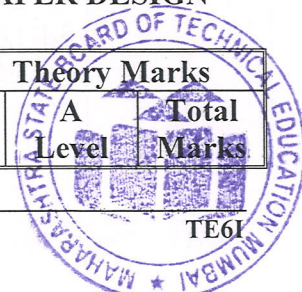
Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Fiber Optic Communication	08	02	04	06	12
II	Optical Losses	12	04	06	06	16
III	Optical network	08	02	06	06	14
IV	Overview of Satellite Systems	08	02	04	06	12
V	Satellite segments and Services	12	02	06	08	16
	Total	**48**	**12**	**26**	**32**	**70**

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

10.   SUGGESTED STUDENT ACTIVITIES

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

a) Visit any industry nearby to your house/college and observe the use of optical devices.
b) List out the specification of various optical devices used in the industries.
c) Undertake Internet survey for various optical fiber cables available in market.
d) Observe various splicing techniques used in industries.
e) Visit any earth station nearby to your house/college and observe the function of different components of satellite system and submit report on it.
f) Write report on various antennas and modulation techniques used for television signal transmission.
g) Visit ISRO website and collect the information related to satellite launching and submit report on it.
h) Collect the information related to Indian satellites program.
i) Prepare report on satellite 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 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) Virtual lab or videos can be use in case of non availability of equipment for mentioned experiments.
g) Correlate subtopics with application of instrumentation.
h) Use proper equivalent analogy to explain different optics concepts.
i) Use Flash/Animations to explain the process of light transmission through various types of fiber optic cable
j) Use open source models to explain working of the fiber optic connectors.
k) Use Flash/Animations to explain satellite communication.
l) Use different websites to explain satellite communication systems

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. For all semesters, the micro-project are group-based 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) Using LED as optical source, photodiode as optical detector and plastic fiber cable make prototype optical communication system.
b) Make flow diagram of Fiber to Home (FTH).
c) Test the performance of PWM using copper cable and compare it with result of experiment no 02.
d) Prepared survey report to compare technical specification of different types of optical sources and detectors.
e) Undertake a survey for different types of optical cables, give its specification and application.
f) Undertake a survey of different OTDRs available in market, along with their specifications.
g) Prepared report on splicing techniques used at RailTel, Reliance and BSNL or any other such organization.
h) Monitor an optical networking used for cable service provider (TV and internet) and prepared report.
i) Prepare an Internet based report on the different types of launch vehicles used for satellite launching.
j) Prepare the chart to indicate applications of various satellite frequency bands (L, S, C, X, Ku and Ka band).
k) Prepare a survey report on the different types of antennas used for Satellite communication.
l) Conduct an Internet survey and prepare a detail report on GPS and its applications.
m) Prepare a report on VSAT communication based on visit and Internet survey.
n) Visit a satellite centre/ pool lab having satellite set up and prepare a report on all the components and its functions.
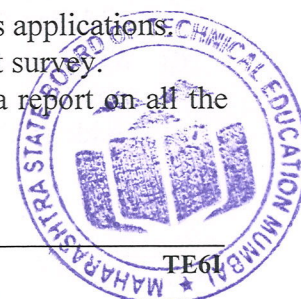
13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic communications Systems: Fundamentals Through Advanced	Tomasi, Wayne	Pearson Education India, New Delhi **ISBN-13:** 978-8131719534
2	Fiber Optic Communication	Kolimbiris, Harold	Pearson Prentice Hall, New Delhi,2004; ISBN 978-81-317-1588-8
3	The ABCs of Fiber Optic Communication	Warier, Sudhir	ARTECH HOUSE, Canton street Norwood, MA, ISBN 9781630814144
4	Fiber Optic Communication	Kieser, Gerd	Mc Graw Hill Higher Education, New Delhi ,2013, ISBN: 9781259006876,
5	Data Communications and Networking	Forouzan, Behrouz A.	Mc Graw Hill Higher Education, New Delhi, 2013, ISBN: 9781259064753,
6	Optical Fiber Communications Principles and practice	Senior, John M.	Pearson Education Limited, New Delhi, 2010, ISBN: 9788131732663,
7	Satellite Communications	Roddy Dennis	Tata McGraw-Hill, New Delhi, fourth edition ,2017 **ISBN-13:** 978-0070077850
8	Satellite Communication	Katiyar, Sapna	Katson publications, 3rd edition 2013 ISBN-978-93-5014-481-7
9	Satellite communication concepts and applications	Rao Raja K. N.	PHI learning Private limited ,New Delhi , second edition, 2012 ISBN-978-81-203-4725-0
10	Satellite communication systems, techniques and technology	Gerard Maral, Bousquet Michel, Zhili Sun	Wiley publication, New Delhi n 5th Edition,2009 ISBN: 978-0-470-71458-4

14. SOFTWARE/LEARNING WEBSITES

a) Optical wavelength bands: http://www.bbcmag.com/2008issues/june08/BBP_June08_OtoL.pdf

b) For virtual lab :- http://iitg.vlab.co.in/?sub=59&brch=269

c) For virtual lab :- http://vlab.co.in/

d) LED data sheet:-http://www1.futureelectronics.com/doc/EVERLIGHT%C2%A0/334-15__T1C1-4WYA.pdf

e) For fiber cleaning video :https://www.youtube.com/watch?v=MMmRdFs96JY

f) http://www.netes.com.tr/upload_x/dosyalar/93DA75C4C94A4B78E5E09EDBB038F0AA.pdf

g) https://recommendedforyou.xyz/books/g4/25739?q=Satellite%20communication%20lab%20manual
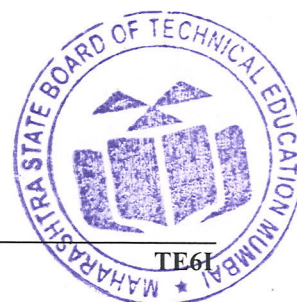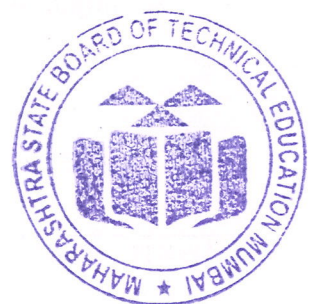
h) http://istc.co.in

i) https://www.isro.gov.in/

j) https://www.nasa.gov/

k) http://www.satcoms.org.uk/satellite/vsat-tutorials.asp?

Program Name	: Diploma in Electronics and Computer Engineering
Program Code	: TE
Semester	: Sixth
Course Title	: Computer Network & Management
Course Code	: 22685

1.   RATIONALE

In today's world, computers have become an essential part of each and every sector for professional activities as well as personal activities. With the increasing demand of technologies, networking came into existence and slowly it became an integral part of our life. The course aims to deliver knowledge about computer networks and apply this knowledge to solve real life problems in networking with hands-on training regarding the design, troubleshooting, modeling and evaluation of computer networks. Students will be able to construct a simple networking model using a network simulator tool. This tool will help them to design and evaluate the performance of the network.

2.   COMPETENCY

The aim of this course is to help the student to attain the following *industry identified* competency through various teaching learning processes.
- **Manage given type of computer networks.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:
  a) Demonstrate the concepts of Computer networks.
  b) Analyze various networking devices along with their configuration.
  c) Configure Windows server as per requirements and roles.
  d) Design the network using IP addressing and sub-netting / super-netting schemes.
  e) Select Routing protocols along with key principles of Security for the given network.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
L	T	P			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 attainment 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.
#: *External Assessment*
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 at the end of the course, in all

domains of learning in terms of the industry/employer identified competency depicted at the center of this map.
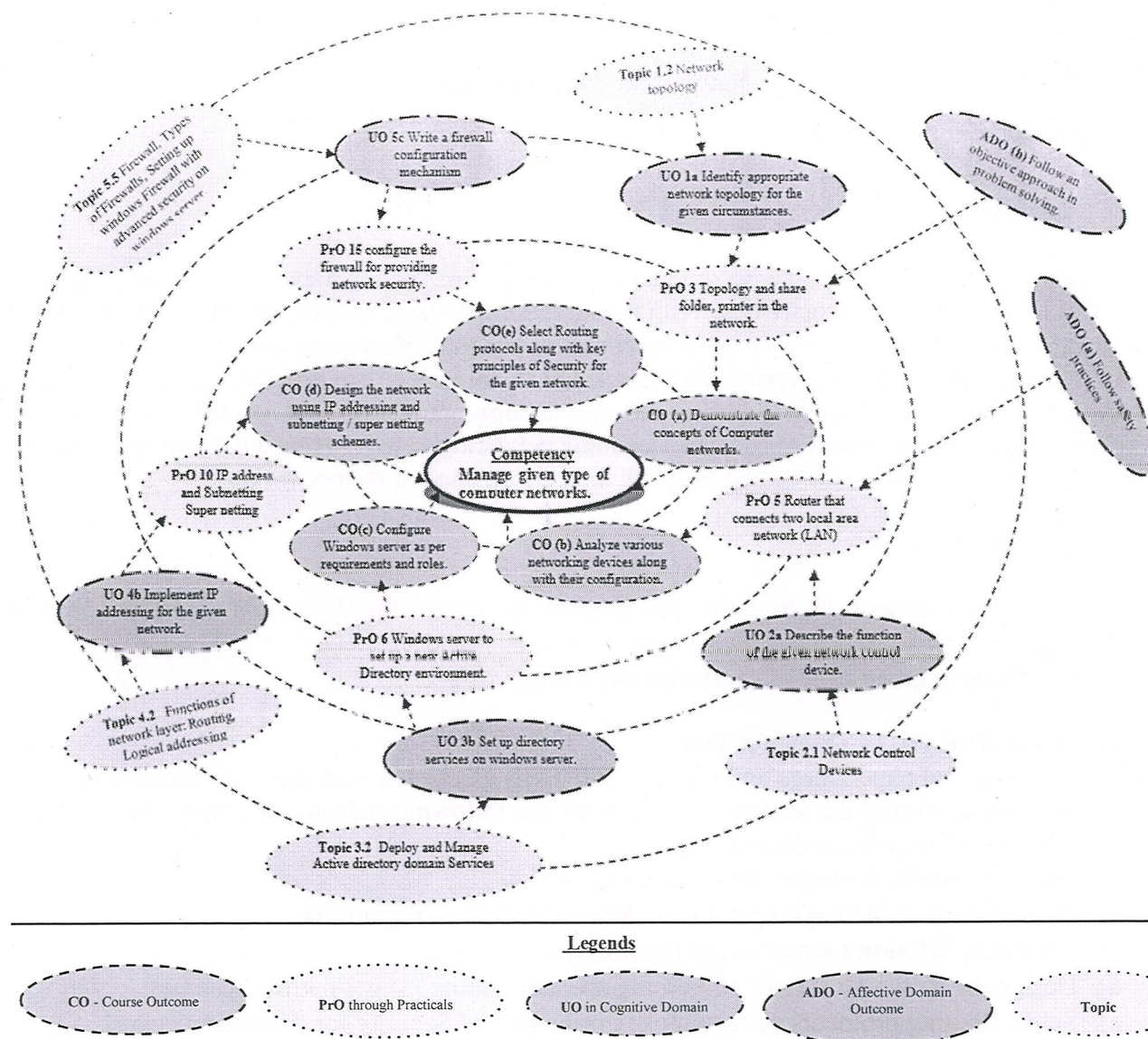
Figure 1- Course Map

6. SUGGESTED PRACTICALS

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

S. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify different components of the network in department/campus along with their technical specification.	I	02*
2	Construct the cross-wired and straight-through cable and test it with the cable tester.	I	02
3	Connect computers in the star topology and share folder, printer in the network.	I	02*
4	Connect computers in the WLAN network.	II	02
5	Demonstrate the simple network configuration with a router that connects two local area network (LAN) segments using CISCO packet tracer.	II	02*

S. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	After installation, configure Windows server to set up a new Active Directory environment.	III	02*
7	Deploy Windows Server Essentials to configure different roles like DHCP, DNS.	III	02*
8	Implement backup and recovery for windows server.	III	02
9	Configure VLAN using CISCO packet Tracer.	III	02
10	Find out the IP address and classify as IPv4, IPv6. a. Subnetting b. Super netting	IV	02*
11	Execute following essential networking commands and Network configuration commands. a. ping b. traceroute c. ipconfig d. netstat e. nslookup f. pathping	IV	02
12	Configure IPv6 network using any network simulator like CISCO Packet Tracer, CORE Network Emulator.	IV	02
13	Install packet sniffing software such as Wireshark, tcpdump, Windump. Analysis of different types of protocols used and packets transmitted in TCP/IP.	V	02*
14	Use the appropriate software such as CISCO packet Tracer to configure IP routing with RIP.	V	02
15	After installation configure the firewall for providing network security.	V	02
16	Configure SNMP by using CISCO packet Tracer.	V	02*
		Total	**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more 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:*

Sr. No.	Performance Indicators	Weightage in %
a.	Preparation of practical set up	20
b.	Setting and operation	20
c.	Use of Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	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 laboratory/field based experiences.

a. Follow safety practices.
b. Follow an objective approach in problem solving.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence the acquisition of ADOs takes place gradually in the student as 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:
a. 'Valuing Level' in 1st year
b. 'Organizing Level' in 2nd year
c. '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 No.
1	Personal computer systems (i3 series/AMD Ryzen3 equal to or greater series, 8 GB RAM,512 GB SSD / HDD, LCD/ LED monitor) or any computer system with basic configuration, connected to LAN and Internet connection.	All
2	Operating System: Windows 7/8/10 or above, MAC OS, Linux (any one)	All
3	Twisted pair cable (UTP CAT5 or CAT6), RJ45 Connector.	1-3
4	Crimping tool (Specification: Crimping Tool for RJ45 Cable, 3 in 1 Modular Crimping Tool for RJ45 UTP CAT5/CAT6 Networking Cable, LAN Cutter 8P/6P/4P All-in-One or similar).	1-3
5	Cable tester (Specification: Network Cable Tester for LAN, RJ45/CAT5/CAT6 UTP Wire Test Tool or similar).	1-3
6	Ethernet Switch 8/16/24/32 ports.	1,3,4,11,13,15
7	Monochrome Laser Printer or similar.	3
8	Windows Server software (Preferably higher version like 2022)	6,7,8
9	Firewall (Open source: oneAlarm, Comodo Firewall, TinyWall, Netdefender or similar).	15
10	Wireshark or any other packet analyzer tool. (http://www.wireshark.org).	13
11	Simulation Software: CISCO Packet Tracer, CORE Network Emulator.	5,9,12,14,16
12	Digital Subscriber Line (DSL) modem or Wireless Router(300Mbps 2.4GHz, Wireless 3G/4G/5G Portable Router with Access Point/WISP/Router Modes, with Mini USB Port, Internal Antenna or similar)	4

8.   UNDERPINNING THEORY COMPONENTS
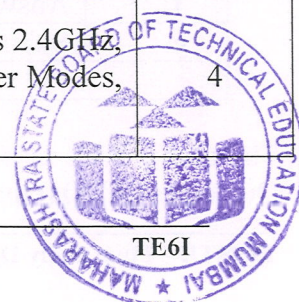
The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit - I **Introduction to Computer Networks**	1a. Identify appropriate network topology for the given circumstances. 1b. Compare different topologies on the given parameters. 1c. Select transmission media for given network application. 1d. Classify a given network based on given parameters. 1e. Compare the various features of the OSI and TCP/IP layers.	1.1 Introduction to computer network, network applications, Advantages and Disadvantages of computer network. 1.2 Network Topology: - Definition, Physical topology and Logical topology, Selection criteria, types. 1.3 Transmission media: Guided transmission Media: - Twisted-Pair cable, Coaxial cable, Fiber Optic cable. Unguided Media: - Radio waves, Infrared, Bluetooth, Satellite. 1.4 Classification of network: LAN, MAN, WAN. 1.5 Reference models (Functions and Comparison of OSI and TCP/IP): Layer details of OSI, TCP/IP models. Communication between layers.
Unit - II **Network Control Devices**	2a. Describe the function of the given network control device. 2b. Explain the features of given IEEE communication standards 2c. Compare 802.11 and 802.16	2.1 Network Control devices: Hub, Switch, Repeater, Bridge, Router (EPON, GPON routers with comparison), gateway (working, types, ISO-OSI layer in which they work, application and configuration) 2.2 IEEE standards: 802.1, 802.2, 802.3 2.3 802.11 Wireless LAN: Architecture and protocol stack , Physical Layer, MAC sub layer protocol 2.4 802.16 Broadband Wireless Access: Architecture and protocol stack , Physical Layer, MAC sub layer protocol
Unit - III **Windows Server Configuration**	3a. Specify the need for Windows Server configuration. 3b. Set up directory services on windows server. 3c. Configure a VPN server on a Windows server. 3d. Compare VLAN and VPN.	3.1 Introduction to Windows Server, Features, Hardware requirements, Installation and Configuration of Windows Server, Version, Security measures, Latest features in Windows server 2022. 3.2 Deploy and Manage Active directory domain Services, Directory access protocol (LDAP over SSL). 3.3 Virtual Private Network Technology: Advantages, Disadvantages, protocols (IPsec, L2TP, PPTP, SSL/ TLS) and types. 3.4 Virtual Local Area Network: Characteristics, types, VLAN trunk protocol (VTP). 3.5 Compare VPN and VLAN using following parameter types, types of

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		service, purpose, tunnel/channel, security, and efficiency.
Unit - IV IP Addressing and Network Configuration	4a. Identify the different network layer issues. 4b. Implement IP addressing for the given network. 4c. Explain the significance of the given field in the packet format of IPv4/IPv6. 4d. Describe the process of creating subnet/supernet for the IPv4. 4e. Explain the transition of IPv4 to IPv6.	4.1 Network Layer issues, Communication Primitives: Unicast, Multicast, Broadcast. 4.2 Functions of network layer: Routing, Logical addressing, Encapsulation, Fragmentation and Reassembly. 4.3 IPv4 Protocol: Packet format, IP addresses classes, Sub-netting, Super-netting, and Masking. 4.4 IPv6 Protocol: Packet format Extension Header, Address space, Address allocation. 4.5 IPv6 Transition mechanism: Dual Stack, Tunneling, NAT Protocol transition. 4.6 Compare IPv4 Vs IPv6.
Unit - V Network Security and Routing Protocols.	5a. Choose a relevant routing algorithm for the given network. 5b. Compare given type of routing protocols. 5c. Write a firewall configuration mechanism. 5d. Explain the key principles of security.	5.1 Inter-domain, Intra- domain Routing. 5.2 Routing Algorithm: Distance Vector Routing, Link State Routing, Path Vector Routing. 5.3 Routing protocols: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Protocol Independent Multicast (PIM) 5.4 Network Security: Need, Key principles of Security, Types 5.5 Firewall, Types of Firewall, Setting up windows Firewall with advanced security on windows server. 5.6 Introduction to SNMP, SNMP protocols (SMI, MIB).

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 Networks	8	4	4	4	12
II	Network Control Devices	8	4	4	4	12
III	Windows Server Configuration	10	4	4	6	14
IV	IP Addressing and Network Configuration	10	2	6	8	16
V	Network Security and Routing Protocols.	12	2	6	8	16
	Total	48	16	24	30	70
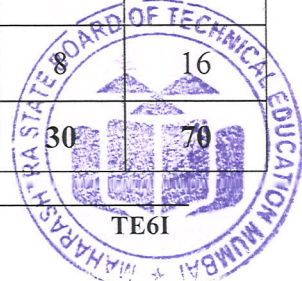
Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should conduct following activities in group and prepare report 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)   Use the latest simulation techniques to explain the working of topologies.
b)   Use the animation techniques to explain the working of OSI Layers.
c)   Install various roles like Remote Access, Hyper-V, Web server etc.
d)   Prepare PowerPoint presentations on analysis of threats.
e)   Visit banks, network startups, and industry to observe the network layout.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

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 *(MOOC's)* 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 are 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 I scheme 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)   Video programs/YouTube/Animations may be used to teach various topics and sub topics.
g)   Demonstrate working of the various networking equipment to students before they start doing the practical.
h)   Encourage students to refer to different websites specified under learning resources to have a deeper understanding of the various communication techniques.
i)   Observe performance of the student continuously and give them feedback about the progress periodically.
j)   Motivate students to participate in course related co-curricular activities

12.   SUGGESTED MICROPROJECTS

Only one microproject is planned to be undertaken by a group of students that needs to be assigned to them at the beginning of the semester. In the first four semesters, the microproject is group based. However, in the fifth and sixth semester, it should 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 the 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 a dated work diary consisting of individual contributions in the project work and give a presentation of it before submission as per course teacher's rubrics. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:
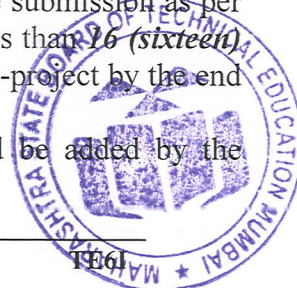
a) **Survey on different Guided/ Unguided Transmission media:** Prepare a report along with a chart on recent and widely used media in industries depending on its various configurations.

b) Design a layout of the network for the Department along with appropriate report, clearly showing type of network, topology, Transmission media and specifications of various components used in Department.

c) Create DNS, Web Server and prepare detailed stepwise reports with configurations.

d) Implement any one routing protocol using network simulation software.

e) An ISP is granted a block of address starting with 150.80.0.0./16. The ISP distributes these blocks to 1000 customers as follows.

   a. The first group has 200 medium size businesses; each need 128 addresses.

   b. The second group has 400 small size businesses; each need 16 addresses

   c. Third group has 2000 households; each need 4 addresses. Design the sub blocks and give slash notation for each sub block. Find out how many addresses are available after these allocations. Also study on IPv4/IPv6 addressing.

f) Create a dynamic Network with DHCP server. Use Routing Protocol to route packets between this network using Cisco packet tracer or any other similar software.

g) Configure inter VLAN Routing using Cisco Packet Tracer.

h) Survey on IEEE standards development Lifecycle along with Request for Comments for protocol.

i) Survey on role of Artificial intelligence (AI) in Computer networks.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Computer Networks	A.S. Tanenbaum	Pearson Education ISBN-13: 978-0-13-212695-3
2	TCP/IP Protocol Suit	Behrouz A. Forouzan	McGraw Hill Education, ISBN-13 978-0073376042
3	Data Communication and Networking	Behrouz A. Forouzan	McGraw-Hill, ISBN -13 978-0-07-296775-3
4	Internet working with TCP/IP	Comer Douglas E	PHI Learning, ISBN:0-13-018380-6
5	Cryptography and Network Security	Atul Kahate	McGraw-Hill, ISBN-13:978-0-07-064823-4 ISBN-10: 0-07-064823-9
6	Firewall for Dummies	Brian Komar, Ronald Beekelaar, and Joern Wettern	Wiley Publishing Inc. ISBN: 0-7645-4048-3
7	Computer Networks: Theory & Practicals	Dr. Brijendra Pratap Singh, Manoj Madhava Gore	All India Council for Technical Education ISBN:978-81-961834-5-5

14. SUGGESTED SOFTWARE WEBSITES

Following websites are suggested for students to better understand the concepts of Networking and/or simulation softwares to enhance psychomotor domain skills. Any other equivalent open source software can be used if required.

Sr. No.	Keyword	QR Code	Website
1	CISCO Packet Tracer		https://www.computernetworkingnotes.com/ccna-study-guide/download-packet-tracer-for-windows-and-linux.html
2	Wireshark		https://www.wireshark.org/
3	Windows server-2022		https://www.microsoft.com/en-us/evalcenter/evaluate-windows-server-2022

15. SUGGESTED ONLINE TEACHING /LEARNING RESOURCES

Following learning websites are suggested to students to enhance their skills in specific learning domain. It helps student to visualize and demonstrate the concept easily using given online resources.

Sr. No.	Keyword	QR code	Weblink
1	Computer Networks by A.S. Tanenbaum		https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf
2	TCP/IP Protocol Suit by Behrouz A. Forouzan		https://vaibhav2501.files.wordpress.com/2012/02/tcp_ip-protocol-suite-4th-ed-b-forouzan-mcgraw-hill-2010-bbs.pdf
3	Internetworking with TCP/IP by Comer Douglas E		https://doc.lagout.org/network/Internetworking%20with%20TCP_IP%20%20Vol%20I.pdf
4	Data Communication and Networking by Behrouz A. Forouzan		http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf

Sr. No.	Keyword	QR code	Weblink
5	Simulating a Wi-Fi Network		http://vlabs.iitkgp.ernet.in/ant/5/references/
6	Network Addressing		https://www.javatpoint.com/network-addressing
7	Reference Models in Computer Networks		https://www.studytonight.com/computer-networks/reference-models-in-computer-networks?utm_content=anc-true
8	Routing protocols		https://www.tutorialspoint.com/data_communication_computer_network/network_layer_routing.htm
9	EPON vs GPON		https://us.hitrontech.com/learn/what-is-the-difference-between-epon-and-gpon/#:~:text=is%20the%20difference%3F-,The%20Differences,efficient%20and%20EPON%20is%20not.
10	Introduction to SNMP		https://www.geeksforgeeks.org/simple-network-management-protocol-snmp/
11	Understand VLAN Trunk Protocol (VTP)		https://www.cisco.com/c/en/us/support/docs/lan-switching/vtp/10558-21.html
12	Types of Network Topology		https://www.geeksforgeeks.org/types-of-network-topology/

Sr. No.	Keyword	QR code	Weblink
13	Network Security		https://nayakuch.files.wordpress.com/2015/08/cryptography-network-security-atul-kahate.pdf
14	Firewall		https://www.youtube.com/watch?v=t0GGcKawHv0y
15	Active Directory Services		http://surl.li/gjqmp
16	Virtual LAN (VLAN)		https://www.geeksforgeeks.org/virtual-lan-vlan/
17	Types of Virtual Private Network (VPN) and its Protocols		https://www.geeksforgeeks.org/types-of-virtual-private-network-vpn-and-its-protocols/
18	Difference Between VLAN and VPN		https://www.geeksforgeeks.org/difference-between-vlan-and-vpn/
19	What Is Artificial Intelligence in Networking?		https://www.cisco.com/c/en/us/solutions/artificial-intelligence/artificial-intelligence-machine-learning-in-networking.html