GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-V

Course Title: Entrepreneurship & Start-ups
(Course Code: 4300021)

Diploma programmer in which this course is offered	Semester in which offered
All Branches of Diploma Engineering	5ᵗʰ Semester

1. RATIONALE

Entrepreneurs have significant impact on our country's current developing economy. The social expectations towards engineering professionals are certainly emerging as job creators especially with the thrust given to "Make in India" and "Vocal for Local" campaigns. Startup India is a well-known flagship initiative of the Government of India, intended to catalyze startup culture and build a strong and inclusive ecosystem for innovation and entrepreneurship. The last 6 years have witnessed tremendous growth of start-ups i.e. from 733 in 2016-17 to 14000 in 2021-22. This course focuses on the basic roles, skills and functions of entrepreneurship with special attention to startup. The course is directed to help students to enhance capabilities in the field of managing the given task as well as to understand peripheral influencing aspects for starting a new business. It will certainly help students to think in a direction to establish a small industry /start-up and develop /validate it using fundamental know how.

2. COMPETENCY

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

- **Establish a small enterprise /start-up validate it and make it scalable.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

1) Understanding the dynamic role of entrepreneurship and Startups by Acquiring Entrepreneurial spirit and resourcefulness, quality, competency, and motivation
2) Identify a Business Idea and implement it
3) Select suitable Management practices like leadership and Ownership, resource institutes
4) Overview of Support Agencies and Incubators
5) Building Project Proposal & knowing CSR , Ethics, Ex-Im, & Exit strategies

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)	Total Credits (L+T+P/2)	Examination Scheme		
		Theory Marks	Practical	Total Marks

L	T	P	C	CA	ESE	Marks		
						CA	ESE	
3	0	0	3	30*	70	0	0	100

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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, **CA** - Continuous Assessment; **ESE** - End Semester Examination.

5.   SUGGESTED Soft PRACTICAL EXERCISES (During Theory)

The entrepreneurial or start-up journey begins by readying for your future dream from college projects and pursuing the same beyond college hours also. It is encouraged to go through COs and identify traits and search for various state and national agencies for your entrepreneurship / start-up journey and convert the same into successful product in market.

The following practical outcomes (SPrOs) are the sub-components of the Course Outcomes (COs). Some of the **SPrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Note

i. *Though the course does not contain any Practical work, a few **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The below table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Entrepreneur Traits and Behavior Modelling	30
2	Various State and Central Entrepreneurship Promotional Schemes and Start-up Policies	30
3	Business Model for a Startup and study of Unicorns*	40
Total		**100**

6. AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

   a. Work as a leader/a team member (while doing a micro-project).
   b. Model behavioral practices of an entrepreneur while planning for an enterprise
   c. Practice ethics and consider methods/ processes that reduce waste and/or possibly conserve environment in designing a new business till it's commercialization.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.   'Valuing Level' in 1st year-Planning
ii.   'Organization Level' in 2nd year-Model Development
iii.   'Characterization Level' in 3rd year-Make it Scalable

7. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major LearningOutcomes (in cognitive domain)	Topics and Sub-topics
1) Introduction to Entrepreneurship and Start – Ups	1a) Define Entrepreneurship 1b) Discuss characteristics and functions of entrepreneurship. 1c) Identify different types of Entrepreneurships 1d) Compare the concepts entrepreneurand intrapreneur and find out the motivation behind it 1e) Distinguish between entrepreneur and managers 1f) Identify 7-M Resources 1g) Know MSME & Startup India, standup India, SSIP and its registration process for both.	1. Definition, Traits of an entrepreneur, 2. Functions of Entrepreneurship - Job Creation, Innovation, Inspiration, Economic Development 3. Types of Entrepreneurship 4. Motivation for Intrapreneurship 5. Types of Business Structures, 6. Similarities and differences between entrepreneurs and managers. 7. 7-M Resources 8. Micro, Small, Medium Enterprise/ MSME - Industry Registration Process 9. Startup India, Standup India and SSIP Gujarat & Startup registration process

2) Business Ideas and their implementation (Idea to Start-up)	2a) Finding Ideas and making an activity map
	
	2b) Develop the plans forcreating and starting the business
	
	2c) To identify business using the ideation canvas and the business model canvas
	
	2d) To know market research related terms
	
	2e) To know market mix related terms
	
	2f) Learn Product related terminologies
	
	2g) Emphasize on Innovation
	
	2h) Explain concept of Risk and SWOT
		1. Discovering ideas and visualizing the business with Activity map
		  1.1 Idea Generation
		  1.2 Product Identification
		2. Business Plan- The Marketing Plan and Financial Plan/ Sources of Capital
		3. Business opportunity identification and evaluation
		4. Market research
		  4.1.1. Questionnaire design
		  4.1.2. Sampling
		  4.1.3. Market survey
		  4.1.4. Data analysis & interpretation
		5. Marketing Mix (4Ps- product,price, promotion place)
		  5.1.1. Identifying the target market
		  5.1.2. Competition evaluation and Strategy adoption
		  5.1.3. Market Segmentation
		  5.1.4. Marketing, Advertising and Branding
		  5.1.5. Digital Marketing
		  5.1.6. B2B, E-commerce and GeM
		6. Product Terms- PLC, Mortality Curve and New product Development Steps, Inventory, Supply Chain Management
		7. Importance and concept of Innovation, Sources and Process
		8. Risk analysis and mitigation by SWOT Analysis

3) Management Practices	3a) Explain the concept and differences between industry, commerce and business.
	3b) Describe various types of ownerships in the organization.
	3c) Explain different types of leadership models.
	3d) Analyze the nature and importance of various functions of management
	3e) Discuss Financial organization Management
	3f) Distinguish management and administration
		1. Industry, Commerce and Business
		2. Types of ownership in the organization -Definition, Characteristics, Merits &Demerits
		3. Different Leadership Models
		4. Functions of Management- Merits & Demerits
		  4.1 Planning
		  4.2 Company's Organization Structure
		  4.3 Directing
		  4.4 Controlling
		  4.5 Staffing- Recruitment and management of talent.
		5. Financial organization and management
		6. Differences between Management and Administration

4) Support Agencies and Incubators	4a) Identify support agencies and current promotional schemes for enterprise and startups
	
	4b) Advocacy to investor
	
	4c) To Explain various Legal Issues
		1. State & National Level Support agencies and Current Promotional Schemes for new Enterprise
		2. Start-up Incubation and modalities
		3. Communication of Ideas to potential investors – Investor Pitch
		4. Legal Issues
		   4.1. Contracts
		   4.2. Copyrights
		   4.3. Insurance
		   4.4. IPR
		   4.5. Licensing
		   4.6. Patents
		   4.7. Trade Secrets
		   4.8. Trademarks

5) Project Proposal & Exit strategies	5a) To work on the development of a project proposal
	
	5b) Describe social responsibility and relate with economic Performance.
	
	5c) Explain managerialethics
	
	5d) To know Ex-Im Policies
	
	5e) Identify suitable strategies of succession and harvesting
		1. Project Planning
		   i. Project planning and report
		   ii. Feasibility study
		   iii. Project cost estimation
		   iv. Breakeven point,
		   v. Return on investment and Return on sales
		2. Corporate Social Responsibilities and Economic performance
		3. Business Ethics
		4. Ex-Im policies
		5. Succession and harvesting strategy
		6. Bankruptcy and avoidance

8. 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	Introduction to Entrepreneurship and Start – Ups	08	4	6	2	12
II	Business Ideas and their implementation (Idea to Startup)	08	6	4	4	14
III	Management Practices	12	6	8	8	22
IV	Support Agencies and	08	4	4	4	12

	Incubators					
V	Project Proposal & Exit strategies	06	2	4	4	10
	Total	**42**	**22**	**26**	**22**	**70**

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

9.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should make a portfolio i.e. perform at least FIVE from following list of activities individually or in group (not more than 2). They should prepare reports of about 2-5 pages for each activity and collect/ record physical evidence for their portfolio which may be useful for their placement interviews:

i.   Develop two products from household waste (attach photographs).
ii.   Download product development and innovative films from internet.
iii.   Prepare a collage for "Traits of successful entrepreneurs."/ "Motivation & Charms of Entrepreneurship"
iv.   Invite entrepreneurs, industry officials, bankers for interaction. Interview at least four entrepreneurs or businessman and identify
v.   Identify your hobbies and interests and convert them into business idea.
vi.   Mock Business Model- Choose a product and design a unique selling preposition, brand name, logo, advertisement (print, radio, and television), jingle, packaging, and labeling for it.
vii.   Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
viii.   Choose any product/ advertisement and analyze its good and bad points/ cost sheet/ supply chain etc. (individuals should select different ads)
ix.   Compare schemes for entrepreneurship promotion of any bank.
x.   Visit industrial exhibitions, trade fairs and observe nitty-gritty of business. Get news of Vibrant Gujarat Events. (Upcoming in Jan 2024)
xi.   Open a savings account and build your own capital.
xii.   Arrange a visit to a Mall, observe products, supply chain management and prepare report.
xiii.   Organize industrial visit and suggest modifications for process improvement. Conduct a market survey for a product /project before visit. In the visit collect data on machinery specifications, price, output/hour, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix etc. Make a detailed report at the end of the visit.
xiv.   Select a social cause, set objectives, plan and work for its accomplishment. Find details about some famous NGOs
xv.   Present Own Dream Start-up story as Seminar OR Analyze 2 products from Shark Tank program.

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/subtopics.
   b)   Guide student(s) in undertaking micro-projects.
   c)   **'L' in section No. 4 means** different types of teaching methods that is to be employed by teachers to develop the outcomes.
   d)   Show animation/ video related to course content.
   e)   Various Apps related to subject topics/ sub-topics
   f)   Other Common instructions as under
      1)   Instructors should emphasize more on exemplary and deductive learning.
      2)   Students should learn to recognize, create, shape opportunities, and lead teams forproviding economic-social value to society.
      3)   Business simulations should be used to enhance behavioral traits of successfulintrapreneurs and entrepreneurs amongst students.
      4)   Emphasis should be on creating entrepreneurial society rather than only setting upof enterprise.
      5)   They must be encouraged to surf on net and collect as much information aspossible.
      6)   Each student should complete minimum ten activities from the suggested list.Minimum possible guidance should be given for the suggested activities.
      7)   Students should be promoted to use creative ideas, pool their own resources, finishtheir presentation, communication and team skills.
      8)   Alumni should be frequently invited for experience sharing, guiding andrewarding students.
      9)   Display must be arranged for models, collages, business plans and othercontributions so that they motivate others.
      10) You may show video/animation film / presentation slides to demonstrate variousmanagement functions, traits of entrepreneur etc.
      11)Arrange a visit to nearby venture capital firm.
      12)Give 1 Mini project and 1project report for future business to all the students.
      13) The following pedagogical tools will be used to teach this course:
         a)   Lectures and Discussions
         b)   Role Playing
         c)   Assignments and Presentations
         d)   Case Analysis
         e)   Quiz on Management and Entrepreneurship
         g)   Mimic/ narrate examples from world's leading businessmen among the students.
         h)   Guide students on how to address issues on environment and sustainability

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-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, 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 seminar presentation of it before submission. The duration of the guidance for micro project should be about **6-8 (six to eight) student engagement hours** during the theory/ course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects/ practical exercise is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:
(It can be a Seminar with bound /hand written notes/ ppts of individual students OR a product/ service portfolio)

1) Entrepreneur Traits and Behavior Modelling
2) Various State and Central Entrepreneurship Promotional Schemes and Start-up Policies
3) Business Model for a Startup and study of Unicorns
4) Make your own Product / Service portfolio/ Proposal with USP, logo, advertisement (print, radio, and television), jingle,packaging, labeling and branding for it.

13.   SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication with place, year and ISBN
1	Entrepreneurship in Action	Coulter	PHI 2nd Edition
2	Entrepreneurship Development	E. Gordon & K. Natarajan	Himalaya
3	Entrepreneurship	Robert D. Hisrich & Mathew J. Manimala	McGraw Hill Education; ISBN 978-1259001635
4	Entrepreneurial Development	S S Khanka	S Chand & Company; ISBN: 978-8121918015
5	Entrepreneurship Development and Management	A. K. Singh	Jain Book Agency (JBA) publishes, New Delhi
6	Entrepreneurship Development& Management	R.K. Singal	S K Kataria and Sons; ISBN: 978-8189757007
7	Small Scale Industries and Entrepreneurship	Vasant Desai	Himalaya 2008
8	Entrepreneurship	Roy Rajeev	Oxford University Press; ISBN: 978-0198072638
9	Industrial Engineering and Management	O.P.Khanna	Dhanpat Rai and Sons, Delhi
10	Industrial Organization and Management	Tara Chand	NemChand and Brothers; Roorkee
11	Industrial Management and Entrepreneurship	V. K. Sharma.	Scientific Publishers, New Delhi
12	Entrepreneurship Developmentand Small Business Enterprise	Poornima M Charantimath	Pearson Education; ISBN: 978-8131759196
13	Entrepreneurship Development	S Anil kumar	NEW AGE Intern. Pvt Ltd; ISBN: 978-8122414349

14	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN – 978-0984999392
15	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN – 978-0670921607
16	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN – 978-0755388974
17	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Christensen	Harvardbusiness ISBN: 978-142219602
18	How to write a business plan,	Brian Finch	2nd edition, 2007, Kogan Page India Pvt. Ltd.
	Advance Reading		
19	HBR - Creating business plan	-	20-minute manager series, 2014.
20	HBR – Creating business plan	-	Expert solution to everyday challenges, 2007.

14.   SOFTWARE/LEARNING WEBSITES

[A] List of Software/Learning Websites:

Sr. No.	Topic Key Word	Link
1	MoCI	https://www.india.gov.in/website-ministry-commerce-and-industry
2	MSME	1)https://msme.gov.in/ 2) https://www.msmex.in/learn/government-schemes-for-startups-and-msmes-in-india/
3	Start-up, Stand-up India & SSIP Gujarat	1) https://www.startupindia.gov.in/ 2) https://www.standupmitra.in 3) https://udyamimitra.in/page/standup-india-loans 4) https://www.ssipgujarat.in/
4	Make in India	https://www.makeinindia.com/
5	Atmanirbhar Bharat Abhiyan Vocal for Local	https://indiancc.mygov.in › uploads › 2021/08
6	Skill India	https://skillindia.gov.in
7	MSDE	https://www.msde.gov.in/
8	Vibrant Gujarat	https://www.vibrantgujarat.com/
9	NABARD	www.nabard.com
10	PAN	https://www.onlineservices.nsdl.com/paam/endUserRegisterContact.html
11	I-hub	https://ihubgujarat.in
12	GSTIN	https://reg.gst.gov.in/registration

13	IEC Code	https://www.dgft.gov.in/CP
14	Mudra	https://www.mudra.org.in/
15	Export-Import	http://niryatbandhu.iift.ac.in/exim/
16	NSIC	https://www.nsic.co.in/
17	DIC	https://ic.gujarat.gov.in/dic -contact.aspx -District Industries Centre
18	EDI	https://www.ediindia.org/
19	CED	https://ced.gujarat.gov.in/home
20	NIESBUD	https://www.niesbud.nic.in/
21	Start-up Talky	https://startuptalky.com/list-of-government-initiatives-for-startups/
22	Invest India	https://www.investindia.gov.in/startup-india-hub
23	SAAC	https://www.saccindia.org/india/startups.html?utm_source=google&utm_medium=cpc&gclid=EAIaIQobChMIutLQ4dfW_wIVeppmAh1cOAAIEAMYASAAEgIJO_D_BwE
24	Action for India	https://actionforindia.org/afi-activity-accelerator-programs.html?gclid=EAIaIQobChMIutLQ4dfW_wIVeppmAh1cOAAIEAMYAiAAEgLVGvD_BwE
25	Indian Chamber of Commerce	https://www.indianchamber.org/
26	FICCI	https://www.ficci.in/api/home
27	GCCI	https://www.gujaratchamber.org/

[B] Some Films (To be seen on Sundays/holidays by students on their own, not to be shown in polytechnics in any case**)**

     i.   Any Body Can Dance (2013)
    ii.   Corporate (2006)
    iii.   Do Duni Char (2010)
    iv.   Guru (2007)
    v.   Oh My God (2013)
    vi.   Pirates of Silicon Valley (1999)
    vii.   The Pursuit of Happiness (2006)
    viii.   Rocket Singh (2010)
    ix.   Start-up.com (2001)
    x.   The Social Network (2010)
    xi.   Wall Street (1987)
    xii.   Band Baja Barat (2010)
    xiii.   You've Got Mail (1998)
    xiv.   Steve Jobs (2015)
    xv.   Chef (2014)
    xvi.   "Office Space (1999)
    xvii.   Erin Brockovich (2000)
    xviii.   The Founder (2016)

15.   PO-COMPETENCY-CO MAPPING:

Semester V	**Entrepreneurship & Startups**

Competency & Course Outcomes	(Course Code: **4300021**)						
	POs						
	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / development of solution	PO4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
**Competency**	Use concepts of management optimally to establish a small enterprise or start-up, validate it and make it scalable.						
CO1-Understanding the dynamic role of entrepreneurship and Startups by Acquiring Entrepreneurial spirit and resourcefulness, quality, competency, and motivation	3	1	2	-	-	2	2
CO2- Identify a Business Idea and implement it	3	2	2	1	1	3	3
CO3-Select suitable Management practices like leadership and Ownership, resource institutes	3	-	1	1	2	2	3
CO4- Overview of Support Agencies and Incubators	2	3	2	2	1	2	2
CO5- Building Project Proposal & knowing CSR , Ethics, Ex-Im, & Exit strategies	3	2	2W	1	1	3	3

Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1.	Mr. Ujjval V Buch (MBA)	G.P.Ahmedabad	9825346922	uvbuch@gmail.com
2.	Dr. Satya Acharya	EDI, Bhat.	7600050606	satya@ediindia.org

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Computer Organization & Architecture
(Course Code: 4350701)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1. RATIONALE

This course provides details of the computer system as a whole and its functional components as part their characteristics, working principles, performance, and internal and external communication. Interactions including system bus, different types of memory and input/output organization with Processor. This course also covers hardware architectural issues and assembly language programming. On top of that, the students are also introduced to the increasingly important area of hardware evolution and working fundamentals of processor. This course provides domain specific fundamental knowledge of microprocessor as well as computer system architecture, working, characteristic and communication with peripherals which are essential for hardware related domain for all students of computer engineering and allied branches.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- **Examine computer architecture and explore assembly language programing using 8085 instructions set.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that learners are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

   i.   Analyze computer systems at the hardware level, including CPU components & circuits, buses, and registers considering trade-offs and the evolution of processors.
   ii. Examine 8085 Architecture and its working
   iii. Perform Assembly language programming using 8085 Instruction Set.
   iv. Characterize need of various Memory types in hierarchy
   v.   Visualize CPU-I/O Communication and working.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	2	4	30	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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,* **CA** - *Continuous Assessment;* **ESE** -*End Semester Examination.*

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

This course map provides the student an overview of the flow and linkages of the various types of learning outcomes to be attained by the students in all domains of learning leading to the industry identified competency depicted at the center of this map.

6. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the subcomponents of the COs These PrOs need to be attained to achieve the COs.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Outline intel processor evolution.	1	2
2	Prepare 8085 Microprocessor architecture in diagram and explain it.	2	2
3	Summarize out Data Transfer Instructions and perform minimum 3 to 5 programs associated with the said concept	3	2
4	Summarize Arithmetic Instructions of 8085 with example and execute minimum 3 to 5 programs associated with said concept.	3	2
5	Summarize Logical Instructions of 8085 with example and execute minimum 3 to 5 programs associated with said concept.	3	2
6	List Input-Output Instructions of 8085 with example and execute minimum 3 to 5 programs associated with said concept.	3	2
7	Recall Machine Control Instructions of 8085 with example and execute minimum 2 to 3 programs associated with said concept.	3	2
8	List Branching and Looping instructions of 8085 with example and execute basic 2-3 programs associated with said concept.	3	4

9	Make a small poster to represent all types of memory in Memory Hierarchy.	4	4
10	Paraphrase Associative Memory in details	4	2
11	Differentiate Programmed I/O and Interrupt initiated I/O in detail.	5	2
12	List steps to carryout CPU-IOP Communication.	5	2
	Total		**28**

Note

  i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.**

 ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

iii. Course faculty can set own's rubrics for assessment.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Regularity	10
2	Concept clarity	30
3	Programming logic / write up	30
4	Representation	20
5	Questions & Answers	10
	Total	**100**

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED
   a.   8085 Microprocessor kit/ Simulator of 8085

8. AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.

   a) Update the knowledge of processor in context with hardware evolution.
   b) Discover working principles of processor.
   c) Develop Assembly language programming skill.
   d) Examine CPU-IOP interface.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

   i.   'Valuing Level' in 1st year
  ii.   'Organization Level' in 2nd year.
 iii.   'Characterization Level' in 3rd year.

9.   UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher-level UOs of Revised Bloom's taxonomy in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher-level UOs could be included by the course teacher to focus on the attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics

Unit – I
Basics of Computer Organization and Processor Evolution
	1.1. Classify Evolution of intel Processors
	
	1.2. Prepare chart of Basic CPU Structure & Registers
	1.3. Differentiate Bus Organization
		1.1.1. Observe the characteristic of Intel processor from 4 bit (4004) to i7
		1.2.1. Basic CPU Structure
		  • CU, ALU and MU
		1.2.2. Various Registers used in CPU & its applications
		  • AC, DR, AR, PC, MAR, MBR, IR
		1.3.1. Types of Buses used in CPU
		  • Common / Shared Bus v/s Dedicated Bus
		  • Serial Bus v/s Parallel Bus

Unit – II
8085 Microprocessor
	2.1. Make a chart of 8085 Microprocessor architecture and describe it.
	2.2. Interpret 8085 Instruction Execution
		2.1.1. 8085 Pin Diagram & Pin Functions
		2.1.2. 8085 Microprocessor Architecture
		2.1.3. 8085 General Purpose Registers
		2.1.4. 8085 Flag Register
		2.2.1. 8085 Instruction Execution
		  ● Fetch
		  ● Decode
		  ● Execute operations

Unit – III **8085 Assembly Language Programming**	3.1. Describe Machine Language Instruction Format & Addressing Modes 3.2. Develop programs using 8085 Instruction Set 3.3. Classify various Interrupts of 8085	3.1.1. Instruction format opcode & Operands 3.1.2. Machine Language Instruction Format: 1-Byte, 2-Byte & 3-Byte 3.1.3. 8085 Addressing Modes 3.2.1. Data transfer Instructions 3.2.2. Arithmetical Instructions 3.2.3. Logical Instructions 3.2.4. Branching & Looping Instructions 3.2.5. Stack Instructions 3.2.6. I/O and Machine Control Instructions 3.3.1. Classification of 8085 Interrupts and its priorities 3.3.2. 8085 Vectored interrupts: TRAP, RST 7.5, RST 6.5, RST 5.5 and RST Instruction 3.3.3. 8085 Non-Vectored Interrupts: INTR

| Unit – IV Memory Organization | 4.1. Classify Memory Types and Memory Hierarchy
4.2. Differentiate types of Main memory, Auxiliary memory, Cache and Virtual Memory | 4.1.1. Memory classifications
4.1.2. Memory Hierarchy
4.2.1. Various types of Main memories
● RAM
● ROM
● PROM
● EPROM
● EEPROM
● Associative Memory
4.2.2. Various types of Auxiliary memories
● Magnetic tape
● Floppy disk
● Hard Disks
● Flash Memory
4.2.3. Cache Memory
4.2.4. Virtual Memory |
| Unit – V Input-Output Organization | 5.1. Explain I/O interface
5.2. Differentiate various Modes of Data Transfer with I/O
5.3. Describe Input-Output Processor (IOP)
5.4. Describe CPU-IOP communication | 5.1.1. Input-Output Interface
5.1.2. Programmed I/O and Interrupt initiated I/O
5.1.3. CPU-IOP communication |

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Basics of Computer Organization and Processor Evolution**	04	03	3	00	6
II	**8085 Microprocessor**	10	08	08	02	18
III	**8085 Assembly Language Programming**	14	08	08	08	24
IV	**Memory Organization**	08	06	06	00	12
V	**Input/output Organization**	06	04	04	02	10
	Total	**42**	**29**	**29**	**12**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)
Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test

items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from the above table.

11.   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 (students') portfolio which will be useful for their placement interviews:

a)   Plan group discussion on Various Memories available.
b)   Undertake Micro-Projects in teams
c)   Give a seminar on recent Processor Architectures like AMD Ryzen, Intel Core i9.
d)   Plan some activities where students make charts and comparison posters on various topics and present them during the laboratory hours.
e)   Ask students to get their hands on various types of memory devices like Floppy Drives, Magnetic Tapes etc. available in the old days to understand its working and the evolution from that memory to currently available disks.

12.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

a)   Massive open online courses (**MOOCs**) may be used to teach various topics/subtopics.
b)   Guide student(s) in undertaking micro-projects.
c)   **'L' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d)   About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
e)   With respect to **section No.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
f)   Guide students for simulator of Assembly language programming.

13.   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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Project Idea 1:** Identify any other microprocessor chip like 8085 prepare a model chart.
- **Project Idea 2:** Make collection of various storage devices and exhibit it in laboratory
- **Project Idea 3:** Make collection of various types of instructions sets.
- **Project Idea 4:** Make small scale Program in 8085.
- **Project Idea 5:** Collect various types of Discs and make a Chart with Explanation
- **Project Idea 6:** Prepare chart of memory hierarchy
- **Project Idea 7:** Prepare chart to show instruction pipelining
- **Project Idea 8:** Prepare chart of various processor evaluation

14.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Microprocessor Architecture, Programming and Application with 8085	Ramesh S. Gaonkar	5th Edition, Prentice Hall
2	Computer system Architecture	Mano, M. Morris	Pearson publication, Latest Edition ISBN**:** 978-81-317-0070-9
3	Microprocessor and interfacing Programming and Hardware	Douglas V. Hall	McGraw-Hill International Edition.
4	Computer Architecture and Organization	Ghoshal, Subrata	Pearson publication, Latest Edition
5	Computer Architecture	Parhami, Behrooz	Oxford publication, Latest Edition ISBN: 978-0-19-808407-5

15.   SOFTWARE/LEARNING WEBSITES

a. http://www.ddegjust.ac.in/studymaterial/msc-cs/ms-07.pdf
b. http://www.iitg.ernet.in/asahu/cs222/Lects/
c. http://www.srmuniv.ac.in/downloads/computer_architecture.pdf
d. https://www.oshonsoft.com/8085.php
e. Sim8085 - A 8085 microprocessor simulator
f. https://www.sim8085.com/
g. https://youtu.be/8c6K0a8xC8w (for intel processor evolution -sample web resource)

16.   PO-COMPETENCY-CO MAPPING

Semester V	Computer Organization and Architecture (4350701)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency **Examine computer architecture and explore assembly language programing using 8085 instructions set**							
Explain Generic Computer and ALU Architecture and processor Evolution.	2	2	2	1			2
Examine 8085 Architecture and its working	3	3	2			1	2
Perform Assembly language programming using 8085 Instruction Set.	2	2	2	2		2	2
Explain various Memory types in hierarchy and their needs	3	2	1			1	1
Test CPU-I/O Communication and working.	2	1	1				1

Legend: '**3**' for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE
GTU Resource Persons

Sr. No.	Name and Designation	Institute	Email
1	Mr. S. B. Prasad	Government Polytechnic Gandhinagar	sbprasad011@gmail.com
2	Jiger P. Acharya	Government Polytechnic-Ahmedabad	jigeracharya@gmail.com
3	Trivedi Niraj Rajeshkumar	A. V. Parekh Technical Institute, Rajkot	niraj.trvd@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Introduction to Machine Learning
(Course Code: 4350702)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1.   RATIONALE

Machine learning focuses on the use of data and algorithms to perform learning similar to the way human learns. To solve recent problems in Computer domain it is important to understand the need of machine learning and apply machine learning methods in efficient ways. Every student of Computer Engineering must therefore understand the blue prints of machine learning approaches and must be able to apply learning methods on available datasets. This course will help students to build up core competencies in understanding machine learning approaches and students will be able to design and train machine learning modes for various use cases.

2.   COMPETENCY

Students acquire the ability to assess and analyze outcomes produced by machine learning algorithms and models, while enhancing their capacity for critical thinking in addressing practical challenges.

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The student will develop underpinning knowledge, adequate programming skills of competency for implementing various applications using python programming language to attain the following course outcomes.

a) Describe basic concept of machine learning and its applications

b) Practice Numpy, Pandas, Matplotlib, sklearn library's inbuilt function required to solve

machine learning problems

c) Use Pandas library for data preprocessing

d) Apply supervised learning algorithms based on dataset characteristics

e) Apply unsupervised learning algorithms based on dataset characteristics

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	4	5	30	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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, CA - Continuous Assessment; ESE -End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explore any one machine learning tool. (like Weka, Tensorflow, Scikit-learn, Colab, etc.)	I	4
2	Write a NumPy program to implement following operation • to convert a list of numeric values into a one-dimensional NumPy array • to create a 3x3 matrix with values ranging from 2 to 10 • to append values at the end of an array • to create another shape from an array without changing its data(3*2 to 2*3)	II	4
3	Write a NumPy program to implement following operation • to split an array of 14 elements into 3 arrays, each with 2, 4, and 8 elements in the original order • to stack arrays horizontally (column wise)	II	4
4	Write a NumPy program to implement following operation • to add, subtract, multiply, divide arguments element-wise • to round elements of the array to the nearest integer • to calculate mean across dimension, in a 2D numpy array • to calculate the difference between neighboring elements, element-wise of a given array	II	4
5	Write a NumPy program to implement following operation • to find the maximum and minimum value of a given flattened array • to compute the mean, standard deviation, and variance of a given array along the second axis	II	4

6	Write a Pandas program to implement following operation • to convert a NumPy array to a Pandas series • to convert the first column of a DataFrame as a Series • to create the mean and standard deviation of the data of a given Series • to sort a given Series	II	4
7	Write a Pandas program to implement following operation • to create a dataframe from a dictionary and display it • to sort the DataFrame first by 'name' in ascending order • to delete the one specific column from the DataFrame • to write a DataFrame to CSV file using tab separator	II	4
8	Write a Pandas program to create a line plot of the opening, closing stock prices of given company between two specific dates.	II	4
9	Write a Pandas program to create a plot of Open, High, Low, Close, Adjusted Closing prices and Volume of given company between two specific dates.	II	4
10	Write a Pandas program to implement following operation • to find and drop the missing values from the given dataset • to remove the duplicates from the given dataset	III	4
11	Write a Pandas program to filter all columns where all entries present, check which rows and columns has a NaN and finally drop rows with any NaNs from the given dataset.	III	4
12	Write a Python program using Scikit-learn to print the keys, number of rows-columns, feature names and the description of the given data.	III	4
13	Write a Python program to implement K-Nearest Neighbour supervised machine learning algorithm for given dataset.	IV	4
14	Write a Python program to implement a machine learning algorithm for given dataset. (It is recommended to assign different machine learning algorithms group wise – micro project)	V	4
	Total		**56**

Note

  i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list*.*

 ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Using the existing python libraries through Python Jupyter notebook.	30
2	Use python to read dataset and modify as per requirement.	25
3	Selecting appropriate machine learning method.	20
4	Train and test the model by importing existing data set.	15
5	Making predictions and improve learning parameters as well as improve accuracy.	10
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system with operating system: Windows 7 or higher Ver., macOS, and Linux, with 4GB or higher RAM Python versions: 2.7.X, 3.6.X	All
2	Python IDEs and Code Editors (jupyter, spyder, google colab) Open Source: Anaconda Navigator	

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.
   a) Work as a Data scientist.
   b) Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
   i.   'Valuing Level' in 1st year
   ii.   'Organization Level' in 2nd year.
   iii. 'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher-level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher-level UOs could be included by the course teacher to focus on the attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I **Introduction to machine learning**	1.1 Describe basic concept of machine learning and its applications	1.1.1 Overview of Human Learning and Machine Learning 1.1.2 Types of Machine Learning • Supervised Machine Learning • Unsupervised Machine Learning • Reinforcement Learning. 1.1.3 Applications of Machine Learning 1.1.4 Tools and Technology for Machine Learning
Unit – II **Python libraries suitable for Machine Learning**	2.1. Develop Program using Python Libraries	2.1 Numpy • Creating Array: array() • Accessing Array: by referring to its index number • Stacking & Splitting: stack(), array_split() • Maths Functions: add(), subtract(), multiply(), divide(), power(), mod() • Statistics Functions: amin(), amax(), mean(), median(), std(), var(), average(), ptp() 2.2 Pandas • Series: Series() • Dataframes: DataFrames() • Read CSV File: read_csv() • Cleaning Empty Cells: dropna() • Cleaning Wrong Data: drop() • Removing Duplicates: duplicated() • Pandas Plotting: plot() 2.3 Matplotlib • Pyplot.plot: plot() • Show: show() • Labels: xlabel(), ylabel() • Grid: grid() • Bars: bar() • Histogram: hist() • Subplot: subplot() • pie chart: pie() • Save the plotted images into pdf: savefig() 2.4 sklearn • Key concepts and features • Steps to Build a Model in Sklearn: Loading a Dataset- `read_csv()`, train_test_split- train_test_split()

| Unit – III Preparing to Model and Preprocessing | 3.1 Describe different types of Machine learning Activities
3.2 Explain Data preprocessing | 3.1.1 Machine Learning activities
• Preparing to Model
• Learning: Data Partition-*k*-fold cross validation, Model Selection
• Performance Evaluation: confusion matrix
• Performance Improvement: Ensemble
3.2.1 Types of Data
• Qualitative/Categorical Data: Nominal, Ordinal
• Quantitative/Numeric Data: Interval, Ratio
3.2.2 Data quality and remediation
• Handling outliers
• Handling missing values
3.2.3 Data Pre-Processing
• Dimensionality reduction
• Feature subset selection: Filter, Wrapper, Hybrid, Embedded |
| Unit– IV Supervised Machine Learning Models | 4.1 Define Supervised Learning
4.2 List types of Supervised Learning, Describe K-Nearest Neighbour and Simple linear regression
4.3 Advantage and disadvantage of supervised machine learning | 4.1.1 Introduction of Supervised Learning
• Brief explanation of Supervised Machine Learning
• Working of Supervised Machine learning
• Real world Applications/Examples of Supervised Machine learning
• Steps in Supervised Machine learning
4.2.1 Types of Supervised Learning
● Classification: Define Classification, list types of classification, list types of Machine learning classification algorithms (list linear models, nonlinear models), list use cases of classification algorithms. **K-Nearest Neighbour (K-NN) :** Working of K-NN, Need of KNN algorithm, steps of working of K-NN, Select value of K, advantage and disadvantage of K-NN algorithm
● Regression: Define Regression analysis, list types of regression analysis, list real world examples of regression analysis **Linear regression:** List types of linear regression, mathematical equation of linear regression, diagram of |

		linear regression line (positive, negative) **Simple linear regression** : (Description, objective, demonstrate example of salary prediction using python) (Steps: Prepare dataset, split data set into training and testing set, visualize training data set and testing data set, i.e. plot it, initialize the training set and fitting it using training set, Predict) list applications of linear regression 4.3.1 Advantage and disadvantage of supervised machine learning
Unit– V Unsupervised Machine Learning Models	5.1 Define Unsupervised Learning 5.2 List types of Unsupervised Learning 5.3 Differentiate Supervised and Unsupervised Learning	5.1.1 Introduction of Unsupervised Learning • Brief explanation of unsupervised Machine Learning • Need of unsupervised learning • Working of unsupervised learning • Real world examples of unsupervised Learning • List unsupervised learning algorithms 5.2.1 Types of Unsupervised Learning • Clustering: Definition, list clustering methods, list real world applications/examples (fruits, vegetables, computer devices (input and output etc)), ● Association: Definition, list association methods, list real world applications/examples ● Advantage and Disadvantage of unsupervised learning algorithm 5.3.1 Differentiate Supervised and Unsupervised Learning

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

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 machine learning	06	4	4	4	12

II	Python libraries suitable for Machine Learning	09	3	4	7	14
III	Preparing to Model and Preprocessing	09	6	6	4	16
IV	Supervised Machine Learning Models	10	5	7	4	16
V	Unsupervised Machine Learning Models	08	5	4	3	12
Total		**42**	**23**	**25**	**22**	**70**

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

Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from the 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)   Explore different data repositories and register for ML based competitions on platforms like Kaggle
b)   Enroll in an online Course related to ML based
c)   Undertake micro-projects in teams
d)   Give a seminar on any relevant topics
e)   Collect various sensor data from smart phones and apply machine learning approach

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

a)   Massive open online courses (**MOOCs**) may be used to teach various topics/subtopics.
b)   Guide student(s) in undertaking micro-projects.
c)   *'L' in section No. 4*means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d)   About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
e)   With respect to **section No.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
f)   Guide students for open-source python editors.

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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Project idea 1:** Breast Cancer Prediction: This machine learning project uses a dataset that can help determine the likelihood that a breast tumor is malignant or benign. You can build a classification model for this project.
- **Project idea 2:** Loan Prediction: The idea behind this ML project is to build a model that will classify how much loan the user can take. It is based on the user's marital status, education, number of dependents, and employments. You can build a linear model for this project.
- **Project idea 3:** Stock Price Prediction: This machine learning beginner's project aims to predict the future price of the stock market based on the previous year's data.
- **Project idea 4:** Phishing: Create a Python program that can predict if a URL is legitimate. Teach a computer to recognize phishing web links.
- **Project idea 5:** Titanic survived Prediction: This will be a fun project to build as you will be predicting whether someone would have survived if they were in the titanic ship or not.
- **Project idea 6:** BigMart Sales Prediction: BigMart sales dataset consists of 2013 sales data for 1559 products across 10 different outlets in different cities. The goal of the BigMart sales prediction ML project is to build a regression model to predict the sales of each of 1559 products for the following year in each of the 10 different BigMart outlets.
- **Project idea 7:** Wine Quality Test: It will use the chemical information of the wine and based on the machine learning model, it will give you the result of wine quality.
- **Project idea 8:** Data from leading music service can be taken to build a better music recommendation system.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Machine Learning	Saikat Dull, S. Chjandramouli	Das, Pearson
2	Machine Learning Using Python	Pradhan Manaranjan, U Dinesh Kumar	Wiley India Pvt. Ltd
3	Introduction to Machine Learning	Jeeva Jose	Khanna Publishers

4	Machine Learning in Action	Peter Harrington	Manning , dreamtech press
5	Machine Learning_ Step-by-Step Guide To Implement Machine Learning Algorithms with Python.	Rudolph Russell	Rudolph Russell Publications
6	Machine Learning with Python Cookbook_ Practical Solutions from Preprocessing to Deep Learning.	Chris Albon	O'Reilly Media, Inc.

14.   SOFTWARE/LEARNING WEBSITES

a.   https://www.geeksforgeeks.org/machine-learning/
b.   https://www.tutorialspoint.com/machine_learning_with_python/index.htm
c.   https://www.javatpoint.com/machine-learning
d.   https://nptel.ac.in/
e.   https://www.coursera.org/
f.   https://scikit-learn.org/
g.   https://www.w3resource.com/python-exercises/pandas/index.php
h.   https://machinelearningforkids.co.uk/
i.   https://monkeylearn.com/machine-learning/
j.   http://appinventor.mit.edu/explore/ai-with-mit-app-inventor

15.   PO-COMPETENCY-CO MAPPING

Semester II	Introduction to Machine Learning (Course Code: 4350702)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Manage ment	PO 7 Life-long learning
Competency Students acquire the ability to assess and analyze outcomes produced by machine learning algorithms and models, while enhancing their capacity for critical thinking in addressing practical challenges.							
Course Outcomes CO a) Describe basic concept of machine learning and its applications	2	-	-	2	-	1	1
CO b) Practice Numpy, Pandas, Matplotlib, sklearn library's inbuilt function required to solve machine learning problems	2	1	2	2	-	1	1
CO c) Use Pandas library for data preprocessing	1	2	2	2	-	1	1
CO d) Apply supervised learning algorithms based on dataset characteristics	2	2	2	2	1	1	1

CO e) Apply unsupervised learning algorithms based on dataset characteristics	2	2	2	2	1	1	1

Legend: '**3'** for high, '**2'** for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Contact No.	Email
1	Ms. Manisha P. Mehta HOD	Government Polytechnic Himatnagar	9879578273	manishamehtain@gmail.com
2	Ms. Jasmine J. Karagthala Lecturer	Government Polytechnic for Girls, Ahmedabad	9824799620	jdaftary@gmail.com
3	Miss. Kumundrini B. Prajapati Lecturer	Government Polytechnic Gandhinagar	9974543026	kumundrini13187@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Mobile Application Development using Android
(Course Code: 4350703)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1.   RATIONALE

Smartphones and mobile applications have grown in popularity in recent years. This trend is expected to continue, resulting in an increased demand for professionals who can create mobile applications. Android mobile application development is a relevant and important topic for computer engineering students because it allows them to apply their programming skills and knowledge to create real-world applications. The course provides students with hands-on experience in developing mobile applications using Android. This practical experience is essential for students to be able to apply the concepts they have learned in a real-world setting. This course will help students to build core competencies in mobile application development with relevant skills and knowledge, practical experience, and career opportunities in a growing and dynamic industry.

2.   COMPETENCY

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

- **Create effective Android Mobile Applications using standard technologies and innovative problem-solving skills.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with this competency are to be developed in the student to display the following Course Outcomes (COs):

CO1. Develop Android applications using Android application Components and Life Cycle of Activity after setting up Android Development Environment.
CO2. Design Activity using Layouts and Widgets.
CO3. Apply Event Handling in Android application to perform user actions.
CO4. Develop Android Applications using Menu, Dialog, and Databases.
CO5. Develop Android applications using Kotlin Language.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA*	ESE	CA	ESE	

-	-	4	2	-	-	25	25	50

(*): For this practical only course, 25 marks under the practical CA has two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. 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, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Set-up of Android development environment, managing AVD and understanding its various components.	I	02
2	Understanding of Various Components available in Android Application	I	02
3	Develop a "Hello World" Application in Android and understand the structure of an Android Application	I	02
4	Develop Android Application to demonstrate methods of Activity Life Cycle.	I	02
5	Design Android Activities using LinearLayout, RelativeLayout, GridView, FrameLayout, and ConstraintLayout	II	06
6	Design various Activities using different Layouts and available Widgets(TextView, EditText, Button, RadioButton, CheckBox, ImageButton, ToggleButton, TimePicker, DatePicker, ProgressBar, ImageView) to make the user-friendly GUI.	II	04
7	Develop code to demonstrate different ways of Handling different events (onClick, onLongClick etc.) over Button, EditText etc. to perform action in Android application at run-time.	III	04
8	Develop code to demonstrate Event handling of CheckBox and RadioButton selection.	III	02
9	Develop code to navigate between different activities and pass the data from one activity to other activity using Intent.	III	02
10	Develop an android application to store data locally using SharedPreferences and access-modify in different activities.	III	02
11	Develop the code to implement the ListView and the Spinner views, perform add, update, remove items operations and implement the item selection event handling over ListView and Spinner for appropriate example.	III	04

12	Develop the code to manage Permission using Manifest file and run time from Activity, and toggle state of WiFi and Bluetooth.	III	02
13	Develop android applications to demonstrate user interaction with the application using Options Menu, Context Menu and Popup Menu.	IV	04
14	Develop Android Applications to demonstrate different AlertDialogs and the Custom Dialog.	IV	04
15	Develop Android Application for local database connectivity and performing basic database operations (select, insert, update, delete) using SQLiteDatabase and SQLiteOpenHelper Classes	IV	04
17	Develop an Android Application to demonstrate the use of RecyclerView and CardView for displaying list of items with multiple information	IV	04
18	Develop a simple application to display "Hello <Application Name>" using Kotlin	V	02
19	Develop an android application using Kotlin having a Button "Click" and upon clicking on that Button a Toast message "Button Clicked" should be displayed on screen through Toast Message	V	02
20	Publish an Android Application on Play Store	V	02
*	**Total**		**56**

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.***

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Analyze the problem statement and propose/design the solution of the problem through the program	20
2	Correctness of the Program	30
3	Effective utilization of different components and various properties to generate Quality output.	20
4	Readability and Documentation of the Program	20
5	Answering various questions regarding the concept of the program	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with Windows/Linux/Unix Operating System	All
2	Android Studio	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.

a) Work as an Android Application Developer.
b) Demonstrate working as a team leader/member.
c) Apply good Coding Practices using Coding Standards and Documentation.

The ADOs are best developed through laboratory exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.   'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

9.   UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher-level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher-level UOs could be included by the course teacher to focus on the attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I **Basics of Android Development**	1.1 Understand the features of Android 1.2 Set up Android Development environment 1.3 Develop simple 'Hello World' Android Application 1.4 Demonstrate the Activity Life cycle	1.1.1 Android: An Open Platform for Mobile Development 1.1.2 Android SDK Features 1.1.3 Introducing the Open Handset Alliance 1.1.4 Introducing the Development Framework 1.2.1 Setting up Android Development Environment: ● Downloading and installing Android Studio ● Downloading and Installing the Android SDK ● Creating AVD ● Installing USB drivers and setup Developer modes in Android Device 1.3.1 Develop "Hello World" Android Application 1.4.1 Components of Android Application 1.4.2 Activity Life cycle

Unit – II Modelling GUI Using Android	2.1 Design the Activity using Layouts. 2.2 Use of views for designing activity.	2.1.1 Understanding the Views and ViewGroups 2.1.2 Layouts: ● LinearLayout ● RelativeLayout ● GridView ● FrameLayout ● ConstraintLayout 2.1.3 ScrollView and HorizontalScrollView 2.1.4 Units of Measurement: dp, sp, pt, px, in etc. 2.2.1 Basic Views: ● TextView, Button, ImageButton, ImageView, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup ● ProgressBar, Slider, RatingBar ● AutoCompleteTextView ● TimePicker, DatePicker ● ListView ● Customizing the ListView ● Spinner View
Unit– III Event Handling in Android Application	3.1 Implement User Event handling on Views 3.2 Implement the Intent for navigation between different activities 3.3 Use the shared preferences for storing user information 3.4 Understanding of Service Life cycle 3.5 Manage permissions	3.1.1 Handling User Events 3.1.2 OnClickListener of Views 3.1.3 OnLongClickListener 3.1.4 TextWatcher to handle the EditText text change 3.1.5 CheckBox, RadioButton selection event handling 3.1.6 ListView, Spinner item selection event handling 3.2.1 Navigating between Activities using Intent 3.2.2 Passing the information through Intents between Activities 3.3.1 Use of SharedPreferences to store the information 3.4.1 Demonstration of Service in Android Application 3.5.1 Permission manager 3.5.2 Toggle state of Bluetooth and WiFi

Unit– IV Dialog, Menu and Database with RecyclerView and CardView	4.1 Develop menu based android application 4.2 Design the Dialog for user interaction in android application. 4.3 Perform Database operation on local SQLite database. 4.4 Implement RecyclerView and CardView for displaying list of items	4.1.1 Working with Menu in Android Application: ● Options Menu ● Context Menu ● Popup menu 4.2.1 Working with Dialogs 4.2.2 Exploring the Different Types of Dialogs 4.2.3 Custom Dialog design 4.3.1 Databases in Android ● Introducing SQLite ● Cursors and Content Values ● Working with Android Databases ● SQLiteDatabase and SQLiteOpenHelper Class for database operations 4.4.1 Use of RecylerView and CardView
Unit– V Introduction to Android Development using Kotlin	5.1 Develop simple Kotlin program 5.2 Perform basic Event handling 5.3 Publish the application on Play Store	5.1.1 Introduction to Kotlin for Android development 5.1.2 Simple Kotlin program for 'Hello World' 5.2.1 Event handling in Kotlin programming 5.3.1 Building the signed APK 5.3.2 Publishing the application on Play Store

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

10.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Practical Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Android Development	08				
II	Modelling GUI Using Android	10				
III	Event Handling in Android Application	16	**NOT APPLICABLE**			
IV	Dialog, Menu and Database with RecyclerView and CardView	16				
V	Introduction to Android Development using Kotlin	06				
Total		**56**				

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and formulate test items to assess the attainment of the UOs.*

11.   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) Undertake a Micro-project to design/develop an Android Application for some real problem definition using latest design standards.
  b) Give a seminar on any relevant topics.
  c) Undertake NPTEL online course **Android Mobile Application Development** https://onlinecourses.swayam2.ac.in/nou21_ge41/preview ,
  d) Undertake Coursera online course **Android App Development Specialization** https://www.coursera.org/specializations/android-app-development

12.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

  a) Massive open online courses (**MOOCs**) may be used to teach various topics/subtopics.
  b) Guide student(s) in undertaking micro-projects.
  c) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature are to be given to the students for **self-learning**, but to be assessed using different assessment methods.
  d) With respect to **section No.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
  e) Guide students for using Android Studio for android development and also guide to setup Developer mode option in their Android Devices.

13.   SUGGESTED MICRO-PROJECTS

Only one micro-project shall be planned to be undertaken by a group of students that may be assigned to him/her at 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 preferably be **individually** undertaken to build up the skill and confidence in every student to become a problem solver so that she/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 a dated work diary consisting of individual contributions to the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Project idea 1 – College Information App:** Design and develop an Application for College information and student-related interaction.
- **Project idea 2 – Admission Procedure information App:** Design and develop an Application for the State level Admission Committee Procedure information application.
- **Project idea 3 – E-commerce:** Design and develop an E-commerce Application.

14.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Beginning Android™ Application development	Wei-Meng Lee	Wiley Publishing, Inc.
2	Android Programming with Kotlin for Beginners	John Horton	Packt Publishing Ltd.
3	Headfirst Android Development: A Brain-Friendly Guide 1st Edition	Dawn Griffiths	O'Reilly Media, Inc.
4	Professional Android Application Development	Reto Meier, Ian Lake	Wrox Publication

15.   SOFTWARE/LEARNING WEBSITES

a. https://www.geeksforgeeks.org/introduction-to-android-development/
b. https://www.tutorialspoint.com/android/index.htm
c. Android Mobile Application Development Course on https://nptel.ac.in/ and https://onlinecourses.swayam2.ac.in/
d. Android App Development Courses on https://www.coursera.org/
e. Android Basics in Kotlin https://developer.android.com/courses/

16.   PO-COMPETENCY-CO MAPPING

Semester II	Mobile Application Development (Course Code: 4350704)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency Develop an Android Application to solve real-world problems.							
Develop Android applications using Android application Components and Life Cycle of Activity after setting up Android Development Environment.	3	1	2	3	-	-	3
Design Activity using Layouts and Widgets.	3	2	3	2	-	2	3
Apply Event Handling in Android application to perform user actions.	3	3	3	3	-	3	3
Develop Android Applications using Menu, Dialog, and Databases	3	3	3	2	-	2	3

Develop Android applications using Kotlin Language.	3	2	3	2	-	2	3

Legend: '**3**' for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE
GTU Resource Persons:

Sr.	Name and Designation	Institute	Email
1	Mr. Paraskumar J. Joshi, Lecturer, Dept of Computer Engineering	K D Polytechnic, Patan	joshiparas@gmail.com
2	Mr. Mayurkumar R. Thakkar, Lecturer, Dept of Computer Engineering	K D Polytechnic, Patan	mayurthakkar.er@gmail.com
3	Mr. Niraj R. Trivedi, Lecturer, Computer Engineering Dept.	A. V. Parekh Technical Institute, Rajkot	niraj.trvd@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Internship Project
(Course Code: 4350704)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1.   RATIONALE

Computer Engineering is emerging field that changes rapidly. New technologies are replacing older one very quickly whose effects can be seen in our society. Internship Project is a opportunity for the students to get flavor of such emerging technology and familiar with industry environment to identify scope as well as focus of their career development path. The main objective of the internship is to get hands-on practice. In turn it will help students to lay down a path for their further professional career by observing, understanding, adopting mechanism of working in the industry. Students will also develop various types of skills by pursuing the internship project programme.

The duration of internship will be six weeks. It will be after completion of 4th Semester and in the beginning of the commencement of Semester 5th. Any options from following can be chosen by the students:

1. Internship in the industry - The student is suggested to select branch-specific training in the IT or relevant Industry where they learn the skills. The student shall produce a joining letter in the beginning and relieving letter after the completion of the internship. It is desirable to do the internship offline. In the case of the online conduction mode, the student has to submit supporting evidence in the form of a screenshot and activity log report of the conducted session along with other necessary documents.

2. Project – If student is not able to carry internship in the industry, student may develop a project on topic related to respective computer engineering branch under faculty guidance. Additionally, Institute/ department may arrange technical sessions/ workshops from industry experts to give exposure to students about recent technologies and tools. It can be fabrication / experimental results/ simulations/ Application development / Design and / or Analysis of System(s) etc. related to the emerging technologies of the Computer/IT.

Students needs to report at institute every 15 days about progress to internal guide in suggested reporting format which is given in syllabus and represent his/her work carried out for monitoring and evaluation purpose.

2.   COMPETENCY

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

- **Develop effective programming skills, problem-solving abilities, and technical knowledge to solve challenge innovatively while gaining hands-on experience for professional development opportunities.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The student will develop underpinning knowledge, adequate programming skills of competency for implementing various applications using tools and technologies to attain the following course outcomes.

a) Apply acquired knowledge to solve domain related societal problems.
b) Develop effective communication within academic and industrial environments.
c) Utilize industry-standard tools as well as technologies to design, develop, and test the systems.
d) Apply problem-solving skills to resolve technical issues encountered in IT Industry.
e) Develop life-long learning skills for a successful professional career.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	6	3	0	0	50	50	100

1. **Internship in industry:** CA Assessment will be carried out based on submitted progress card by Industry resource person, Institute resource person and ESE Assessment will be carried out by Examiner.
2. **Project:** CA and ESE Assessment will be carried out based on project work by institute resource person(s) and Examiner.

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

List of Documents to be prepared for Submission:

1. Student has to submit Work Report Sheet duly signed by industry resource person and internal guide fortnightly (suggested format given in syllabus).
2. Student Attendance Sheet Report (suggested format given in syllabus) duly signed by industry resource person. In the case of the online internship, student has to take screenshot of daily attended session in softcopy and submit to institute resource person by email for every 15 days.
3. Detailed report of said work approved and duly signed by the institute and/or industry resource person.
4. A softcopy of Presentation approved by the institute and/or industry resource person.

5. A Poster showing overall work carries out during the Internship project approved by institute and/or industry resource person.

Note: Faculty should counsel as well as inform students in advance about the internship or project. Student needs to finalize training from industry or project at institute before commencement of 5th semester and report at institute.

Internship Project Registration Form

Note: Students needs to submit this registration form after finalize mode of internship and before starting of internship project.

Student Details													
Enrollment Number													
Student Name													
Student Details	Mobile Number:												
	Email Address:												
Branch													
Code and Name of the Institute													
Mentor Details (Institute)	Name:												
	Designation:												
	Mobile No:												
	Email Address:												
Industry Details	Name:												
	Address:												
	Email:												
	Phone:												
	Website:												
Mentor Details (Industry)	Name:												
	Designation:												
	Mobile No:												
	Email Address												
Mode of Internship Carried Out	Internship in industry (offline/online mode) / Project at institute												
Title of the Project / Internship Carried Out													
Nature of Work Carried Out	Web Design / Application development (Web / Mobile), Experimental results/ simulations/Analysis of System(s) etc. Other please Specify_____												

Student Signature   Faculty Signature

Internship Project -Suggested Letter for Completion

[Company /Institute/
Department letter head]

No: Date

TO WHOM SO EVER IT MAY CONCERN

This   is   to   certify that, Mr. / Mrs. _____

Enrollment No._____ Student of _____

Has successfully completed a six-week Internship in the field of_____

From the date:_____ to date: _____

[90% Attendance is mandatory for completion of Internship]

During the period of his/her internship project with us, He / She were exposed to following different processes and were found sincere and hardworking.

1. _____

2. _____

3. _____

4. _____

Resource Person Signature with stamp

SUGGESTED 15 DAYS WORK SHEET REPORT

Student Name :	
Enrollment No:	
Internship/Project Title	
Tools and Technologies	
Company/ Organization Name	

Student's Activity Details:

Week Number	Start Date to End Date	Tasks to be assigned	Tasks to be completed	Remarks

Signature of Industry Person

[TO BE FILLED BY INTERNAL GUIDE/FACULTY ONLY]

Any Suggestion/Remarks:

Signature of Institute Resource/Faculty

<div align="center">**SUGGESTED STUDENT ATTENDANCE SHEET REPORT**</div>

ORGANIZATION INFORMATION

Organization Name	
Organization Address	
Organization Email ID	

STUDENT INFORMATION

Name of Student :			
Enrollment NO :		Name of Course:	
Date of Commencement of training:		Date of Completion of Training	
Internship/ Project Title			

Student's Attendance Sheet

Week No	Day of week (- >)	Day1	Day2	Day3	Day4	Day5	Day6	COUNT (present day)
Week 1	Date							
	PR/AB							
Week 2	Date							
	PR/AB							
Week 3	Date							
	PR/AB							
Week 4	Date							
	PR/AB							
Week 5	Date							
	PR/AB							
Week 6	Date							
	PR/AB							
Total Count of student's presents during internship								
Total Working days of company during internship								
Student's percentage present during internship								

NOTE :
1. Attendance sheet should be submitted after completion of training to internal guide of institute/department.
2. Holidays should be marked in RED INK.
3. Absent should be marked as "AB" in RED INK.

Signature of Industry resource person with Industry stamp/seal :
Name of Industry internship person:
Contact No of Industry resource person :

5.   AFFECTIVE DOMAIN OUTCOMES

The following affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs. More could be added to fulfill the development of this course competency.

  a) Work as a leader/a team member as role of Engineer.
  b) Practice environmentally friendly methods and processes.
  c) Follow safety precautions and ethical practices.

6.   SUGGESTED STUDENT ACTIVITIES

Following are the suggested student-related curricular, co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities and prepare reports and give presentation in front of students and faculty members. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

  a) Perform various tasks given by industry resources person during internship project.
  b) Perform various tasks required to complete project work under guidance of faculty member.
  c) Internship project interns are required to give a presentation to the review committee consisting of a group of academic staff members.
  d) The review committee gives feedback and suggests possible improvements in the work.
  e) At the end of the program all the Internship project interns make a poster presentation of the work carried out. The poster presentation is open to the public. It is also evaluated by faculty members.
  f) A completion certificate will be issued to all Internship project interns only after the completion of internship tenure.

7.   REFERENCE/LEARNING WEBSITES
  - AICTE Internship Policy.pdf (aicte-india.org)
  - https://internshala.com
  - https://swayam.gov.in
  - https://nptel.ac.in
  - https://neat.aicte-india.org
  - https://www.edx.org
  - https://www.coursera.org
  - https://www.udemy.com

8.   PO-COMPETENCY-CO MAPPING

Semester V	Internship/Project (Course Code: 4350706)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency •Develop effective programming skills, problem-solving abilities, and technical knowledge to solve challenge innovatively while gaining hands-on experience for professional development opportunities.							
Course Outcomes a) Apply acquired knowledge to solve domain related societal problems.	2	2	1	2	1	1	1
b) Develop effective communication within academic and industrial environments.	1	1	1	1	1	1	1
c) Utilize industry-standard tools and technologies to design, develop and test systems.	2	2	2	3	-	1	1
d) Apply problem-solving skills to resolve technical issues encountered in IT Industry.	2	3	2	1	1	-	1
e) Develop life-long learning skills for a successful professional career.	1	1	1	1	-	-	2

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

9.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Email
1	Alpeshkumar R. Thaker	GP, Ahmedabad	alpeshrthaker@gmail.com
2	Umang D. Shah	GP, Ahmedabad	umang.shah111gp@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Fundamentals of Artificial Intelligence
(Course Code: 4350705)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1.   RATIONALE

Artificial intelligence is an expansive branch of computer science that focuses on building smart machines. Thanks to AI, these machines can learn from experience, adjust to new inputs, and perform human-like tasks. AI is more popular than ever today due to increased data volumes, advancements in computing and storage and advanced algorithms. We encounter several examples of artificial intelligence in our daily lives. From Netflix's movie recommendation to Amazon's Alexa, we now rely on various AI models without knowing it. Hence, every student of Computer Engineering must therefore understand the blue prints of artificial intelligence and must be able to apply AI on available data. This course will help students to build up core competencies in understanding different concepts of AI.

2.   COMPETENCY

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

● **Conceptualize the basic ideas and techniques underlying the design of AI systems.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

a) Identify different AI techniques and its applicable areas.
b) Classify different problem characteristics and algorithms for AI
c) Illustrate the issues in knowledge representation and the use of resolution procedures for solving AI problems
d) Illustrate the components, development phases and applications of Expert Systems
e) Perform case studies on different available AI systems

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	2	4	30	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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, **CA** -Continuous Assessment; **ESE** -End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the subcomponents of the COs. . . . These PrOs need to be attained to achieve the COs.

Sr. No.	Practical Outcomes (PrOs)	Unit	Approx. Hrs.
1	Study about NumPy library of Python.	1	1
2	Study about Scikit library of Python.	1	1
3	Study about Panda library of Python.	1	1
4	Develop a program that read rules from the rules file and acts accordingly for given user input. For this, create a text file of five rules of any situation and ask the user to give input and according to the rules give the response.	2	2
5	Read data from a CSV file using panda library.	2	1
6	Write a python program to generate Calendar for the given month and year?	2	1
7	Write a python program to implement Breadth First Search Traversal?	2	2
8	Write a program to implement Tic-Tac-Toe game using python.	2	2
9	Perform math functions using NumPy library.	3	2
10	Identify the missing values from given CSV file.	3	2
11	Write a program to identify the noisy value of the age data set.	3	2
12	Write a python program to implement simple Chatbot	3	2
13	Write a python program to remove stop words for a given passage from a text file using NLTK?	4	2
14	Write a python program to for Text Classification for the give sentence using NLTK?	4	2
15	Study about how to asking ChatGPT to Write Complex Algorithms	5	2
16	Study about Movie recommendation based on emotion in Python	5	2
	Total		28

Note

 i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.***
ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Analyze given problem and find possible solution methods	25
2	Select appropriate algorithm/method to solve the problem	10
3	Use python libraries to implement solution	25
4	Test the model solution by different data sets	20
5	Making predictions and improve learning parameters as well as improve accuracy.	20
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system with operating system: Windows 7 or higher Ver., macOS, and Linux, with 4GB or higher RAM, Python versions: 2.7.X, 3.6.X	All
2	Python IDEs and Code Editors Open Source: Anaconda Navigator	

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.
   a) Work as a Data scientist.
   b) Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
   i.   'Valuing Level' in 1st year
   ii.   'Organization Level' in 2nd year.
   iii. 'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher-level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher-level UOs could be included by the course teacher to focus on the attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
Unit – I Introduction to artificial intelligence	1a. Describe different AI techniques 1b. Summarize applications of AI	1.1 The AI Problem 1.2 The Underlying Assumption 1.3 AI Techniques 1.4 The level of model 1.5 Criteria for success 1.6 Application of AI
Unit – II State Space Search and Heuristic Technique	2a. Discuss different problem characteristics for solving AI problems 2b. Illustrate algorithms to solve AI problems	2.1 Solving problems as state space search 2.2 Production system 2.3 Problem characteristics 2.4 Depth First Search 2.5 Breadth-First Search 2.6 Heuristic function 2.7 Hill climbing 2.8 Best First Search
Unit– III Knowledge Representation	3a. Explain different issues in Knowledge Representation 3b. Compare Forward and Backward Reasoning 3c. Use resolution procedures to solve AI problems	3.1 Knowledge Representation 3.2 Issues in Knowledge Representation 3.3 FIRST ORDER LOGIC 3.4 Computable function and predicates 3.5 Forward/Backward reasoning 3.6 Unification and Lifting 3.7 Resolution procedure 3.8 Logic programming
Unit– IV Expert System	4a. Describe the basic building blocks and development phases of the Expert System 4b. Discuss the importance of knowledge acquisition for Expert System	4.1 Expert System 4.2 Building Blocks of Expert System 4.3 Development phases of Expert System 4.4 Expert System-shell 4.5 Explanations 4.6 Knowledge Acquisition 4.7 Application of the expert system
Unit– V AI Case Studies	5a. Perform case studies on different available AI systems	5.1 Chatbots 5.2 ChatGPT 5.3 Recommendation Algorithm 5.4 Digital (Voice) Assistant 5.5 Virtual Face Filters

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

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 artificial intelligence	08	04	06	04	14
II	State Space Search and Heuristic Technique	12	06	08	04	18
III	Knowledge Representation	08	04	06	04	14
IV	Expert System	08	04	06	04	14
V	AI Case Studies	06	02	06	02	10
	Total	**42**	**20**	**32**	**18**	**70**

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

<u>***Note***</u>*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from the 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) Explore different algorithms and methods to solve AI problems.
   b) Undertake micro-projects in teams
   c) Give a seminar on any relevant topics.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
   a) Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
   b) Guide student(s) in undertaking micro-projects.
   c) ***'L' in section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
   d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
   e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
   f) Guide students for open-source python editors.

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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Resume Parser**
- **Chatbots**
- **Animal Species Prediction System**
- **Object Detection System**
- **Facial Emotions Recognition System**
- **Autocorrect Tool**

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Artificial Intelligence, 3rd ed	Elaine Rich, Kevin Knight, Shiv Shankar B Nair	TMH (Tata McGraw Hill)
2	A First Course in Artificial Intelligence	Deepak Khemani	TMH (Tata McGraw Hill)
3	Artificial Intelligence: A Modern Approach, 2nd ed	Stuart Russell and Peter Norvig	Pearson
4	Introduction to Artificial Intelligence and Expert Systems	Dan W. Patterson	PHI (Prentice Hall of India)

14.   SOFTWARE/LEARNING WEBSITES

a.   https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
b.   https://www.tutorialspoint.com/artificial_intelligence/index.htm
c.   https://www.britannica.com/technology/artificial-intelligence
d.   https://nptel.ac.in/

e.   https://www.coursera.org/
f.   https://scikit-learn.org/

15.   PO-COMPETENCY-CO MAPPING

Semester V	Fundamentals of Artificial Intelligence (Course Code: 4350705)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ developm ent of solutions	PO 4 Engineerin g Tools, Experimen tation &Testing	PO 5 Engineeri ng practices for society, sustainab ility & environm ent	PO 6 Projec t Manag ement	PO 7 Life- long learni ng
Competency Conceptualize the basic ideas and techniques underlying the design of AI systems.							
Course Outcomes CO a) Identify different AI techniques and its applicable areas.	2	-	-	-	-	-	3
CO b) Classify different problem characteristics and algorithms for AI	2	2	3	3	-	2	3
CO c) Illustrate the issues in knowledge representation and the use of resolution procedures for solving AI problems	2	3	3	3	-	2	3
CO d) Illustrate the components, development phases and applications of Expert Systems	2	2	2	2	-	2	3
CO e) Perform case studies on different available AI systems	2	3	3	3	-	3	3

Legend: '**3**' for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Email
1	Mrs. Manisha P. Mehta – Head (Comp)	Government Polytechnic Himmatnagar	manishamehtain@gmail.com
2	Mr. Sanjay A. Valaki – Lect. (Comp)	Government Polytechnic Himmatnagar	sanjay.valaki@gmail.com
3	Mr. Hardik N. Talsania - Lect. (Comp)	R. C. Technical Institute Ahmedabad	hardik.n.talsania@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Advanced Computer Network
(Course Code: 4350706)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1. RATIONALE

In today's interconnected world, computer networks form the backbone of communication and information exchange between individuals, businesses, and organizations. As the demand for faster and more efficient network communication continues to increase, there is a need for professionals who can design, implement, and manage computer networks. This course on Advanced Computer Networks will focus on various concepts and protocols of computer networks. Students will learn about IPv4, IPv6 and its features, routing protocols like RIP, OSPF and BGP, and Transport Layer Protocols like TCP, UDP and SCTP. They will also gain knowledge about Application Layer Protocols such as HTTP, SMTP, POP3, IMAP4, and DNS. The course will provide hands-on experience in configuring and managing network infrastructures, troubleshooting network issues, and analyzing network traffic. Upon completion, students will be equipped with the skills and knowledge to design, implement, and manage advanced computer networks with a strong understanding of network, transport and application layers concepts and protocols.

2. COMPETENCY

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

- **Configure network using different network, transport, and application layer protocols of TCP/IP protocol stack.**

3. COURSE OUTCOMES (COs)

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

a) Configure a computer network using IPv4 protocol.
b) Configure a computer network using IPv6 protocol.
c) Choose unicast routing protocols to implement routing in the given computer network.
d) Compare features, formats, and applications of various transport layer protocols.
e) Use various application layer protocols in the network configuration.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	2	4	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	a) Rewrite the following IP addresses in binary notation 192.168.12.79 156.152.187.189 172.16.12.11 10.159.187.198 b) Rewrite the following IP addresses in dotted decimal notation 11000000.10101000.00111000.00001100 10101001.00001100.00001011.01001111 00001010.10111011.00001100.01111011 01111101.10111011.11100000.11111111 c) Consider the following IP addresses 214.229.206.83/28 153.120.147.39/26 115.173.104.1/18 70.173.166.71/1 Find the following for each above IP address 1. Network Address 2. First Host Address	1	2

	3. Last Host Address 4. Broadcast Address 5. Next Subnet Address d) An organization is granted block 212.18.190.0/24. The administrator wants to create 32 subnets. 1. Find the subnet mask. 2. Find the number of addresses in each subnet. 3. Find the first and last address in subnet 1 4. Find the first and last address in subnet 32.		
2	a) Investigate IP protocols by capturing and studying IP datagrams using Wireshark b) An IP datagram has arrived with the following partial information in the header (in hexadecimal): 45000054 00030000 2006... What is the header size? Are there any options in the packet? What is the size of data? Is the packet fragmented? How many more routers can the packet travel to? What it the protocol number of the payload being carried by the packet?	1	2
3	Capture and study ICMPv4 packets generated by Other utility programs such as ping and traceroute using relevant software	1	2
4	Create a small IPv4 static routing network using relevant software.	1	2
5	Create a small IPv6 network using any relevant software.	2	2
6	Configure RIP routing protocol using relevant software.	3	2
7	Configure OSPF routing protocol using relevant software.	3	2
8	Configure BGP routing protocol using relevant software.	3	2
9	a) The following is a dump (contents) of a UDP header in hexadecimal format. 0045DF0000580000 a. What is the source port number? b. What is the destination port number? c. What is the total length of the user datagram? d. What is the length of the data? e. Is the packet directed from a client to a server or vice versa? f. What is the application-layer protocol? g. Has the sender calculated a checksum for this packet? b) The following is part of a TCP header dump (contents) in hexadecimal format.	4	2

	E293 0017 00000001 00000000 5002 07FF.. a. What is the source port number? b. What is the destination port number? c. What is the sequence number? d. What is the acknowledgment number? e. What is the length of the header? f. What is the type of the segment? g. What is the window size? c) The following is a dump of an SCTP general header in hexadecimal format. 04320017 00000001 00000000 a. What is the source port number? b. What is the destination port number? c. What is the value of the verification tag? d. What is the value of the checksum?			
10	Capture and Study TCP and UDP Packets using relevant software.	4	2
11	Configure Dynamic Host Configuration Protocol using relevant software.	5	2
12	a) Configure Domain Name Server (DNS) using relevant software. b) Configure Web Server using relevant software.	5	2
13	Configure File Transfer Protocol (FTP) using relevant software.	5	2
14	Configure Mail Server Using relevant software.	5	2
	Total		**28**

Note

i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.**

ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Completion of given task	25
2	Correctness of the given task	30
3	Question & Answers	25
4	Regularity of report submission	20
	Total	**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure the proper conduct of practicals in all institutions across the state in a proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO S.No.
1	Computer System with basic configuration and connected with LAN and Internet.	2 to 8, 10 to 14
2	Wireshark or any other similar software to capture and investigate packets.	2, 3 and 10
3	Cisco Packet Tracer or any other similar software.	4,5,6,7,8 and 11 to 14

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs More could be added to fulfill the development of this competency.

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

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

   i.   'Valuing Level' in 1st year
   ii.   'Organization Level' in 2nd year.
   iii. 'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher-level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher-level UOs could be included by the course teacher to focus on the attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-1 Network Layer Protocols	1.a Explain classful and classless IP addressing.	1.1 **Introduction** - Network layer protocols

	1.b Solve various problems related to subnetting and supernetting. 1.c Explain Network Address Translation. 1.d Explain forwarding of IP packets based on destination address. 1.e Explain significance of the fields of IPv4 Datagram format. 1.f Explain ICMPv4 protocol.	1.2 **IPV4 Addresses** - Address space, Classful addressing, Classless addressing, Network Address Resolution (Translation). 1.3 **Forwarding of IP Packets**- Forwarding based on destination address. 1.4 **Internet Protocol**-Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. 1.5 **ICMPv4**-Messages, Debugging tools, ICMP checksum.
Unit-2 **Next Generation IP**	2.a Compare IPv4 and IPv6 2.b Classify Binary and Hexadecimal representation of IPv6 address. 2.c Explain address space allocation of IPv6 address. 2.d Describe the benefits of autoconfiguration and renumbering. 2.e Convert the given IPv4 address to IPv6 address. 2.f Explain significance of the fields of IPv6 Packet Format. 2.g Compare ICMPv6 and ICMPv4. 2.h Outline the given strategy of Transition from IPv4 to IPv6.	2.1 **IPv6 Addressing**-Representation, Address space, Address space allocation, Autoconfiguration, Renumbering 2.2 **The IPv6 Protocol**-Packet Format, Extension Header 2.3 **The ICMPv6 Protocol**- Error reporting, Informational Messages, Neighbor-Discovery Messages, Group Membership Messages 2.4 **Transition from IPv4 to IPv6**- Strategies, Use of IP addresses
Unit-3 **Unicast Routing**	3.a Differentiate intra and interdomain routing. 3.b Explain various routing algorithms. 3.c Demonstrate various unicast routing protocols	3.1 **Introduction -** Routing 3.2 **Intra- and Interdomain Routing** 3.3 **Routing Algorithms**-Distance vector routing, Link-state routing, Path-vector routing 3.4 **Unicast Routing Protocols**-Internet structure, Routing Information Protocol, Open Shortest Path first, Border Gateway Protocol version 4
Unit-4 **Transport Layer Protocols**	4.a Explain significance of the fields of UDP 4.b Explain various UDP services. 4.c Outline the different features of UDP. 4.d Explain various TCP services. 4.e List out different features of TCP.	4.1 **Introduction**-Services, Port Numbers 4.2 **User Datagram Protocol**-User Datagram, UDP Services, UDP Applications 4.3 **Transmission Control Protocol**-TCP Services, TCP Features, Segment, A

	4.f Explain significance of the fields of TCP Segment. 4.g Explain TCP connections. 4.h Describe State Transition Diagram of TCP. 4.i Explain various SCTP services. 4.j Explain significance of the fields of SCTP packet format.	TCP Connection, State Transition Diagram 4.4 **SCTP**-SCTP Services, SCTP Features, Packet Format, An SCTP Association
Unit-5 Application Layer Protocols	5.a Explain WWW and URL. 5.b Demonstrate the working of HTTP Protocol. 5.c Demonstrate the working of FTP Protocol. 5.d Explain the architecture of Electronic mail. 5.e Compare POP3 and IMAP4. 5.f Describe MIME protocol. 5.g Describe Web-based Mail. 5.h Explain working of DNS. 5.i Explain the significance of the fields of resource records. 5.j Explain DNS message format. 5.k Outline DDNS and security of DNS.	5.1 **Introduction –** Application Layer Protocols 5.2 **World Wide Web and HTTP** 5.3 **FTP**-Two connections, Control Connections, Data Connection, Security for FTP 5.4 **Electronic Mail**-Architecture (SMTP, POP, IMAP, Introduction of MIME) Web-Based Mail, E-mail Security 5.5 **Domain Name System**-Name Space, DNS in the internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, DDNS, Security of DNS

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

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
1	Network Layer Protocols	10	4	6	6	16
2	Next Generation IP	6	4	5	3	12
3	Unicast Routing	7	4	9	0	13
4	Transport Layer Protocols	9	4	7	3	14
5	Application Layer Protocols	10	4	11	0	15
	Total	42	**20**	**38**	**12**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)
Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test

items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from the 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)   Undertake micro-projects in teams.
b)   Give a seminar on any relevant topics.
c)   Visit any ISP in your area.
d)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.
e)   Encourage students to form a Network club at institute level and can help to solve basic network related faults in your institute as well as help slow learners.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
a)   Massive open online courses (*MOOCs*) may be used to teach various topics/subtopics.
b)   Guide student(s) in undertaking micro-projects.
c)   Managing Learning Environment.
d)   Diagnosing Essential Missed Learning concepts that will help students.
e)   Guide students to do personalized learning so that students can understand the course material at his or her pace.
f)   Encourage students to do group learning by sharing so that teaching can easily be enhanced.
g)   *'L' in section No. 4* means different types of teaching methods that are to be employed by teachers to develop the outcomes.
h)   About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.
i)   With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
j)   Demonstrate students thoroughly before they start doing the practice.
k)   Encourage students to refer different websites to have deeper understanding of the topic.
l)   Observe continuously and monitor the performance of students in the laboratory.
m)   Guide students on how to address issues on environment and sustainability using the knowledge of this course.

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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Create a webserver. Host any two websites in this webserver. Create a domain server for the domain of these websites and enter the domain of the websites in it. Access these websites from another computer's browser with its domain name.
b) Configure an email server in intranet and access it by using any email client.
c) Configure an ftp server in intranet and access it by using any ftp client.
d) Configure Telnet & SSH Server in intranet and access it by using particular client.
e) Configure Proxy server in intranet.
f) Prepare one static and one dynamic network with DHCP server. Use routing protocol to route packets between these networks using any network simulator.
g) Configure VLAN using any network simulator.
h) Configure Site to Site VPN using any network simulator.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Data Communication and Networking 5E	Forouzan Behrouz	McGraw Hill Educattion (India), New Delhi, 2005, ISBN-13:978-1-25-906475-3 ISBN-13:978-0-07-337622-6
2	Computer Networks: A Top-Down Approach Special Indian Edition	Behrouz A. Forouzan, Firouz Mosharraf	McGraw Hill Education(India) ISBN-13:978-1-25-900156-7 ISBN-10:1-25-900156-3
3	Computer Networks Fifth Edition	Andrew S. Tanenbaum DaviD J. Wetherall	Pearson Education India; 5th edition ISBN-10 : 9332518742 ISBN-13 : 978-9332518742
4	Computer Networking, A Top-down approach, Seventh Edition	James F. Kurose Keith W. Ross	Pearson; 7th edition, 2016 ISBN-10 : 9780133594140 ISBN-13 : 978-0133594140
5	Packet Tracer Network Simulator	Jesin A	Packt Publishing Limited ISBN-10 : 1782170421 ISBN-13 : 978-1782170426
6	Wireshark Network Analysis (Second Edition)	Laura Chappell	Chappell University; 2nd edition ISBN 978-1-893939-94-3

14.   SOFTWARE/LEARNING WEBSITES

a) https://subnetipv4.com/
b) https://learningcontent.cisco.com/games/binary/index.html
c) http://cisco.num.edu.mn/CCNA_R&S1/index.html
d) https://study-ccna.com/
e) https://www.nwkings.com/types-of-ipv6-addresses
f) https://campus.barracuda.com/product/cloudgenfirewall/doc/79462780/dynamic-routing-protocols-ospf-rip-bgp/
g) https://www.geeksforgeeks.org/multipurpose-internet-mail-extension-mime-protocol/
h) https://www.cloudns.net/blog/what-is-dynamic-dns/
i) https://study-ccna.com/ios-basic-commands/
j) https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/fundamentals/configuration/15mt/fundamentals-15-mt-book/cf-cli-basics.html
k) https://www.cisco.com/c/en/us/td/docs/ios/fundamentals/command/reference/cf_book.pdf
l) https://www.packettracernetwork.com/
m) https://www.computernetworkingnotes.com/networking-tutorials/
n) https://www.youtube.com/watch?v=lb1Dw0elw0Q
o) https://www.javatpoint.com/wireshark
p) https://nptel.ac.in/courses/106105183
q) https://nptel.ac.in/courses/106106091
r) https://www.udemy.com/course/computer-networks-course-networking-basics/
s) https://www.studytonight.com/computer-networks/
t) https://www.wireshark.org/download.html
u) https://www.netacad.com/courses/packet-tracer
v) https://www.server-world.info/en/

15.   PO-COMPETENCY-CO MAPPING

Semester II	Advanced Computer Network (Course Code: 4350706)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency: Configure network using different network, transport, and application layer protocols of TCP/IP protocol stack.							
CO a) Configure a computer network using IPv4 protocol.	2	3	3	3	1	1	1
CO b) Configure a computer network using IPv6 protocol.	2	2	2	2	-	1	1
CO c) Choose unicast routing protocols to implement routing in the given computer network.	2	2	2	2	-	1	1

CO d) Compare features, formats, and applications of various transport layer protocols.	2	1	1	2	-	1	1
CO e) Use various application layer protocols in the network configuration.	2	2	2	2	1	1	1

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Email
1	Smt. Manisha P. Mehta HOD, Computer	GP, Himmatnagar	manishamehtain@gmail.com
2	Shri Chetan C. Kamani LEC (COMPUTER)	GP, Jamnagar	chetan.kamani@yahoo.com
3	Shri Ashok K. Panchasara LEC (COMPUTER)	A.V.P.T.I. Rajkot	akpanchasara@gmail.com
4	Shri Narendrasinh V. Limbad LEC (COMPUTER)	CUSP, Surendranagar	limbad.narendra09@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester -V

Course Title: Multimedia Technologies
(Course Code: 4350707)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th semester

1.   RATIONALE

Multimedia Technologies refers to the use of different forms of media such as text, audio, images, and videos in a digital environment. It has become an essential part of modern society and has many applications in fields such as education, entertainment, and communication.

One important aspect of Multimedia Technologies is the use of software tools that enable the creation, manipulation, and distribution of multimedia content. Open source software, in particular, has gained popularity in recent years due to its availability, cost-effectiveness, and flexibility.

There are various tools which you can use to create and edit multimedia contents. The use of open source software like GIMP and OpenShot in Multimedia Technologies has several advantages. Firstly, open source software is often free of charge, which makes it accessible to a wider range of users. Secondly, open source software is developed by a community of volunteers who are passionate about creating high-quality tools, which often results in software that is stable, reliable, and constantly improving. Finally, open source software provides users with greater flexibility and control over their tools, as they are able to modify and customize the software to suit their specific needs.

GIMP (GNU Image Manipulation Program) is a powerful alternative to commercial software like Adobe Photoshop, and it is used by graphic designers, photographers, and artists. OpenShot is a cost-effective alternative to commercial software like Adobe Premiere Pro with features such as timeline editing, video effects, and audio mixing

There are number of technologies that form the heart of enabling the new Web 2.0 paradigm, with rich user interactions. Such popular Web 2.0-based social media sharing websites as YouTube, Facebook, Twitter and many more have drastically changed the content generation and distribution landscape, and indeed have become an integral part in people's daily life. The developments in the coding algorithms and hardware for sensing, communication, and interaction also empower virtual reality (VR) and augmented reality (AR), providing better immersive experiences beyond 3D. It examines these new-generation interactive multimedia services and discusses their potential and challenges.

In conclusion, the use of open source software like GIMP and OpenShot in Multimedia Technologies provides users with powerful and flexible tools for creating, manipulating, and distributing multimedia content. These tools are cost-effective, reliable, and constantly improving, making them an attractive option for users in various fields.

COMPETENCY

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

- To sharpen both theoretical and practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary software technologies.

2.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:
Students will be able to

CO1) Identify basic multimedia features and applications.
CO2) Demonstrate various photo editing techniques to enhance visual effects of the image.
CO3) Create, edit videos and animate geometrical objects by applying different animation principles.
CO4) Examine the unique characteristics of social media sharing with their impact and cloud-assisted multimedia computing with content sharing
CO5) Describe working of augmented reality and virtual reality system.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	2	4	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment 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, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES
The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Browse the internet and find different webpages and identify the building blocks related to the multimedia.	I	01

2	Install and setup any open source tool for image editing like GIMP. Import and open an image file in tool. Practice with different menus or tools supported by image editing tool.	II	01
3	Import an image from the browser / picture folder and place it on the workspace. After that straighten, crop, scale, border and frame the given image.	II	02
4	Open any image of you with nature background and assess it for faults like brightness, contrast, sharpness etc. and use tools to adjust brightness-contrast, levels, curves, hue-saturation, NL_filter, Unsharp Mask, Red eye reduction, dodge brush, burn brush, smudge brush, healing brush to correct an image.	II	02
5	Combine multiple images using layers and then add text in resultant image and share it with any social media. Or By using multiple images and text make a flyer for upcoming college event.	II	02
6	Import a picture of a stationary motorcyclist. Apply suitable masking filters and background. The image should appear as though the motorcyclist is speeding fast.	II	02
7	Restore old monochrome photos to a new one. Apply suitable colors.	II	02
8	Import an image from the internet. Remove back ground from it using selecting part of an image and change the shape of object from an image using cage transform tool. Also remove an object by using clone tool.	II	02
9	Import any image from the computer and apply various effects on it and save it with new name.	II	01
10	Install and setup any open source tool for video Editing like OpenShot. Create a video of simple slideshow with images and background music.	III	01
11	Edit video using trimming, slicing and transitions using any video editing tool.	III	02
12	Apply various audio and video effect on imported video. Also give a title in a video using appropriate tool.	III	02
13	By using any animation tools create bouncing of ball animation.	III	02
14	Narrate any inspirational short story by using animation.	III	02
15	Upload video on YouTube and explore its meta data. Also discuss the key differences between YouTube videos and the traditional movies / TV shows. How would they affect content distribution? Prepare comparison chart for that.	IV	02

| 16 | Explore software/hardware required for AR/VR technology and make a list of it with specifications. Also explore limitations and challenges affect the development of AR/VR applications. | V | 02 |

Note

i. More **Practical Exercises** *can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some* **sample** *'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed* **Practical Exercises** *of this course required which are embedded in the COs and ultimately the competency..*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Technical Skills	30
2	Creativity	25
3	Attention to Detail	20
4	Timeliness	15
5	Presentation	10
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Minimum System Requirements: Computer System with 64-bit Operating System (Linux, OS X, Chrome OS, Windows 7/8/10/11), Multi-core processor with 64-bit support, 4GB of RAM	All
2	Multimedia projector	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this competency.

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

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

    i.   'Valuing Level' in 1st year

   ii.   'Organization Level' in 2nd year.

  iii.   'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of Revised Bloom's taxonomy are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
Unit 1: Fundamentals of Multimedia	1.1 Define multimedia & list components of multimedia 1.2 Discuss the effects of multimedia in your daily life. 1.3 Examine multimedia applications in several areas. 1.4 Classify multimedia software based on its function 1.5 List multimedia skills required in a team.	1.1 What is multimedia? Components of multimedia 1.2 Multimedia: past and present: early history of multimedia, hypermedia, www, and internet, multimedia in the new millennium 1.3 Where to use multimedia? , delivering multimedia 1.4 Multimedia software tools: music sequencing and notation, digital audio, graphics and image editing, video editing, animation, multimedia authoring, multimedia broadcasting, Augmented reality and virtual reality 1.5 Multimedia skills required in a team
Unit 2: Image Editing	2.1. Describe image data types. 2.2. Describe types of file format to represent image 2.3. Describe steps for Image Straightening, Cropping, Scaling, 2.4. Apply image enhancement techniques on image 2.5. Use layering approach to edit images**.**	2.1. Graphics and image data types : 1-bit images, 8-bit gray-level images ,image data types, 24-bit color images, higher bit-depth images , 8-bit color images 2.2. File formats: gif, jpeg, png, tiff, windows bmp , Windows WMF, Netpbm Format , EXIF,HEIF , PS and PDF PTM 2.3. Explore image editing tool interface , various tools 2.4. Image straightening, cropping, scaling, framing an image 2.5. Image enhancement technique - correcting with brightness, correcting a dull image, oversaturated image, noisy image, removing red eye, repair images 2.6. Adding text to an image 2.7. Layers 2.8. Working on part of an image

Unit 3: Video and Animation	3.1 Explain about digital video standards, formats and technology. 3.2 Illustrate working of video 3.3 Use software tools to edit videos 3.4 Examine basic principles behind animation and techniques 3.5 Apply animation tools to make animation	3.1 Video basic terminology: codec, resolution, bit rate, frame rate, aspect ratio 3.2 How video works? Analog video , digital video 3.3 Video editing: clips - split clip, export clips, add to timeline, trimming & slicing, transform, effects: video effects, audio effects, export video in different mode, give titles. 3.4 Animation: power of motion 3.5 12 principals of animation 3.6 Animation fundamentals , animation techniques and file formats 3.7 Making animation that works : rolling ball , a bouncing ball, create an animated scene
Unit 4: Multimedia Information Sharing	4.1 Describe social media sharing 4.2 Discuss unique features of YouTube 4.3 Illustrate cloud computing for multimedia services.	4.1. Online social media sharing 4.2. representatives of social media services : user-generated content (UGC) , online social networking (OSN) 4.3. User-generated media content sharing 4.4. Case study : YouTube with unique features - video format and meta-data, characteristics of YouTube video, small-world in YouTube videos, YouTube from a partner's view 4.5. Cloud computing for multimedia services : cloud computing overview, multimedia cloud computing, cloud assisted media sharing, case study : Netflix

| Unit 5: Augmented Reality and Virtual Reality | 5.1 Differentiate Augmented Reality, Virtual Reality and Mix Reality
5.2 Describe working of Augmented Reality and Virtual Reality
5.3 Discuss application of Augmented Reality and Virtual Reality | 5.1 Defining augmented reality, virtual reality and mix reality
5.2 Workflow of augmented reality its component - sensory data collection, localization and alignment, world generation and emission
5.3 Workflow of virtual reality and its component - virtual world, immersion, sensory feedback, and interactivity
5.4 Applications |

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

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
	Fundamentals of Multimedia	6	3	6	3	12
I	Image Editing	14	2	8	8	18
II	Video and Animation	10	4	6	6	16
III	Multimedia Information Sharing	6	4	4	4	12
IV	Augmented Reality and Virtual Reality	6	3	6	3	12
	Total	**42**	**16**	**32**	**24**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)
Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from the 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:
i.   Survey various image editing and video editing software and give a seminar on any of them.
ii. Make small video using GIMP and OpenShot in the group
iii. Undertake micro-projects in teams

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
   a) Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
   b) Guide student(s) in undertaking micro-projects.
   c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
   d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
   e) With respect to ***section No.11***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit a micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

Project 1: Create a logo for a new brand

- Design a logo for a new brand

- Create a short video showcasing the logo and brand name

Project 2: Create a video slideshow

- Create a video slideshow of photos or images

- Edit and enhance the photos or images before importing them into video tool

Project 3: Create a social media post graphic

- Design a graphic for a social media post

- To add text animations and effects to the graphic to make it more eye-catching

Project 4: Create an animated GIF

- Create a series of frames for an animated GIF

- Combine the frames into a final animated GIF

Project 5: Create a video bumper

- Create a short video bumper to introduce a video or brand

● Design the graphics and text for the bumper

Project 6: Create a meme

● Edit an image and add humorous text to create a meme

● Create a short video showcasing the meme with added effects and music

Project 7: Create a YouTube thumbnail

● Design a thumbnail image for a YouTube video

● Add text and other elements to the thumbnail to make it stand out and attract viewers.

Project 8: Create an advertisement for new employee recruitment.

Project 9: Create 5 minute video by using minimum 5 different video clips

Project 10: Create brochure for your college.

Project 11: Create Invitation card for college reunion.

Project 12: Case study on any social media platform like Facebook, twitter in terms of content sharing

Project 13: Create animated sorting algorithm

Project 14: Explore any online image editing tools and make a note of new features

Project 15: Explore any online video editing tools and make a note of new features

Project 15: Create a flyer or advertisement for social issue.

Project 15: Create colorful balls and apply animation effects such that balls fall from a table and roll in different directions.

Project 15: Animate blossoming of a flower.

Project 15: Create scenery with a mirror reflection and proper lighting effect.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Fundamentals of Multimedia	Ze-Nian Li Mark S. Drew Jiangchuan Liu	Springer, Nature Switzerland AG 2021, Third Edition ISBN 978-3-030-62123-0
2	Multimedia: Making It Work	Tay Vaughan	McGraw-Hill, 2011, Eighth Edition ISBN: 978-0-07-174850-6
3	Principles of Multimedia	Ranjan Parekh	Tata McGraw Hill, New Delhi , 2013, Second Edition ISBN - 978-1-25-900650-0
4	GIMP for Absolute Beginners	Jan Smith with Roman Joost	APress , 2012 ISBN 978-1-4302-3168-4
5	THE BOOK OF GIMP: A Complete Guide To Nearly Everything	Olivier Lecarme, Karine Delvare	No Starch Press ,2013 ISBN : 978-1593273835
6	Openshot Video Editor	Jesse Russell, Ronald Cohn	Book on Demand Ltd. ISBN: 978-5-5122-8281-6

7	The Illusion of Life: Disney Animation	Frank Thomas and Ollie Johnston	Disney productions, 1995 ISBN: 0-7868-6070-7

14. SOFTWARE/LEARNING WEBSITES

   I. Software:
      1. GIMP open source software (https://www.gimp.org/downloads/)
      2. OpenShot open source software(https://www.openshot.org/download/)
  II. https://www.gimp.org/tutorials/
 III. https://docs.gimp.org/
 IV. https://cdn.openshot.org/static/files/user-guide/index.html
  V. https://cdn.openshot.org/static/files/user-guide/OpenShotVideoEditor.pdf

15. PO-COMPETENCY-CO MAPPING

Semester V	Multimedia Technologies(Course Code: 4350708)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency To sharpen both theoretical and practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary software technologies.							
CO1) Identify basic multimedia features and applications.	3	-	1	1	-	-	2
CO2) Demonstrate various photo editing techniques to enhance visual effects of the image.	3	-	3	3	-	2	3
CO3) Create, edit videos and animate geometrical objects by applying different animation principles.	3	-	3	3	-	2	3
CO4) Examine the unique characteristics of social media sharing with their impact and cloud-assisted multimedia computing with content sharing	2	1	2	2	-	-	2
CO5) Describe working of augmented reality and virtual reality system.	2	1	2	2	-	-	3

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Email
1	Ms. Manisha P. Mehta HOD	Government Polytechnic, Himatnagar	manishamehtain@gmail.com

	Shri Lalit M. Pandya, Lecturer	Shri K. J. Polytechnic, Bharuch	pandyalalit@gmail.com
2	Mrs. Komalben P. Patel, Lecturer	Government Polytechnic, Gandhinagar	komalpatel.gpg@gmail.com

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-V

Course Title: Web based Java Programming
(Course Code: 4350708)

Diploma programme in which this course is offered	Semester in which offered
Computer Engineering	5th Semester

1.   RATIONALE

This course is designed to teach web based java programming concepts, techniques, and applications like JDBC, Hibernate, server side technologies, web services etc. Web based Java Programming is a set of technologies and frameworks used for developing enterprise-level Java applications. It emphasis on the fundamentals of the client service architecture for web based applications. The reason behind the development of advanced Java technology is to provide a solution to the limitations of basic Java. JDBC (Java Database Connectivity) and Hibernate are technologies used for interacting with databases in Java applications. Servlets and JavaServer Pages (JSPs) are technologies used for building dynamic web applications in Java. They are often used together to provide a complete solution for handling web requests and generating dynamic web pages. Web socket programming is a technology used for real-time communication between web clients and servers which provides more efficient and scalable alternative to traditional HTTP-based communication. Web services are to provide a standardized, platform-independent, and language-independent mechanism for applications to communicate with each other over the internet.

2.   COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching-learning experiences:
● Develop java web based applications using Servlet, JSP and Hibernate.

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

The 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:

Course Outcomes:
 a) Implement basic database operations using JDBC.
 b) Develop database-driven Java applications using Hibernate ORM framework.
 c) Develop server side programs using Servlets.

d) Develop Java Server Pages application using JSP tags.
e) Develop networked applications in java using using network protocols, socket programming, and related technologies.
f) Develop of simple web service applications using Java technologies.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
C	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30	70	25	25	150

Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.
Legends: CI-Class Room Instructions; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, CA - Continuous Assessment; ESE - End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Req
1	Develop a database application that uses any JDBC driver	I	2
2	Write a program to present a set of choice for user to select a product &display the price of produc Develop a program to present a set of choice for user to select a product and display the price of product.	I	2
3	Develop a simple hibernate Web Application that displays all records stored in a student table having attributes student_id, student_name and student_branch.	II	2
4	Develop a simple hibernate Web Application that displays total number of employees in an organization with its maximum,	II	2

	minimum, total and average salary of employees.		
5	Write an HTML code to create login form having one submit button, two textboxes labeled as Login name and Password as respectively. Write a Servlet class named as ReadParameter to read these two parameters and display entered parameters values on the page using doGet() or doPost() method when user clicked on submit button.	III	2
6	Create a java application to call one servlet from another servlet.	III	2
7	Create a web form which processes servlet and demonstrates use of cookies and sessions.	III	2
8	Develop a simple JSP program for user registration and then control will be transfer it into second page.	IV	2
9	Develop a JSP program to display the grade of a student by accepting the marks of five subjects.	IV	2
10	Develop a JSP application to insert, update and display record in MySQL database. (Assume suitable database)	IV	2
11	Develop a student login application using MVC architecture. Create StudentLogin.jsp, StudentLoginController, StudentLoginDAO and StudentLoginModel and display whether student gets successfully logged in or not.	IV	2
12	Write a client server program where client sends two numbers and server responds with square of them.	V	2
13	Develop chat application using socket programming.	V	2
14	Develop a SOAP web service that prints your name using eclipse.	VI	2

Note

i.   More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.**

ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Understanding of problem statement.	20
2	Design/Develop/Implement Program/application.	20

3	Execution of the program/application and answer to the sample questions.	20
4	Correctness of the program/application.	20
5	Readability and documentation of the program/application.	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with latest configuration with Windows/Linux/Unix Operating System.	All
2	JDK (Java Development Kit) Version 8 or above	All
3	Apache Tomcat Version 8 or above	All
4	Any editor - Notepad++, Visual Studio Code, Eclipse IDE, NetBeans IDE	All

7. AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.
a)   Motivation and Attitude towards learning
b)   Learning Methodology and Communication styles
c)   Use of technology
d)   Work as a leader/a team member.
e)   Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
i.   'Valuing Level' in 1st year
ii.   'Organization Level' in 2nd year.
iii.   'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically includes lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit 1 **Java Data Base Connectivity (JDBC)**	1a Describe the basics of JDBC and its connectivity 1b Develop program using JDBC to query a database and modify it 1c Explain different types of JDBC drivers and their advantages and disadvantages	1.1 Introduction, JDBC Architecture – 2 tier, 3 tier, JDBC Components 1.2 JDBC API : The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Transaction processing – commit, rollback, savepoint. Creating simple JDBC Application – (CRUD operations) 1.3 JDBC drivers, Advantages and Disadvantages of JDBC
Unit 2 **Hibernate**	2a Illustrate architecture of Hibernate 2b Setting up environment for Hibernate 2c. Implementing O/R Mapping in Hibernate	2.1 Introduction to Hibernate, Exploring the Hibernate Architecture. 2.2 Downloading, installing and setting up development environment for hibernate, Exploring HQL. 2.3 Understanding O/R Mapping in Hibernate, Working with Hibernate O/R Mapping – Developing Hibernate configuration file, Hibernate mapping file and Java Beans
Unit 3 **Servlets**	3a Implementing and deploying servlets on Tomcat server. 3b Develop applications at various scopes of Servlet programming. 3c Illustrate session tracking mechanisms using servlet	4.1 Introduction to Servlets, Life Cycle of Servlet.Creating, configuring and deploying echo servlet on Tomcat Server 4.2 Parameters and Attributes – HttpServletRequest Interface, ServletContext and ServletConfig Interface, Request Delegation – RequestDispatcher Interface. 4.3 Exploring Session Tracking Mechanisms. 4.4 Connecting and reading database/table

	3d Reading database records using Servlet API	records and displaying them using servlet , Advantages and Disadvantages of Servlet
Unit 4 **Java Server Pages**	4a Overview of JSP Technology 4b Implementing JSP Elements in JSP Page 4c Retrieving data from database using JSP	4.1 Introduction to JSP, Architecture of JSP, JSP Lifecycle. 4.2 JSP Elements – Directives, Scripting Elements (Declarations, Expressions and Scriptlets), Action Tags. 4.3 Simple JSP program to fetch database records, Compare JSP and Servlets
Unit 5 **Network Programming with Java**	5a Describe Networking Fundamentals in Java 5b Develop applications for client server communication.	5.1 Network Programming With java.net Package- InetAddress class, URL class, URLConnection class. 5.2 Establishing two way communication between Server and Client - TCP/IP client sockets, TCP/IP server sockets .
Unit 6 **Java Web Services**	6a Overview of Web Services 6b Implementing web services using eclipse IDE	6.1 Introduction to web services, Webservice architecture, functions of webservice 6.2 Components of Web Service – SOAP, UDDI, WSDL 6.3 Implement HelloWorld SOAP webservice using eclipse.

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

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	Java Data Base Connectivity (JDBC)	7	4	4	4	12
II	Hibernate	8	3	4	5	12
III	Servlets	10	4	4	6	14
IV	Java Server Pages	9	4	4	6	14
V	Network Programming with Java	4	2	3	5	10
VI	Java Web Services	4	2	3	3	8
Total		**42**	**19**	**22**	**29**	**70**

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the 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 small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a)   Undertake micro-project web development in teams.

b)   Discover various advancement in technologies of java with their new features

c)   Prepare charts to explain use/process of the identified topic.

d)   Students are encouraged to register themselves in various MOOCs such as: Swayam, edX, Coursera, Udemy etc. to further enhance their learning.

e)   Encourage students to form a coding club at institute level and can help the slow learners.

f)   Encourage students to interact with the industry person to discuss and gather information of current trends, models, documentation, testing methods and different tools used in industry.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

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

c)   Managing Learning Environment

d)   Diagnosing Essential Missed Learning concepts that will help for students.

e)   Guide Students to do Personalized learning so that students can understand the course material at his or her pace.

f)   Encourage students to do Group learning by sharing so that teaching can easily be enhanced.

g)   *'CI" in section No. 4* means different types of teaching methods that are to be employed by teachers to develop the outcomes.

h)   About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.

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

j)   Guide students on how to address issues on environment and sustainability using the knowledge of this course

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 (group of 3 to 5). However, **in the fifth and sixth semesters**, 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 work load on each student due to the micro-project should be about **16 (sixteen) student engagement hours** (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

1.   Online Chatbot for Customer Support
2.   Car Rental System
3.   Online Doctor Appointment System
4.   Online Food Ordering System
5.   Social Networking System
6.   Library Management System

7.   Online Pharmacy System
8.   Online Art Gallery System
9.   Online Plant Nursery System
10.   Online Crime Reporting System
11.   Chat Application
12.   Online Weather Forecasting System
13.   Online Hospital Management System
14.   Online Legal Services Platform
15.   Online Personalized Nutrition System

13.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	JAVA SERVER PROGRAMMING Java EE 7 (J2EE 1.7), Black Book	DREAMTECH PRESS	DREAMTECH PRESS
2	J2EE: The complete Reference	James Edward Keogh	McGraw Hill Education
3	THE COMPLETE REFERENCE JSP 2.0	PHIL HANNA	BPB
4	Complete Reference Java 2	Herbert Schildt	McGraw Hill Education

14.   SUGGESTED LEARNING WEBSITES

i) Hibernate
https://www.tutorialspoint.com/hibernate/index.htm
https://www.javacodegeeks.com/hibernate-tutorials
ii) JDBC Database Access
https://docs.oracle.com/javase/tutorial/jdbc/

https://www.javacodegeeks.com/jdbc-tutorials
iii) Servlet Technologies
http://www.oracle.com/technetwork/java/index-jsp-135475.html
https://www.javacodegeeks.com/java-servlet-tutorials
iv) Java Server Pages
http://www.oracle.com/technetwork/java/javaee/jsp/index.html
https://www.javacodegeeks.com/jsp-tutorials
v) Networking with java
https://www.geeksforgeeks.org/socket-programming-in-java/
https://examples.javacodegeeks.com/java-socket-programming/
vi)Web services
https://www.geeksforgeeks.org/what-are-web-services/
https://java2blog.com/soap-web-service-example-in-java-using/
vii)The Java EE 6 Tutorial
https://docs.oracle.com/javaee/6/tutorial/doc/bnafd.html

15.   PO-COMPETENCY-CO MAPPING

Semester V	Web based Java Programming (Course Code:)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutiOns	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency Develop java web based applications using Servlet, JSP and Hibernate.										
Course Outcomes CO a) Implement basic database operations using JDBC	3	2	2	3	-	2	2			
CO b) Develop database-driven Java applications using Hibernate ORM framework	3	2	2	3	-	2	2			
CO c) Develop server side programs using Servlets.	3	3	2	3	-	2	2			
CO d) Develop Java Server Pages application using JSP tags	3	3	2	3	-	2	2			
CO e) Develop networked applications in java using using network protocols, socket programming, and related technologies.	3	2	2	2	-	2	2			
CO f) Develop of simple web service applications using Java technologies	3	3	2	3	-	2	2			

Legend: '**3**' for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S No	Name and Designation	Institute	Contact No	Email
1	**Smt. Manisha Mehta** Head of Computer Department	Government Polytechnic - Himatnagar	9879578273	manishamehtain@gmail. com
2	**Smt. Jasmine Kargathala** Lecturer in Computer Engineering	Government Girls Polytechnic - Ahmedabad	9824799620	jdaftary@gmail.com
3	**Ms. Drashti S. Baldev** Lecturer in Computer Engineering	Government Girls Polytechnic - Ahmedabad	9925200501	drashti.baldev@gmail.com