

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basic of Electrical Engineering
(Code: 3320901)

Diploma Programmes in which this course is offered	Semester in which offered
Electronics & Communication Engineering	First Semester
Plastic Engineering, Power Electronics Engineering,	Second Semester

1. RATIONALE

Use of basic of electrical engineering principles occurs in different occupations. It is therefore necessary for diploma engineering students of almost all the branches to know some of the fundamentals of electrical engineering concepts. Therefore, this course has been designed to take care of this need.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competency:

- i. Use different types of electrical test and measuring instruments

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Fundamentals of Electric and Magnetic Circuits	1.1 Explain concepts of electric and magnetic parameters 1.2 Differentiate electric and magnetic circuits 1.3 Apply Faraday's laws in different circuits 1.4 Differentiate Statically and dynamically induced EMFs	1.1 Concepts of EMF, Current, Potential Difference, Power and Energy. 1.2 Concepts of M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor etc. 1.3 Concepts of magnetic and electric circuits Faraday's laws of electromagnetic induction. 1.4 Dynamically induced emf. 1.5 Statically induced emf.-(a) Self induced emf (b) Mutually induced emf. 1.6 Equations of self & mutual inductance.
Unit – II A.C. Circuits	2.1 Explain the various basic parameters of AC fundamentals 2.2 Solve simple numericals related to AC circuits 2.3 Derive the current and voltage relationship in star and delta connections 2.4 Find currents and voltages in series and parallel AC circuits	2.1 A.C. circuit parameter: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, current, RMS value, Average value, Form Factor & Peak Factor, impedance, phase angle, and power factor. 2.2 Vector representation of emf and current. 2.3 Mathematical representation of an alternating emf and current 2.4 A.C. through pure a) resistors, b) inductors and c) capacitors 2.5 A.C. through R-L series, R-C series, and R-L-C series & parallel circuit 2.6 Power in A. C. Circuits. Concept of power triangle. 2.7 Voltage and Current relationship in Star and Delta connections.
Unit– III Transformer	3.1 Explain the construction and working of a single phase transformer 3.2 Calculate transformer performance parameters 3.3 Describe working principle of auto transformer	3.1 General construction and principle of transformers. 3.2 Emf equation and transformation ratio of transformers. 3.3 Various losses in transformers and efficiency equation. 3.4 auto transformers.
Unit– IV Electrical Machines	4.1 Describe the construction of a typical single phase motor 4.2 Explain working principle of single phase induction motors 4.3 Explain the working of induction motor starters	4.1 Construction and Working principle of single phase A.C. motor. 4.2 Various types of single phase motors 4.3 Starting methods for induction motors 4.4 Applications of single phase motors
Unit– V Protection	5.1 Justify the need for protection and the use of MCB, MCCB and ELCB 5.2 List the different types of electrical related personal protective equipment. 5.3 State the need for electrical Earthing. 5.4 Describe the type of Earthing used in domestic and industrial applications.	5.1 Different protective devices such as fuse, MCB, MCCB and ELCB. 5.2 Electrical related Personal Protective Equipment 5.3 Earthing systems: purpose, material used for Earthing, types of Earthing system

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks (Duration –Hours)			
			R Level	U Level	A Level	Total
1.	Fundamentals of Electric and Magnetic Circuits	10	8	5	2	15
2.	A.C. Circuits	10	8	5	4	17
3.	Transformer	07	5	4	2	11
4.	Electrical Machines	08	5	5	4	14
5.	Protection	07	4	5	4	13
	Total	42	30	24	16	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency.

S. No.	Unit No.	Experiment
1	II	Measure voltage, current and power in 1-phase circuit. (with resistive load)
2	II	Measure voltage, current and power in R-L series circuit.
3	III	Measure transformation ratio K of 1-phase transformer.
4	III	Connect single phase transformer and measure input & output quantities.
5	IV	Make Star & Delta connection in induction motor starters and measure the line and phase values
6	V	Identify switches, switch fuse and fuse switch units, MCB, MCCB & ELCB.
7	V	Measure voltage, current and power using analog and digital instruments.

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

- Interpret the name plate ratings and identify the parts of an induction motor
- Connect the various types of meters to measure the current and voltage of induction motor
- Interpret the name plate ratings and identify the parts of a transformer
- Make star delta connections of transformer
- Study of various electrical Earthing systems
- Study of various safety equipments used for preventing electrical hazards.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication/Year
1	Prasad P.V and Sivanagaraju S.	Electrical Engineering: Concepts and Applications	Cengage Learning India, New Delhi, 2012
2	Bhattacharya S.K	Electrical Machine	Tata McGraw Hill; New Delhi, 2010
3	Thereja B.L.	Electrical Technology	S. Chand & Company Ltd; New Delhi 2010

B. List of Major Equipment/ Instrument

- Analog and Digital Ammeter, Voltmeter, Wattmeter, Multimeter, Megger, Clamp on meter

- ii. Single phase Transformer, Auto transformer
- iii. Single phase AC Motors
- iv. Different types of starters

C. List of Software/Learning Websites:

- i. <http://www.animations.physics.unsw.edu.au/jw/AC.html>
- ii. <http://en.wikipedia.org/wiki/Transformer>
- iii. <http://www.alpharubicon.com/altenergy/understandingAC.htm>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.S.Mehta.** Lecturer, Electrical engg.Dept. B&B Institute of Technology, Vallabhvidyanagar.
- **Prof. B. R. Shrotriya.** Lecturer,Electrical Engg.Dept Govt. Polytechnic, Junagadh.
- **Prof. A. S. Pandya.** HOD. Electrical Engg.Dept Govt. Polytechnic, Rajkot.
- **Prof. V. R. Kotdawala.** Lecturer, Electrical Engg.Dept Govt. Polytechnic, Himmatnagar.
- **Prof. A.A.Parmar** Lecturer, Electrical Engg.Dept. B&B Institute of Technology, Vallabhvidyanagar.
- **Prof. P.S. Chaudhary.** Lecturer,Electrical Engg.Dept. B&B Institute of Technology, Vallabhvidyanagar.

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Prof. A.S.Walkey,** Associate Professor, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal.
- **Prof.(Mrs.)Susan.S.Mathew,** Associate Professor, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basics Mathematics
(Code: 3300001)

Diploma Programmes in which this course is offered	Semester in which offered
Automobile Engineering, Biomedical Engineering, Ceramic Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Electronics & Communication Engineering, Environment Engineering, Fabrication Technology, Information Technology, Instrumentation & Control Engineering, Mechanical Engineering, Mechatronics Engineering, Metallurgy Engineering, Mining Engineering, Plastic Engineering, Power Electronics Engineering, Printing Technology, Textile Manufacturing Technology, Textile Processing Technology, Transportation Engineering	First Semester

1. RATIONALE

The subject is classified under Basic Sciences and students are intended to know about the basic concepts and principles of Mathematics as a tool to analyze the Engineering problems. Mathematics has the potential to understand the Core Technological studies.

2. LIST OF COMPETENCIES

The course content should be taught so as to understand and perform the Engineering concepts and computations. Aim to develop the different types of Mathematical skills leading to the achievement of the following competencies:

- i. **Apply the concepts and principles of mathematics to solve simple engineering problems**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
2	2	0	4	70	30	0	0	

Legends:

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Logarithm	1.1 Solve simple problems using concepts of Logarithms	Concept ,Rules and related Examples
Unit– II Determinants and Matrices	2.1 Solve simultaneous equations using concepts of Determinants and Matrices	Idea of Determinant and Matrix, Addition/Subtraction, Product, Inverse up to 3X3 matrix, Solution of Simultaneous Equations(up to three variables)
Unit– III Trigonometry	3.1 Solve simple problems using concepts of Trigonometry	Units of Angles(degree and radian), Allied & Compound Angles, Multiple –Submultiples angles, Graph of Sine and Cosine, Periodic function, sum and factor formulae, Inverse trigonometric function
Unit– IV Vectors	4.1 Solve simple problems using concepts of Vectors	Basic concept of Vector and Scalar, addition & subtraction, Product of Vectors, Geometric meaning of Scalar and Vector Product. Angle between two vectors, Applications of Dot (scalar) and Cross (vector) Product, Work Done and Moment of Force.
Unit-V Menstruation	5.1 Calculate the surface area and volume of different shapes and bodies.	Area of Triangle, Square, Rectangle, Trapezium, Parallelogram, Rhombus and Circle Surface & Volume of Cuboids, Cone, Cylinder and Sphere.

5. SUGGESTED SPRCIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Logarithms	03	4	4	2	10
2.	Determinants and Matrices	08	6	8	4	18
3.	Trigonometry	08	8	6	4	18
4.	Vectors	06	5	5	4	14
5.	Mensuration	03	3	3	4	10
Total		28	26	26	18	70

Legends:

R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's Taxonomy)

6. SUGGESTED LIST OF EXERCISES (During tutorial hours)

The exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency.

S. No.	Unit No.	Exercises/Tutorial
1	1	Logarithms-Simple Examples related Definition and Rules
2		Examples on various types and Graphs
3	2	Determinants, Simple Examples on Matrix Addition/Subtraction and Product
4		Co-factors, Adjoint and Inverse of Matrix
5	2	Solution of Simultaneous Equation using 3X3 Matrix and its Applications
6	3	Practice Examples: Allied & Compound Angles
7		Practice Examples: Periodic functions, Sum/Diff and factor formulae, Inverse Trigonometric function etc.
8		Simple Graphs of Sine and Cosine Functions(Explain Spherical Trigonometry, if possible, for Applications)
9	4	Practice Simple Examples Vectors
10		Example related to Dot and Cross Products and Applications
11	5	Examples on Area
12		Surface Area & Volume and its Applications

Note: The above Tutor sessions are for guideline only. The remaining Tutorial hours are for revision and practice.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based Mini-Projects etc. These could be individual or group-based.

1. Applications to solve identified Engineering problems and use of Internet.
2. Learn MathCAD to use Mathematical Tools and solve the problems of Calculus.
3. Learn MATLAB and use to solve the identified problems.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication
1	Anthony croft and others	Engineering Mathematics (third edition)	Pearson Education
2	W R Neelkanth	Applied Mathematics-I	Sapna Publication
3	S P Deshpande	Polytechnic Mathematics	Pune Vidyarthi Gruh Prakashan
4	Rudra Pratap	Getting Started with MATLAB-7	OXFORD University Press

B. List of Major Equipment/ Instrument

1. Simple Calculator
2. Computer System with Printer, Internet
3. LCD Projector

C. List of Software/Learning Websites

1. Excel
2. DPlot
3. MathCAD
4. MATLAB

You may use other Software like Mathematica and other Graph Plotting software. Use wikipedia.org, mathworld.wolfram.com Etc...

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE:**Faculty Members from Polytechnics**

- **Dr.N.R.Pandya**, HOD-General Dept. Govt. Polytechnic, Ahmedabad
- **Dr N. A. Dani**, Lecturer, Govt. Polytechnic, Junagadh.
- **Smt R. L. Wadhwa**, Lecturer, Govt. Polytechnic, Ahmedabad
- **Shri H. C. Suthar**, Lecturer, BPTI, Bhavnagar
- **Shri P. N. Joshi**, Lecturer, Govt. Polytechnic, Rajkot
- **Shri P. T. Polara**, Lecturer, Om Institute of Engg. And Tech, Junagadh,
- **Smt Ami C. Shah**, Lecturer, BBIT, V. V. Nagar.

Coordinator and Faculty Member From NITTTR Bhopal

- **Dr. P. K. Purohit**, Associate Professor, Dept. of Science, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: English
(Code: 3300002)

Diploma Programmes in which this course is offered	Semester in which offered
Architectural Assistanship, Automobile Engineering, Biomedical Engineering, Ceramic Engineering, Chemical Engineering, Civil Engineering, Computer Aided Costume Design & Dress Making, Computer Engineering, Electrical Engineering, Electronics & Communication Engineering, Environment Engineering, Fabrication Technology, Information Technology, Instrumentation & Control Engineering, Mechanical Engineering, Mechatronics Engineering, Metallurgy Engineering, Mining Engineering, Plastic Engineering, Power Elctronics Engineering, Printing Technology, Textile Designing, Textile Manufacturing Technology, Textile Processing Technology, Transportation Engineering	First Semester

1. RATIONALE

English language has become a dire need to deal successfully in the globalized and competitive market and hence this curriculum aims at developing the functional and communicative abilities of the students in English. Proficiency in English is one of the basic needs of technical students. A technician has to communicate all the time with peers, superiors, subordinates and clients in his professional life. Hence this course is being offered.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

- i. **Communicate verbally and in writing in English.**
- ii. **Comprehend the given passages and summarize them.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Tutorial Marks		
3	2	0	5	ESE	PA	ESE	PA	150
				70	30	20	30	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Grammar	1.1 Apply correct verb in the given sentence	1b. Use grammatically correct sentence in day to day communication	1.1 Tenses - Present Tense (Simple, Continuous, Perfect, Perfect Continuous) - Past Tense (Simple, Continuous, Perfect) - Future Tense (Simple)
	1.2 Distinguish among various Determiners	1d. Distinguish among determiners and apply correctly in communicative usage.	1.2 Determiners - Articles (A, An, The) Some, Any, Much, Many, All, Both, Few, A few, The few, Little, A little, The little, Each, Every.
	1.3 Use appropriate modal auxiliaries in a given expression	1f. Choose appropriate modals in situations where different modes of expressions are used.	1.3 Modal Auxiliaries Can, Could, May, Might, Shall, Should, Will, Would, Must, Have to, Need, Ought to
	1.4 Choose the correct verb for the given subject	1h. Use the correct verb depending on the subject in a sentence.	1.4 Subject- Verb Agreement
	1.5 Distinguish between Active and Passive structures. Apply correct model auxiliary in the given sentence.	1j. Apply the correct voice in formal communication	1.5 The Passive Voice Simple Tenses, Perfect Tenses And Modal Auxiliary Verbs
	1.6 Use appropriate preposition in a sentence	1l. Usage of correct preposition as per time, place and direction.	1.6 Prepositions: Time, Place and Direction
	1.7 Identify different connectors and their usage.	1n. Join words or sentences using connectors and bring out the desired meaning.	1.7 Connectors: And, But, Or, Nor, Though, Although, If, Unless, Otherwise, Because, as, Therefore, So, Who, Whom, Whose, Which, Where, When, Why.

Unit	Major Learning Outcomes		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – II Comprehension Passages	2.1 Formulate sentences using new words. 2.2 Enrich vocabulary through reading. 2.3 Write short as well as long answers to questions. 2.4 Express ideas in English in written form effectively	2e. Discuss the content of the passage/story in the class. 2f. Ask appropriate questions as well to answer them. 2g. Follow oral instructions and interpret them to others. 2h. Present topics effectively and clearly. 2i. Use dictionary, thesaurus and other reference books. 2j. Describe an object or product. 2k. Use correct pronunciations and intonations. 2l. Give instructions orally	2.1 Comprehension Passages <ul style="list-style-type: none"> Lincoln's Letter to His Son's Teacher (Abraham Lincoln) What we must Learn from the West (Narayana Murthy) Dabbawallas: Mumbai's Best Managed Business (Amberish K. Diwanji) Internet (Jagdish Joshi) 2.2 Vocabulary Items: <ul style="list-style-type: none"> - Matching items (word and its Meaning) - One word Substitution - Phrases and idioms - Synonyms and Antonyms from given MCQs
Unit – III Short Stories		3a Express ideas and views on given topics. 3b. Speak briefly on a given topic fluently and clearly. 3c. Participate in formal and informal conversations 3d. Recapitulate orally the facts or ideas presented by the speaker	<ul style="list-style-type: none"> My Lost Dollar by Stephen Leacock The Snake in the Grass by R K Narayan A Day's Wait by Earnest Hemingway
Unit – IV Writing Skills	4.1 Write letters and dialogues on given topics / situations.	4b. Face oral examinations and interviews	4.1 Dialogue Writing 4.2 Samples for Practice: <ul style="list-style-type: none"> - Meeting and Parting - Introducing and Influencing - Requests - Agreeing and Disagreeing - Inquiries and Information 4.3 Letter: <ul style="list-style-type: none"> - Placing an order - Letter to Inquiry - Letter of Complaint - Letter of Adjustment - Letter seeking permission
Unit – V Speaking Skills		5a. Follow correct pronunciation, stress and intonation in everyday conversation.	For 28 hours of practical periods , digital language laboratory is recommended to be established in every polytechnic. But as polytechnics currently do not have digital language laboratories practical periods will be engaged encouraging the students to speak as per the text taught in the class.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit Title	Teaching Hours 42+28	Distribution of Theory Marks			
		R Level	U Level	A Level	Total
Unit – I Grammar	14	8	8	9	25
Unit – II Comprehension Passages	07	4	6	5	15
Unit – III Short Stories	07	4	5	5	14
Unit – IV Writing Skills	14	3	6	6	15
Unit – V Speaking Skills	28	1			01
Total	70	20	25	25	70

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF TUTORIAL EXERCISES

The tutorial exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned competencies.

S. No.	Unit No.	Experiment
1	I	Conversation <ol style="list-style-type: none"> 1. Introducing oneself 2. Introduction about family 3. Discussion about the weather 4. Seeking Permission to do something 5. Description about hobbies 6. Seeking Information at Railway Station/ Airport 7. Taking Appointments from superiors and industry personnel 8. Conversation with the Cashier- College/ bank 9. Discussing holiday plans 10. Asking about products in a shopping mall 11. Talking on the Telephonic 12. Wishing Birthday to a Friend 13. Talking about Favourite Sports
2	II	Presentation Skills General Presentations pertaining to Unit I, II, III

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- course/topic based seminars,
- internet based assignments,
- teacher guided self learning activities,
- course/library/internet/lab based mini-projects etc.

These could be individual or group-based.

8. SUGGESTED LEARNING RESOURCES

A. Text Book

Sr. No.	Author/s	Title of Books	Publication
1	Juneja & Qureshi	Active English	Macmillan

B. List of Reference Books

Sr. No.	Author/s	Title of Books	Publication
1	Wren & Martin	High School English Grammar	S. Chand & Co. Ltd
2	M. Gnanamurali	English Grammar at Glance	S. Chand & Co. Ltd.
3	E. Suresh Kumar & Others	Effective English	Pearson
4	S. Chandrashekhar & Others	English Communication for Polytechnics	Orient BlackSwan
5	-	English Fluency Step 1 & 2	Macmillan
6	-	Active English Dictionary	Longman

C. List of Major Equipment/ Instrument

- i. Digital English Language Laboratory
- ii. Computers for language laboratory software
- iii. Headphones with microphone
- iv. Computer furniture

D. List of Software/Learning Websites

- i. <http://www.free-english-study.com/>
- ii. <http://www.english-online.org.uk/course.htm>
- iii. <http://www.english-online.org.uk/>
- iv. <http://www.talkenglish.com/>
- v. <http://www.learnenglish.de/>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Polytechnic Faculty Members

- **Prof. K. H. Talati**, Govt. Polytechnic, Gandhinagar (Convener)
- **Ms. Almas Juneja**, Gujarat Technological University, Ahmedabad.
- **Shri. D. M. Patel**, Govt. Polytechnic, Ahmedabad.
- **Dr. Sonal K. Mehta**, Govt. Girls Polytechnic, Ahmedabad.
- **Shri. Bhadresh J. Dave**, Govt. Polytechnic, Rajkot.
- **Dr. Peena Thanki**, Govt. Polytechnic, Jamnagar.
- **Dr. Chetan Trivedi**, Govt. Engineering College, Bhavnagar.
- **Dr. Raviraj Raval**, Govt. Polytechnic, Rajkot.
- **Shri Vaseem Qureshi**, Vishwakarma Govt. Engineering College, Chandkheda, Ahmedabad.

NITTTR Bhopal Faculty and Co-ordinator

- **Dr. Joshua Earnest**, , NITTTR, Bhopal
- **Prof.(Mrs.) Susan S. Mathew**, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT COURSE CURRICULUM

Course Title: Environment Conservation & Hazard Management
(Code: 3300003)

Diploma Programmes in which this course is offered	Semester in which offered
Biomedical Engineering, Ceramic Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environment Engineering, Fabrication Technology, Information Technology, Instrumentation & Control Engineering, Mechanical Engineering, Mining Engineering, Textile Design, Transportation Engineering	First Semester
Architecture Assistantship, Automobile Engineering, Chemical Engineering, Electronics & Communication, Mechatronics Engineering, Metallurgy Engineering, Plastic Engineering, Power Electronics, Printing Technology, Textile Manufacturing, Textile Processing	Second Semester

1. RATIONALE

For a country to progress, sustainable development is one of the key factors. Environment conservation and hazard management is of much importance to every citizen of India. The country has suffered a lot due to various natural disasters. Considerable amount of energy is being wasted. Energy saved is energy produced. Environmental pollution is on the rise due to rampant industrial mismanagement and indiscipline. Renewable energy is one of the answers to the energy crisis and also to reduce environmental pollution. Therefore this course has been designed to develop a general awareness of these and related issues so that the every student will start acting as a responsible citizen to make the country and the world a better place to live in.

2. COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies.

- i. **Take care of issues related to environment conservation and disaster management while working as diploma engineer.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
4	0	0	4	70	30	0	0	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Ecology and environment	1.1 Enhance knowledge about engineering aspects of Environment 1.2 Correlate the facts of ecology and environment A 1.3 assess the effect of pollution 1.4 List the causes of environmental pollution 1.5 State the major causes of air, water and noise pollution 1.6 Describe how industrial waste contaminates the land 1.7 Describe the effects of radiation on vegetables, animals	1.1 Importance of environment and scope 1.2 Engineering and environment issues 1.3 The natural system, Biotic and a-Biotic components and processes of natural system 1.4 Eco system, food chain and webs and other biological Systems, 1.5 Causes of environmental pollution 1.6 Pollution due to solid waste 1.7 water pollution, air pollution, the Noise as pollution, 1.8 Pollution of land due to industrial and chemical waste 1.9 Radiation and its effects on vegetables and animals
Unit– II Sustainable Development	2.1 Explain the concept of sustainable development 2.2 Justify the need for renewable energy 2.3 Describe the growth of renewable energy in India 2.4 Explain the concepts of waste management and methods of recycling	2.1 Concept of sustainable development, 2.2 Natural resources, a-biotic and biotic resources 2.3 Principles of conservation of energy and management 2.4 Need of Renewable energy 2.5 Growth of renewable energy in India and the world 2.6 Concept of waste management and recycling
Unit – III Wind Power	3.1 Describe the growth of wind power in India 3.2 State the differences between VAWTs and HAWTs 3.3 Explain the differences between drag and lift type wind turbines 3.4 Describe the working of large wind turbines 3.5 List the types of aerodynamic control of large wind turbines 3.6 Name the generators used in large wind turbines	3.1 Growth of wind power in India 3.2 Types of wind turbines – Vertical axis wind turbines (VAWT) and horizontal axis wind turbines (HAWT) 3.3 Types of HAWTs – drag and lift types 3.4 Working of large wind turbines 3.5 Aerodynamic control of large and small wind turbines 3.6 Types of electrical generators used in small and large wind turbines
Unit – IV Solar Power	4.1 Describe the salient features of solar thermal and PV systems 4.2 Describe a solar cooker and solar water heater 4.3 Describe the working of solar PV system 4.4 State the salient features of polycrystalline, monocrystalline and thin film PV systems	4.1 Features of solar thermal and PV systems 4.2 Types of solar cookers and solar water heaters 4.3 Solar PV systems and its components and their working 4.4 Types of solar PV cells 4.5 Solar PV and solar water heaters, rating and costing
Unit – V Biomass energy	5.1 State the different types of biomass energy sources 5.2 Describe about the energy content in biomass 5.3 Describe the working of simple biogas plant	5.1 Types of Biomass Energy Sources 5.2 Energy content in biomass of different types 5.3 Types of Biomass conversion processes 5.4 Biogas production

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – VI Seismic Engineering and disaster management	6.1 Explain the principles of seismic Engineering in design of structure 6.2 State the appropriate actions to be taken during disasters	6.1 Introduction of seismic engineering and its application civil engineering designs 6.2 Features of disasters such as Floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc. 6.3 Management and mitigation of above disasters

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Ecology and Environment	8	4	4	0	8
2.	Sustainable Development	10	4	5	1	10
3.	Wind Power	10	4	6	4	14
4.	Solar Power	10	4	6	4	14
5.	Biomass energy	8	4	4	2	10
6.	Seismic Engineering and disaster	10	6	6	2	14
	Total	56	26	31	13	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF EXPERIMENTS/PRACTICAL EXERCISES

Nil

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Prepare paper on various sustainable development
- ii. Make a report after gathering information the values of water, noise pollution and air pollution in your city/town and compare the values in other cities and towns in India with respect to environmentally acceptable levels
- iii. Prepare a paper on air and water pollution in an industry/institute
- iv. Undertake some small mini projects in any one of the renewable energies
- v. Visit an energy park and submit project on various sources of energy
- vi. Prepare powerpoint on clean and green technologies
- vii. Prepare a list of do's and don'ts applicable during disasters
- viii. Submit a report on garbage disposal system in your city/town.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication/Year
1	Renewable Energy Technologies	Solanki, Chetan Singh	PHI Learning, New Delhi, 2010
2	Ecology and Control of the Natural Environment	Izrael, Y.A.	Kluwer Academic Publisher
3	Environment Engineering and Disaster Management	Sharma, Sanjay K.	Luxmi Publications, New Delhi
4	Environmental Noise Pollution and Its Control	Chhatwal, G.R.; Katyal, T.; Katyal,	Anmol Publications, New Delhi
5	Wind Power Plants and Project Development	Earnest, Joshua & Wizelius, Tore	PHI Learning, New Delhi, 2011
6	Renewable Energy Sources and Emerging Technologies	Kothari, D.P. Singal, K.C., Ranjan, Rakesh	PHI Learning, New Delhi, 2009
7	Environmental Studies	Anandita Basak	Pearson
8	Environmental Science and Engineering	Alka Debi	University Press
9	Coping With Natural Hazards, Indian Context	K. S. Valadia	Orient Longman
10	Engineering and Environment	Edward S. Rubin	Mc Graw Hill Publ.

B. List of Major Equipment/ Instrument

- i. Digital sound level meters (to check noise pollution)
- ii. Digital air quality meter (to measure air pollution)
- iii. Digital handheld anemometer (to measure wind speeds)
- iv. Digital hand held pyranometer (to measure solar radiation levels)

C. List of Software/Learning Websites

- i. http://www1.eere.energy.gov/wind/wind_animation.html
- ii. http://www.nrel.gov/learning/re_solar.html
- iii. http://www.nrel.gov/learning/re_biomass.html
- iv. <http://www.mnre.gov.in/schemes/grid-connected/solar-thermal-2/>
- v. <http://www.mnre.gov.in/schemes/grid-connected/biomass-powercogen/>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- Prof. H.L.Purohit , HOD, Civil Engg. Dept. L.E.College. Morbi
- Shri. P.A.Pandya, LCE, Civil Engg. Dept, G.P , Himatnagar

Co-ordinator and Faculty Members from NITTTR Bhopal

- Dr. J.P.Tegar, Professor Dept of Civil and Environmental Engg, NITTTR, Bhopal.
- Dr. Joshua Earnest, Professor and Head, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Engineering Physics (Group-1)
(Code: 3300004)

Diploma Programmes in which this course is offered	Semester in which offered
Automobile Engineering, Ceramic Engineering, Civil Engineering, Environment Engineering, Fabrication Technology, Mechanical Engineering, Mechatronics Engineering, Metallurgy Engineering, Mining Engineering, Plastic Engineering, Transportation Engineering	First Semester
Chemical Engineering, Textile Manufacturing Technology, Textile Processing Technology	Second Semester

1. RATIONALE

As Physics is the mother of all engineering disciplines, students must have some basic knowledge on physics to understand their core engineering subjects more comfortably. Accordingly, in reviewing the syllabus, emphasis has been given on the principles, laws, working formulae and basic ideas of physics to help them study the core subjects. Complicated derivations have been avoided because applications of the laws and principles of physics are more important for engineering students.

As Physics is considered as basic science its principles, laws, hypothesis, concepts, ideas are playing important role in reinforcing the knowledge of technology. Deep thought is given while selecting topics in physics. They are different for various branches of engineering. This will provide sound background for self-development in future to cope up with new innovations. Topics are relevant to particular program and students will be motivated to learn and can enjoy the course of Physics as if it is one of the subjects of their own stream.

Engineering, being the science of measurement and design, has been offspring of Physics that plays the primary role in all professional disciplines of engineering. The different streams of Physics like Optics, Acoustics, Dynamics, Semiconductor Physics, Surface Physics, Nuclear physics, Energy Studies, Materials Science, etc provide Fundamental Facts, Principles, Laws, and Proper Sequence of Events to streamline Engineering knowledge.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

Laboratory experiments have been set up keeping consistency with the theory so that the students can understand the applications of the laws and principles of physics.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies.....

i. Apply principles and concepts of Physics for solving various Engineering Problems

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I	1.1 Explain Physical Quantities and their units. 1.2 Measure given dimensions by using appropriate instruments accurately. 1.3 Calculate error in the measurement 1.4 Solve numerical based on above outcomes	<u>SI Units & Measurements</u> 1.1 Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI, fundamental and derived quantities and their units 1.2 Least count and range of instrument, least count of vernier caliper, micrometer screw gauge 1.3 Definition of accuracy, precision and error, estimation of errors -absolute error, relative error and percentage error, rules and identification of significant figures. (Numerical on above topics)
Unit– II	2.1 List Newton’s laws of motion 2.2 Differentiate among various forces in nature 2.3 Define inertia, momentum and impulse of force 2.4 State Newton’s laws of motion 2.5 State law of conservation of momentum 2.6 Solve numerical problems based on above topics	<u>Force and Motion:</u> Recapitulation of equations of motion, Newton’s Ist law of motion, Force, basic forces in motion, gravitational force, electrostatic force, electromagnetic force, nuclear force, Inertia, types of inertia (inertia of rest, inertia of motion, inertia of direction), Momentum, Newton’s IInd law of motion, measurement of force using second law, simple problems on $F = ma$ and equations of motion, Impulse of force, Impulse as the product of force and time, impulse as the difference of momentum, examples of impulse, simple problems on impulse, Newtons IIIrd law of motion and its examples. Law of conservation of momentum, Statement, simple problems (Numerical on above topics)
Unit– III	3.1 Comprehend the concept of elasticity and Define Stress, Strain and Elastic limit.	<u>General properties of matter</u> 3.1 Elasticity Deforming force, restoring force, elastic and plastic

Unit	Major Learning Outcomes	Topics and Sub-topics
	3.2 State Hooke's law. 3.3 Explain the term elastic fatigue. 3.4 Distinguish between Streamline and Turbulent flow 3.5 Define coefficient of viscosity. 3.6 Apply the principle of viscosity in solving problems. 3.7 State significance of Reynold's number 3.8 Explain terminal velocity. 3.9 Mention Stoke's formula. 3.10 Explain the effect of temperature on viscosity 3.11 Comprehend the phenomenon of surface tension and its applications. 3.12 Define surface tension. 3.13 Explain angle of contact and capillarity. 3.14 Solve problems related to surface tension.	body, stress and strain with their types. elastic limit, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity and relation between them (no derivation), stress strain diagram. behavior of wire under continuously increasing load, yield point, ultimate stress, breaking stress, factor of safety. 3.2 Surface Tension. Molecular force, cohesive and adhesive force, Molecular range, sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I. unit, angle of contact, capillary action with examples, shape of meniscus for water and mercury, relation between surface tension, capillary rise and radius of capillary (no derivation), effect of impurity and temperature on surface tension 3.3 Viscosity Fluid friction, viscous force, Definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, free fall of spherical body through viscous medium (no derivation), up thrust force, terminal velocity, Stokes law (statement and formula). (Numericals on Above topics)
Unit– IV	4.1 Distinguish between Heat and Temperature. 4.2 Explain modes of Transmission of heat and their applications. 4.3 Define heat capacity and specific heat of substances. 4.4 Explain temperature 4.5 List various temperature scales and convert among temperatures	<u>Heat Transfer</u> 4.1 Three modes of transmission of heat -conduction, convection and radiation, good and bad conductor of heat with examples, law of thermal conductivity, coefficient of thermal conductivity and its S.I. unit. 4.2 Heat capacity and specific heat of materials 4.3 Celsius, Fahrenheit and Kelvin temperature scales and their conversion formulae (Numericals on above topics)
Unit– V	5.1 Comprehend the concept of wave motion 5.2 Distinguish between transverse and longitudinal waves. 5.3 Define period, frequency, amplitude and wavelength 5.4 Explain principle of superposition of waves 5.5 Define resonance 5.6 Explain resonance. 5.7 State Formula for velocity of sound in air 5.8 Comprehend the Importance of Reverberation 5.9 State Sabine's formula and Factors affecting Reverberation time 5.10 Explain ultrasonic waves. Mention applications of	<u>Waves and Sound</u> Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength, longitudinal and transverse wave, principle of superposition of waves, definition of resonance with examples, Formula for velocity of sound in air and various factors affecting it Ultrasonic Waves Definition, Properties of ultrasonic waves Uses of ultrasonic waves. Acoustics Of Building Importance of Reverberation, Reverberation time, Optimum time of Reverberation, Coefficient of absorption of Sound, Sabine's formula for Reverberation time, Factors affecting Reverberation time and acoustics of building. (Numericals on above topics)

Unit	Major Learning Outcomes	Topics and Sub-topics
	ultrasonic waves	
Unit– VI	6.1 State Properties Of Light 6.2 Define various phenomena of light 6.3 State Snell’s law of refraction. 6.4 Explain importance and list applications of nanotechnology in engineering field	<u>Light and Nanotechnology</u> Properties Of Light, Electromagnetic spectrum, Reflection, refraction, snell’s law, diffraction, polarization, interference of light, constructive and destructive interference (Only definitions), physical significance of refractive index, dispersion of light Introduction to Nanotechnology (Numericals on above topics)
Unit – VII	7.1 Define radio activity 7.2 Distinguish between Natural & Artificial radioactivity 7.3 State relation between Half Life, Average Life & Decay Constant. 7.4 Describe properties of Alpha, Beta and Gamma rays.	<u>Radioactivity</u> 7.1 Radioactivity Definition, Natural & Artificial radioactivity, Units and Laws of Radioactivity, Half Life, Average Life & Decay Constant. 7.2 Radioactive Rays Properties and uses of alpha particles, beta particles and gamma rays (Numericals on Above topics)

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	SI Units & Measurements	05	03	02	05	10
2.	Force and Motion	05	02	02	04	08
3.	General Properties of Matter	10	04	06	08	18
4.	Heat Transfer	04	02	02	02	06
5.	Waves and sound	07	04	04	04	12
6.	Light and Nanotechnology	07	03	03	04	10
7.	Radioactivity	04	02	02	02	06
	Total	42	20	21	29	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom’s taxonomy)

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

S. No.	Unit No.	Experiment /Practical Exercises
1	1	Linear Measurement by Vernier calipers
2	1	Linear Measurement by Micrometer screw
3	3	Measurement of Surface tension
4	3	Measurement of Viscosity
5	3	Measurement of Young's Modulus
6	3	To determine Force constant with the help of periodic time of oscillations of spring
7	3	Measurement of specific gravity
8	6	To calculate refractive index of material of prism using spectrometer device.
9	4	Joule's mechanical equivalent of heat
10	4	Measurement of co-efficient of thermal conductivity
11	5	To study the relation between the length of a stretched string and the tension in it with the help of a sonometer.
12	6	To calculate SA/V ratio of simple objects to understand nanotechnology

Minimum 8 experiments/practical exercises should be performed from the above list

- Hours distribution for Physics Experiments :

Sr. No.	Description	Hours
1	An introduction to Physics laboratory and its experiments (for the set of first four experiments)	02
2	Set of first four experiments	08
3	An introduction to experiments (for the set of next four experiments)	02
4	Set of next four experiments	08
5	Mini project	06
6	Viva and Submission	02

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

Laboratory based mini projects:

1. To calculate acoustics of given class room
2. To prepare models of Vernier calipers, micrometer screw gauge and travelling microscope

And many more Teacher guided self learning activities:

1. To prepare a chart of applications of nanotechnology in engineering field
2. To prepare models to explain different concepts

And many more Course/topic based seminars:

1. Seminar by student on any relevant topic

8. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr No.	Author	Title of Books	Publication
1	Sears And Zemansky	University Physics	Pearson Publication
2	Paul G Hewitt	Conceptual Physics	Pearson Publication
3	Halliday & Resnick	Physics	Wiley India
4	G Vijayakumari	Engineering Physics, 4e	Vikas-Gtu Students' Series
5	Arvind Kumar & Shrish Barve	How And Why In Basic Mechanics	Universities Press
6	Ncert	Physics Part 1 And 2	Ncert
7	Giancoli	Physics For Scientists And Engineers	
8	H C Verma	Concepts Of Physics	
9	Gomber & Gogia	Fundamentals Of Physics	Pradeep Publications, Jalandhar

B. List of Major Equipment/ Instrument

- 1.Redwood's Viscometer
- 2.Digital Vernier Calipers And . Digital Micrometer Screw Guage
- 3.Digital Travelling Microscope
- 4.Joule's Calorimeter
- 5.Searle's Thermal Conductivity Apparatus
- 6.Visible Light Spectrometer

C. List of Software/Learning Websites

1. www.physicsclassroom.com
2. www.physics.org
3. www.fearofphysics.com
4. www.sciencejoywagon.com/physicszone
5. www.science.howstuffworks.com

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- Dr. S. B. Chhag**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Rajkot
- Ku. B. K. Faldu**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
- Shri D. V. Mehta**, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad
- Shri S. B. Singhania**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
- Dr. U. N. Trivedi**, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad

Coordinator and Faculty Members From NITTTR Bhopal

- Dr. P. K. Purohit**, Professor, Department of Applied Science, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basics Engineering Drawing
(Code: 3300007)

Diploma Programmes in which this course is offered	Semester in which offered
Automobile Engineering, Ceramic Engineering, Civil Engineering, Environment Engineering, Mechanical Engineering, Mechatronics Engineering, Metallurgy Engineering, Mining Engineering, Printing Technology, Textile Manufacturing Technology, Textile Processing, Transportation Engineering	First Semester
Chemical Engineering, Electrical Engineering, Fabrication Technology, Plastic Engineering	Second Semester

1 RATIONALE:

Engineering drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization. It is an attempt to develop fundamental understanding and application of engineering drawing. It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards. The curriculum aims at developing the ability to draw and read various drawings, curves & projections.

The subject mainly focuses on use of drawing instruments, developing imagination and translating ideas. Developing the sense of drawing sequence and use of drawing instruments effectively yields not only with productive preparation of computer aided graphics but also yields with effective industrial applications ranging from marking to performance of operations.

2 LIST OF COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

- i. Prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments. .**
- ii. Visualize the shape of simple object from orthographic views and vice versa.**

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
2	0	4	6	70	30	40	60	200

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Sub-topics
Unit – 1 ENGINEERING DRAWING AIDS	1.1 Use drawing equipments, instruments and materials effectively.	1.1 Drawing equipments, instruments and materials. (a) Equipments-types, specifications, method to use them, applications. (b) Instruments-types, specifications, methods to use them and applications. (c) Pencils-grades, applications, types of points and applications. (d) Other materials-types and applications.
Unit– 2 PLANNING, LAYOUT AND SCALLING OF DRAWING	2.1 Follow and apply standard practice as per bureau of I.S. for planning and layout 2.2 Choose appropriate scale factor for the drawing as per given situation	2.1 I.S. codes for planning and layout. 2.2 Scaling technique used in drawing.
Unit– 3 LINES, LETTERING AND DIMENSIONING	3.1 Write annotations on a drawing where ever necessary. 3.2 Choose appropriate line and dimensioning style for a given geometrical entity.	3.1 Different types of lines. 3.2 Vertical capital and lower case letters. 3.3 Inclined capital and lower case letters. 3.4 Numerals and Greek alphabets. 3.5 Dimensioning methods. (a) Aligned method. (b) Unilateral with chain, parallel, progressive and combined dimensioning.

Unit	Major Learning Outcomes	Sub-topics
Unit- 4 GEOMETRIC CONSTRUCTION	4.1 Develop the ability to draw polygons, circles and lines with different geometric conditions.	4.2 Geometric construction related with line like bisecting a line, to draw perpendicular with a given line, divide a line, etc. 4.3 Geometric construction related with angle like bisect an angle, trisect an angle, etc. 4.4 To construct polygon. a: Triangle b: Square / Rectangle. c: Pentagon with special method. d: Hexagon with special method. 4.5 To draw tangents. 4.6 Geometric construction related with circle & arc.
Unit-5 ENGINEERING CURVES	5.1 Able to draw engineering curves with proficiency and speed as per given dimensions.	5.2 Conic sections. (a) Concept and understanding of focus, directrix, vertex and eccentricity and drawing of conic sections. (b) Using various methods, understand construction of : i. Ellipse. ii. Parabola. iii. Hyperbola. 5.3 Cycloidal Curves(Cycloid, Epicycloid, Hypocycloid) 5.4 Involutés. (a) Involutés of a circle (b) Involutés of a polygon 5.5 Spiral (Archimedean spiral only).
Unit- 6 PROJECTION OF POINTS, LINES AND PLANES	6.1 Draw the projection of points, lines and planes with different conditions. 6.2 Find out true shape and size of a inclined line or plane	6.1 Reference planes, orthographic projections. 6.2 Concept of quadrant. 6.3 1 st angle and 3 rd angle projection and their symbols. 6.4 Projection of points. 6.5 Projection of lines – determination of true length and inclinations for following cases. (a) Line parallel to one or both the plane. (b) Line perpendicular to one of the plane. (c) Line inclined to one plane and parallel to another. (d) Line inclined to both the planes. 6.6 Projection of Planes. (a) Types of planes. (b) Projection of planes parallel to one of the reference planes. (c) Projection of plane inclined to one reference plane and perpendicular to another. (d) Projection of planes inclined to both reference planes. Note : Triangle, Square / rectangle, pentagon, hexagon and circle shape should be included in various plane problems.

Unit	Major Learning Outcomes	Sub-topics
Unit- 7 ORTHOGRAPHIC PROJECTIONS	7.1 Draw the orthographic views of object containing lines, circles and arc geometry. 7.2 Interpret given orthographic views and to imagine the actual shape of the component.	7.1 Types of projections-orthographic, perspective, isometric and oblique: concept and applications. 7.2 Various term associated with orthographic projections. (a) Theory of projection. (b) Methods of projection. (c) Orthographic projection. (d) Planes of projection. 7.3 Conversion of simple pictorial views into Orthographic views. Illustrative problems on orthographic projection. 7.4 B.I.S. code of practice. Note : (1) Problem should be restricted up to four views- Front view/Elevation, Top view/Plan and Side views only. (2) Use First Angle Method only.
Unit- 8 ISOMETRIC PROJECTIONS	8.1 Draw the isometric view from orthographic views of object/s containing lines, circles and arcs.	8.2 Isometric axis, lines and planes. 8.3 Isometric scales. 8.4 Isometric view and isometric drawing. 8.5 Difference between isometric projection and isometric drawing. 8.6 Illustrative problems limited to objects containing lines, circles and arcs shape only.

5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Engineering drawing aids.	0	00	00	02	02
2.	Planning, layout and scaling of drawing.	0	02	00	03	05
3.	Lines, lettering and dimensioning.	0	00	02	00	02
4.	Geometric construction.	3	00	03	07	10
5.	Engineering curves.	6	02	00	10	12
6.	Projection of points, lines and planes.	8	03	00	14	17
7.	Orthographic projections.	6	00	00	12	12
8.	Isometric projections.	5	00	02	08	10
	Total	28	07	07	56	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels.

NOTES:

a: If midsem test is part of continuous evaluation, unit number 4, 5 and 6 (For Unit 6, except projections of planes) are to be considered.

b: Ask the questions from each topic as per weightage of marks. Choice of questions must be given from the same topic.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Ex. No.	Unit No.	Practical Exercises	Hours
1	1,2,3	<p>USE OF DRAWING INSTRUMENTS:</p> <p>1. Teacher will demonstrate-</p> <p style="padding-left: 20px;">a: Use of drawing instruments.</p> <p style="padding-left: 20px;">b: Planning and layout as per IS.</p> <p style="padding-left: 20px;">c: Scaling technique.</p> <p>2. Draw following.</p> <p>Problem – 1 Drawing horizontal, vertical, 30 degree, 45 degree, 60 & 75 degrees lines using Tee and Set squares/ drafter.</p> <p>Problem – 2 Types of lines.</p> <p>Problem – 3 Types of dimensioning.</p> <p>Problem – 4 Alphabets & numerical (Vertical & inclined as Per I.S.).</p>	14
2	4	<p>GEOMETRIC CONSTRUCTION:</p> <p>Drawing of set of lines with different conditions. (Two problems)</p> <p>Drawing Polygons. (Three Problems)</p> <p>Drawing circles and arcs with different geometric conditions and with line constraints. (Three problems)</p>	06
3	5	<p>ENGINEERING CURVES – I:</p> <p>Problem –1: Construction of ellipse using any two methods from arc of circle method, four centre method, rectangular method, eccentricity method and concentric circle method.</p> <p>Problem –2: Construction of parabola with any one method from rectangular method, tangent method and eccentricity method.</p> <p>Problem –3: Construction of hyperbola with any one method from eccentricity method and rectangular method.</p> <p>Problem –4: Construction of spiral. (Refer note c for dimensions).</p>	04
4	5	<p>ENGINEERING CURVES – II:</p> <p>Problem – 1: Construction of cycloid.</p> <p>Problem – 2: Construction of hypocycloid & epicycloids.</p> <p>Problem – 3: Construction of involute (circle).</p>	04

		Problem – 4: Construction of involute (polygon). (Refer note c for dimensions).	
5	6	PROJECTIONS OF POINTS AND LINES: Draw projection of points-For 10 various conditions.(One problem) Draw projection of lines with different conditions. (Four problems) (Refer note c for dimensions).	06
6	6	PROJECTIONS OF PLANE: Draw projection of different planes with different conditions. (triangle, square / rectangular, pentagonal / hexagonal, and circular -one for each). (Four problems) (Refer note c for dimensions).	04
7	7	ORTHOGRAPHIC PROJECTIONS: Draw Orthographic projections of different objects. (Two problems) (Draw four views of each object). (Refer note c for dimensions).	08
8	8	ISOMETRIC DRAWINGS: Draw isometric drawings from given orthographic views (Three problems) (Refer note c for dimensions).	10
9	All	PROBLEM BASED LEARNING: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketch book.	-
10	All	SCHOOL WITHIN SCHOOL: <ul style="list-style-type: none"> • Explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each batch student. • Each student will assess at least one sheet of other students (May be a group of 5-6 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any. 	-

Notes :-

- a: **Use both sides of sheet. For example, draw sheet number 2 on back side of sheet number 1, 4 on back of 3, and likewise.**
- b: Theory & practice should be in first angle projections and IS codes should be followed wherever applicable.
- c: The dimensions of line, axes, distances, angle, side of polygon, diameter, etc. must be varied for each student in batch so that each student will have same problems, but with different dimensions.
- d: The sketchbook has to contain data of all problems, solutions of all problems and student activities performed. Students' activities are compulsory to be performed.

- e: A hand out containing applicable standards from IS codes including title block as per IS standard should be given to each student by concerned teacher.
- f: For 40 marks Practical Marks ESE, students are to be assessed for competencies achieved. Students are to be given data for practical ESE to prepare drawings.

7. LIST OF STUDENT ACTIVITIES:

Following is the list of student activities to be performed by each student individually:

Activity No.	Details of student activity
1	Sketch the combinations of set squares to draw angles in step of 15° . (15° , 30° , 45° , 60° , 75° , 90° , 105° , 120° , 135° , 150° , 165° , 180°).
2	Solve all problems for all sheets number 1 to 8 in sketch book (with dimensions).
3	List the shapes you are observing around you in real life with place/item. (For ellipse, parabola and hyperbola).
4	Take two simple objects. Sketch isometric of them. Also draw orthographic projections of them (all views).
5	Take one circular shape. Assume one point on circumference and mark it. Roll that shape on flat and circular surface. Observe the path of point.
6	List at least two questions individually which you would like to ask for followings: a: Ellipse. b: Involute of circle. c: Perspective projections. d: Use of geometric constructions. e: Quadrants.

8. SUGGESTED LEARNING RESOURCES:

A. List of Books

Sr.No	Title of Books	Author	Publication
1	Elements of Engineering Drawing.	N.D. Bhatt	Charotar Publishing House, Anand.
2	Engineering Drawing.	P.J.Shah	S.Chand, New Delhi.
3	Fundamentals of Engineering Drawing.	W.J.Luzzadar	Prentice-hall of India Pvt. Ltd.-New Delhi
4	Fundamentals of Drawing.	K.R.Gopalkrishna	Subhash Publications, Bangalore.
5	Engineering Drawing	M.B.Shah, B.C.Rana	Pearsons.
6	Machine Drawing.	V. Laxminarayan & M.L.Mathur	Jain Brother, New Delhi.
7	Fundamentals of Engineering Drawing.	French & Vierck	McGraw-Hill

B. List of Major Equipments/ Instruments :

- Models- full and cut.
- Set of various industrial drawings being used by industries-up dated.
- Drawing equipments and instruments for class room teaching-large size.
- Drawing board-half imperial size.
- T-square or drafter (Drafting Machine).

- Set squares (45^0 and 30^0-60^0)
- Protector.
- Drawing instrument box (containing set of compasses and dividers).
- Drawing sheets.
- Drawing pencils.
- Eraser.
- Drawing pins / clips.
- Roller scale

C. List of Software/Learning Websites:

- rgpv-ed.blogspot.com/2009/02/engineering-curves.html
- <http://www.slideshare.net/sahilsahil992/conic-section-1819818>
- <http://www.technologystudent.com/designpro/drawdex.htm>
- http://www.engineeringdrawing.org/engg_curves/problem-3-8-engineering-curves/490/
- <http://web.iitd.ac.in/~hirani/mel110-part3.pdf>
- <http://www.studyvilla.com/ed.aspx>
- http://www.youtube.com/watch?v=a703_xNeDao
- http://www.youtube.com/watch?v=TCxTP_8ggNc
- <http://www.youtube.com/watch?v=JpgFPZILTu8&feature=related>
- <http://www.youtube.com/watch?v=o1YPja2wCYQ&feature=related>
- <http://www.youtube.com/watch?v=dJyKV3Ay7vM&feature=fvwrel>
- E-learning package from KOROS.
- E-learning package from Cognifront.
- CD with book-Engineering drawing, M.B. Shah-B.S. Rana (Pearson).
- Computer based learning material published by KOROS.

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof.K. H. Patel**, Head Dept.of Mech., Engg., Dr. S. & S. Gandhi College of Engineering and Technology, Surat,
- **Shri.H. R. Sapramer**, Lecturer in Mech. Engineering, Dr. J.N.Mehta Government Polytechnic, Amreli.
- **Prof.A.M. Talsaniya**, Lecturer in Mech. Engineering, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.

Co-ordinator and Faculty Memberfrom NITTTR Bhopal

- **Prof. Sharad Pradhan**, Associate Professor, Dept. of Mech. Engg., NITTTR, Bhopal.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Computer Application & Graphics
(Code: 3300012)

Diploma Programmes in which this course is offered	Semester in which offered
Ceramic Engineering, Chemical Engineering, Civil Engineering, Environment Engineering, Fabrication Technology, Mining Engineering, Plastic Engineering, Textile Manufacturing Technology, Textile Processing Technology, Transportation Engineering	First Semester
Automobile Engineering,	Second Semester

1. RATIONALE

This subject envisages making the student know the fundamentals of Computer Application. It will also helps the student to have hands on experience on different application software used for office automation like MS-Word day-to-day problem solving, in particular for creating business documents, data analysis and graphical representations. Computer Application & Graphics is a course where student will be able to write, Draw, Tabulate, Report, Store and Retrieve and also print on Computer using various Hardware and Software.

Moreover the market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. Some units in this course has been introduced at Diploma level in order to develop the skills in student so that they can generate various digital drawings as required using various CAD software.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies.

- i. Use MS word software for word processing applications.
- ii. Use relevant software for drafting and editing 2D entities.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
0	0	4	4	0	0	40	60	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Basics of Computer System	1.1 Describe computer hardware and software 1.2 Identify I/O devices 1.3 Describe functioning of CU ALU and memory unit 1.4 Differentiate various types of printers 1.5 Explain use of OS 1.6 Demonstrate various file handling operations	Basics of Computer System <ul style="list-style-type: none"> • Concept of Hardware and Software • Computer block diagram • Input Output unit • CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit • Monitor, Printers: Dot matrix, Laser, Inkjet, Plotters, Scanner • System software and Application Software • Operating system concepts, purpose and functions • Operations of Windows OS. • Creating and naming of file and folders • Copying file, renaming and deleting of files and folders, • Searching files and folders, installation application, creating shortcut of application on the desktop • Overview of control Panel, Taskbar.
Unit– II Using MS - Word 2007	2.1 Use basics text formatting features 2.2 Manipulate text 2.3 Use page Setup features 2.4 Use spell and grammar utility 2.5 Work with graphics/ clipart 2.6 Create and manipulate table 2.7 Use auto shapes and its formatting with text	Using MS - Word 2007 <ul style="list-style-type: none"> • Overview of Word processor • Basics of Font type, size, colour, • Effects like Bold, italic, underline, Subscript and superscript, • Case changing options, • Inserting, deleting, undo and redo, Copy and Moving (cutting) text within a document, • Formatting Paragraphs and Lists • Setting line spacing; single • Page settings and margins including header and footer • Spelling and Grammatical checks • Table and its options, Inserting rows or columns, merging and splitting cells, Arithmetic Calculations in a Table. • Working with pictures, Inserting Pictures from Files, • Using Drawings and WordArt; Lines and Shapes, Modifying Drawn Objects, Formatting Drawn Objects, options for Creating and Modifying a WordArt Object
Unit– III Creating digital drawings using a Computer Aided Drafting (CAD) Software	3.1 Start Computer aided drafting software (AutoCAD). 3.2 Invoke commands in AutoCAD. 3.3 Set limits & Coordinate systems. 3.4 Use object selection methods. 3.5 Create basic & advance 2D	Introduction to Basic Draw Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • System requirement & Understanding the interface. • Components of a CAD software window: Such as Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify toolbar, cursor cross hair. Command window, status bar,

Unit	Major Learning Outcomes	Topics and Sub-topics
	entities. 3.6Close & save your work	drawing area, UCS icon. <ul style="list-style-type: none"> • File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Quit. • Setting up new drawing: Units, Limits, Grid, Snap, • Methods of Specifying points- Absolute coordinates and Relative Cartesian & Polar coordinates. • Using Object Snap like Endpoint, Midpoint, Intersection, Center Point, Quadrant Point, Nearest, Perpendicular, Apparent Intersection • SNAP, GRID, OTRACK, LINE, PLINE, ARC, CIRCLE, Ellipse, DONUT, Polygon, Region, File Commands: New, Open, Templates Save, Exit, • Standard sizes of sheet. Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview • Concept of model space and paper space. • Creating view ports in model space and creating floating viewport in paper space. Shifting from model space to paper space and vice versa
Unit – IV Editing & viewing a Digital Drawing using a CAD software	4.1Modify existing 2D entities. 4.2Use different arrays in existing 2D drawing. 4.3View given drawing entities properly. 4.4Enquire about various attributes of existing 2D entities.	Introduction to Basic Edit, Inquiry and display Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • Copy, Rotate, Move, Erase, Mirror, Array, Trim, Break, Extend, Chamfer, Fillet • Zoom window, Zoom in-out, PAN • List, Dblist, Area, Massprop
Unit – V Advance editing of a digital drawing using a CAD Software	5.1Use layers for proper management of drawings. 5.2Set properties of existing drawing entities as per requirement. 5.3 Able to dimension given 2D entities with perfection. 5.4Use Blocks effectively to create perfect drawings.	Introduction to Advanced Modify & other utility Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • Properties, Line type, colour, line weight • Concept of Layers: Creating Layers, Naming layers, Making layers ON/OFF, Freeze-Thaw layers, Lock/Unlock Layers. Setting the properties of layers like Color, Line type, Line weight • Concept of Blocks: Local block, global block. Creating, inserting, redefining & exploding blocks. • Concept of Hatch: Selecting Hatch pattern, Hatch styles, Hatch Orientations. Associative Hatch. Boundary Hatch, Hatching Object. • Dimensioning: Types of dimensioning: Linear-Horizontal, Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions. • Dim scale variable. • Editing dimensions.

Unit	Major Learning Outcomes	Topics and Sub-topics
		<ul style="list-style-type: none"> Text: Single line Text, Multiline text. Text Styles: Selecting font, size, alignment etc.

5. SPECIFICATION TABLE (for theory)

There is no theory paper and hence specification table for theory is not applicable

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

S.No.	Unit No.	Practical Exercises
1	1	<ul style="list-style-type: none"> Create and manage files and folder tree Use accessories utilities of windows OS Identify icons, processes going on, messages and interpretation Write given text using WORD software and beautify Plot and Print drawing, text on suitable paper Prepare report using stored text and drawing
2	2	<ul style="list-style-type: none"> Entering and editing text in document file. Apply formatting features on Text like Bold, Italics, Underline, font type, colour and size. Apply features like bullet, numbering Create documents, insert images, format tables Create and manipulate tables Students will prepare File for the above mentioned practical and assignments on individual basis. Students will collect photographs from internet which are related to field application of topics.
3	3	<ul style="list-style-type: none"> Study of different types of drafting packages related to 2D e.g. AutoCAD, Power draft, Micro station. Creating a new folder in the computer for saving your practical work. Draw any three complicated 2D shapes using lines only following Absolute, Relative coordinate systems and object snaps. Draw Five problems on different geometrical shapes in AutoCAD software using Lines, Polylines, Polygon, Circles, Arcs, Ellipse AutoCAD commands. Construc a common templates for all the following assignments with institutes logo & standard title block. Plot one drawing using above template and containing some 2D entities on suitable size of paper(A4).
4	4	<ul style="list-style-type: none"> List different properties of entities made in above activity slot. Try viewing commands on entities made in above activity slot.

		<ul style="list-style-type: none"> • Create drawing of three different Doors & Windows (Elevations). • Create drawing of a modern Study table (Elevations). • Create drawing of a modern sofa Set (Plan). • Draw three problems with polar & rectangular Arrays. • Create Top view of a circular and a rectangular Dining Table with six chairs using Polar and Rectangular array concept respectively. • Create plan & elevation of a primary school building. • Create plan & elevation of a medium size modular kitchen.
5	5	<ul style="list-style-type: none"> • Convert above door, windows, Bed, Dinning table into Blocks and use these blocks in following activities. • Three problems on 2D entity generation, which involve the use of layers, blocks and hatching. • Dimensioning of above figures. • Create your own text style (individually) • Draw two sheets on template developed at serial no.-3 and Create a plan & elevation of a Duplex Bungalow with following layers: <ul style="list-style-type: none"> • Basic civil structure • Water supply line • Electric supply • Toilet fittings • Furniture(using blocks)

7. SUGGESTED LIST OF STUDENT ACCTIVITY

Teachers can decide on their own the list of student activities to promote the intereste of students in use of computers and develop the competencies

8. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	R Taxali	Computer Course	Tata McGraw Hills. New Delhi.
2.	P. Nageswara Rao	AutoCAD For Engineering Drawing Made Easy	Tata McGraw Hill
3.	George Omura	Mastering AutoCAD	BPB publication
4.	Sham Tickoo	AutoCAD 2004	Galgotia Publications,New Delhi
5.	Devid Frey	AutoCAD 2000	BPB publication
6.	A. Yarwood	An Introduction to AutoCAD2000	LongMan
7.	Ron House	Using AutoCAD 2000	Prentice Hall
8.	Autodesk Inc.	Latest AutoCAD Manual	Autodesk Inc.

B. List of Major Equipment/ Instrument

- Computer System
- Printer
- Flat Bed Plotter A4 size

C. List of Software/Learning Websites

- Latest Educational Network version of Auto CAD Software
- MS Office

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. H. L. Purohit**, Head of Civil Engineering Department, L. E. College, MORBI
- **Prof. B G RAJGOR**, HOD, Applied Mechanics Department , B & B Institute of Technology

Coordinator & Faculty from NITTTR Bhopal

- **Prof. Sanjay Agarawal**, Professor & Head Dept. of Computer Engg. & Application, NITTTR, Bhopal
- **Prof. Sharad Pradhan**, Associate Professor, Dept. of Mechanical Engg., NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Fundamental of Mechanical Engineering
(Code: 3300015)

Diploma Programmes in which this course is offered	Semester in which offered
Electrical Engineering, Plastic Engineering	First Semester
Ceramic Engineering, Metallurgy Engineering, Mining Engineering, Transportation Engineering	Second Semester

1. RATIONALE:

In the era of technology integration, it has become unavoidable to possess the basic knowledge of various engineering disciplines. The advancement in technology is the best on multi technology integration and hence in performance too. The motive of this subject is to enhance the knowledge & skill level in the inter disciplinary area to strengthen the present practices.

This course is specially designed with a view to impart basic knowledge of other conventional disciplines (other than own discipline).

This course mainly encompasses the major and general areas of mechanical engineering which are being used by common man to large industrial sectors. A technician has to know many times the implications and knowledge of other disciplines so as to conclude the solution of his/her own branch tasks.

2. LIST OF COMPETENCIES:

- i. **To perform the simple tasks related to mechanical engineering so as to reduce the dependency on mechanical engineers and to achieve the reliability and quality of own branch's tasks.**

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

4. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes	Sub-topics
Unit –1 INTRODUCTION	1.1 Identify mechanical related basic components and their uses.	1.1 Introduction of mechanical engineering. 1.2 Use of mechanical engineering : a. In day to day life. b. Interdisciplinary use. 1.3 Items in general use- identification criteria, major types, specifications and uses : such as bolts, nuts, washers, bearings, bushes, belts, springs, levers, couplings, brakes, screws, rivets, keys, o’ rings, oil seals, gears, pulleys, shafts, axles, etc. 1.4 Pipes and pipe fittings- Types , specifications and uses of pipes and pipe fittings. 1.5 Hand and power tools: a. Types, specifications and uses of spanners (such as fix, ring, box, pipe, allen, adjustable, etc.). b. Types, specifications and uses of hand tools (such as pliers, screw drivers, saws, hammers, chisels, cutters, planes, etc.). c. Types, specifications and uses of power tools(drill, chipper, etc.)
Unit –2 POWER TRANSMISSION & SAFETY	2.1 Identify the type of power transmissions being used. 2.2 Follow general safety norms.	2.1 Power transmission: a. Importance. b. Modes (belt drives, rope drives, chain drives and gear trains). c. Types of belts. d. Gear train-concept, transmission ratio. e. Applications. 2.2 Types and applications of couplings in power transmission. 2.3 Causes and remedies of general accidents in power transmission. 2.4 Safety norms to be followed for preventing accidents and damage in power transmission. 2.5 Safety norms to be followed in mechanical based industries / shop floors.
Unit – 3 PROCESSES ON MATERIAL	3.1 Understand common metal joining and machining methods.	3.1 Welding. a. Types. b. Working setup of arc and gas welding, accessories and consumables. c. Types of work carried out by welding. d. Precautions and safety during arc and gas welding.

Unit	Major Learning Outcomes	Sub-topics
		3.2 Brazing and Soldering. <ul style="list-style-type: none"> a. General set up. b. Applications. 3.3 Gas cutting. <ul style="list-style-type: none"> a. Working setup, accessories and consumables. b. Types of work carried out. c. Precautions and safety during gas cutting. 3.4 Foundry. <ul style="list-style-type: none"> a. Concept. b. Process of getting cast material. c. Applications. 3.5 Other metal forming and cutting operations- bending, shearing-concept and applications. 3.6 Basic machine tools. <ul style="list-style-type: none"> a. Working principle of hacksaw, lathe, drill and milling machines. b. Types of operations / jobs which can be performed on machine tools listed above.
UNIT –4 STEAM GENERATION AND PRIME MOVERS	4.1 Explain working of boilers and prime movers.	4.1 Steam. <ul style="list-style-type: none"> a. Generation process. b. Properties. 4.2 Boilers. <ul style="list-style-type: none"> a. Classification. b. Working. c. Accessories and mountings-types and applications. d. Applications. e. Regulations and safety requirements. f. Common troubles and remedies. 4.3 Prime movers. <ul style="list-style-type: none"> a. Meaning. b. Classification. c. Working. d. Steam turbine-working. e. Gas turbine-types and applications. f. Common troubles and remedies.
Unit –5 INTERNAL COMBUSTION ENGINES	5.1 Explain working of internal combustion engines.	5.1 Internal combustion engines. <ul style="list-style-type: none"> a. Meaning. b. Classification. 5.2 Working of petrol engine, diesel engine and gas engine. 5.3 Performance parameters. 5.4 Main parts and functions. 5.5 Applications. 5.6 Common troubles and remedies.

Unit	Major Learning Outcomes	Sub-topics
Unit– 6 HYDRAULIC AND PNEUMATIC DEVICES	6.1 Identify the applications of fluid concepts. 6.2 Use pumps and other hydraulic – pneumatic equipments and machineries.	6.1 Concept of theory of fluid flow. 6.2 General properties of fluids. 6.3 Pump. <ul style="list-style-type: none"> a. Working principle. b. Types. c. Working of centrifugal and reciprocating pumps. d. Performance parameters. e. Main parts of pumps and their functions. f. Common troubles and remedies. 6.4 Water turbines-working principle, types and applications. 6.5 Common troubles and remedies of water turbine. 6.6 Air compressor. <ul style="list-style-type: none"> a. Working principle. b. Types. c. Performance parameters. d. Applications. 6.7 Other hydraulic/pneumatic/ hydro-pneumatic equipments. <ul style="list-style-type: none"> a. Principle of working-hydraulic lift, hydraulic pump, hydraulic power pack, hydraulic jack. b. Applications of above.
Unit – 7 MATERIAL HANDLING	7.1 Select proper material handling equipment. 7.2 Identify common reasons for common troubles.	7.1 Need of material handling. 7.2 Types , principle of working and applications of material handling equipments. <ul style="list-style-type: none"> a. Hoisting equipments. b. Conveying equipments. c. Surface & overhead equipments. d. Earth moving machineries. e. Construction machineries. 7.3 Criteria for selection of material handling equipments. 7.4 Factors affecting selection of material handling equipments. 7.5 Selection of suitable material handling equipment for the given situation. 7.6 Common troubles and remedies.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Introduction	4	5	0	2	07
2.	Power transmission & safety	8	7	7	0	14
3.	Processes on material	8	7	3	4	14
4.	Steam generation and prime movers	4	3	4	0	07
5.	Internal combustion engines	6	3	4	2	09
6	Hydraulic and pneumatic devices	6	3	3	3	09
7	Material handling	6	7	0	3	10
Total		42	35	21	14	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels.

NOTES:

- a: If mid sem test is part of continuous evaluation, unit numbers 1, 2 and 3 are to be considered.
- b: Ask the questions from each topic as per marks weightage. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of questions will be equal to marks allotted to each topic.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Ex. No.	Unit No.	Practical Exercises/Experiment	Hours
1	1	Demonstrate use of various mechanical items, spanners, hand tools and power tools. Student will prepare the report which will include sketches of each item demonstrated with specifications and applications.	02
2	2	a: Demonstrate various power transmission methods. Also demonstrate items used in power transmission with material of construction and specifications of each item. Student will prepare the report on working principles, set up sketch, working parameters, specifications of items and safety norms followed. b: Student will calculate velocity ratios for belt drives and number of teeth for gear train based on given data.	04
3	3	Demonstrate working of welding transformers, welding process, gas welding process, gas cutting process, brazing and soldering process. Student will prepare the report on working principles, set up sketch, working parameters, consumables used with specifications and safety norms	02

		followed.	
4	3	Prepare simple weld joint job.	02
5	3	a: Demonstrate various machining methods on hacksaw, lathe, drill and milling machines. b: Also prepare simple turning job.	04
6	4	Study boiler, boiler mountings and boiler accessories.	02
7	5	Perform and study the effect of variation of load on fuel-consumption of an I.C. engines (On petrol engine). Also locate the faults in a given petrol engine and suggest remedial measures.	02
8	5	Perform and study the effect of variation of load on fuel-consumption of an I.C. engines (On diesel engine). Also locate the faults in a given diesel engine and suggest remedial measures.	02
9	6	Demonstrate a water-turbine.	02
10	6	Perform test on Air compressor.	02
11	6	Perform test on centrifugal pump. Also find fault and remedies for centrifugal pump.	02
12	7	Study various types of materials handling equipments.	02
Total			28

NOTES:

1. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by laboratory assistant/instructor and teacher.
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. For 20 marks practical ESE, students are to be assessed for competencies achieved.

7. STUDENT ACTIVITIES:

S. No.	Details of activity.
1	Student will visit the respective discipline industry / site (electrical, printing, as applicable) and will prepare the list of mechanical engineering related equipments/machineries used by that industry / site.
2	Student will observe the fuel supply system of any bike and will also observe the working of engine. Student will also identify the type and specification of engine used for bike.
3	Prepare the list of mechanical items surrounding to you.

8. SUGGESTED LEARNING RESOURCES:**A. List of Books.**

S.No.	Title of Books	Author	Publication
1	Theory of Machines	R.S.Khurmi and J.K.Gupta	S.Chand
2	Heat engine	Shah & Pandya	Charotar Publishing House
3	Hydraulic machines	Jagdish lal	Metropolitan Book Company
4	Elements of Workshop	Hazara chauthary	Asia Publishing House

S.No.	Title of Books	Author	Publication
	Technology (Vol. 1,2)		
5	Hydraulics	R.C.Patel	Acharya Book Depot
6	Pumps operation and maintenance	Tyler and Hicks	Tata McGraw-Hill
7	Material Handling equipments	M.Rundenko	Mir Publishers

B. List of Major Equipment/ Instrument.

- a: Various mechanical items, spanners, hand tools and power tools..
- b: Various power transmission devices.
- c: Welding transformers, welding accessories and consumables.
- d: Gas welding set up with all accessories and consumables.
- e: Brazing and soldering setup with all accessories and consumables.
- f: Gas cutting process set up with all accessories and consumables.
- g: Workshop based machine tools-Hacksaw, Lathe, Drill and Milling.
- h: Boiler/ Working model of boiler.
- i: Petrol engine test rig.
- j: Diesel engine test rig.
- k: Air compressor test rig.
- l: Water turbine / working model of water turbines.
- m: Centrifugal pump test rig.
- n: Models / working models of various material handling devices.

C. List of Software/Learning Websites: ---

- a: <http://www.youtube.com/watch?v=1cFu2bkZ7Vw&feature=related> (ic engine)
- b: http://www.youtube.com/watch?v=pCg1Ih_oVSA (pump)
- c: <http://www.youtube.com/watch?v=V3aPHmZ97yM&feature=related> (pump)
- d: <http://www.youtube.com/watch?v=FENCiA-EfaA&feature=related> (impeller)
- e: <http://www.youtube.com/watch?v=TBdUcGYo7XA> (gas turbine)
- f: <http://www.youtube.com/watch?v=HzQPNpP55xQ> (turbines)
- g: http://www.youtube.com/watch?v=e_CcrgKLyzc (coal power plant)
- h: <http://www.youtube.com/watch?v=8GSUg womb dE&feature=related> (boiler)
- i: <http://www.youtube.com/watch?v=A3ormYVZMXE> (hy.lift)
- j: <http://www.youtube.com/watch?v=FP05rYRI9JU&feature=related> (hy.pump)
- k: <http://homepages.cae.wisc.edu>
- l: http://www.youtube.com/watch?v=E6_jw841vKE&feature=related (air compressor)
- m: <http://www.youtube.com/watch?v=twM-GLUYQ-o&feature=related> (belt drive)
- n: <http://www.youtube.com/watch?feature=endscreen&v=gjUwJ1CJVq4&NR=1> (belt drive)
- o: <http://www.youtube.com/watch?v=XunM7yUC06M&feature=related> (gear drive)

p: <http://www.youtube.com/watch?v=ftdgB93QOD8&feature=related> (gear box)

q: <http://en.wikipedia.org/wiki/Boiler>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Shri. M.K.Shukla**, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.
- **Shri. A.M.Talsaniya**, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.
- **Shri. R.B.Variya**, Lecturer in Mechanical Engineering, B and B institute of Technology, Vallabhvidyanagar.
- **Shri. N.C.Pandya**, Lecturer in Mechanical Engineering, Government Polytechnic, Himmatnagar

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Dr. K.K. Jain**, Professor & Head, Dept. of Mechanical Engg, NITTTR, Bhopal
- **Dr. Joshua Earnest**, Professor & Head, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basic Polymer Chemistry
(Code: 3312301)

Diploma Programmes in which this course is offered	Semester in which offered
Plastic Engineering	First Semester

1. RATIONALE

The plastic industry occupies a prominent position in the development of both industrially advanced and developing countries. Plastics are now becoming basic engineering material which is now replacing steel because of their unique properties and low cost. Knowledge of Basic polymer chemistry is essential to take up career in plastic technology. An attempt has been made to make students aware about the basic concepts of polymer chemistry applied for understanding the engineering application in the field of plastics.

2. LIST OF COMPETENCIES

- i. Use basic concepts of organic chemistry in the field of plastic engineering

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	05	70	30	20	30	

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Sub-topics
Unit-1 ORGANIC CHEMISTRY	1.1 Understand basic principles of organic chemistry. 1.2 Identify bond types & different organic compounds. 1.3 Understand configuration of Carbon.	1. Introduction 2. Periodic table and element structure (C, H, O, S, Cl, N, Si) 3. Types of Bond, Bond angle, Bond length, Bond energy, Electro negativity, Polar Bonds, Bond Polarity & Dipole moment 4. Carbon: Structure and configuration SP-I, SP-II, and SP-III. 5. Classifications of Hydro-Carbons. 6. Classifications of functional groups. 7. Nomenclatures of Organic Compounds (IUPAC).
Unit-2 CONCEPTS OF MONOMER	2.1 Familiarize with different monomers & its functionality.	1. Basic concepts of Monomer 2. Types of Monomer 3. Functionality of Monomer 4. Purification of Monomer
Unit-3 CONCEPTS OF POLYMER	3.1 Understand different types of polymer & its structure.	1. Basic concepts of Polymer. 2. Effect of functionality on Polymer Structure. 3. Chemical and geometric structure of polymer. Configuration and conformation, Linear, branched and cross-linked structure, Random, alternating, block and graft polymers, Stereo regular polymer. 4. Classification of Polymer based on: a. Structure b. Repeating unit c. Applications d. Source e. Nature and Processing
Unit-4 POLYMERIZATION REACTIONS	4.1 Develop ability to understand polymerization reactions to produce polymer.	1. Addition Polymerization reactions: a. Free radical polymerization b. Ionic polymerization c. Co-ordination polymerization 2. Condensation Polymerization a. Poly condensation polymerization b. Poly addition polymerization 3. Rearrangements and Stereo Polymerization 4. Co-Polymerization a. Free radical polymerization b. Ionic polymerization c. Co-poly condensation polymerization

5. Suggested Specification Table with Hours and Marks (Theory)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Organic chemistry	12	09	04	03	16
2.	Concepts of monomer	05	05	03	02	10
3.	Concepts of polymer	09	08	07	05	20
4.	Polymerization reactions	16	10	08	06	24
	Total	42	32	22	16	70

Legends: R = Remembrance; U = Understanding; A = Application and above levels.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the minimum list of exercises/practical/experiments

Ex. No.	Unit No.	EXERCISES/PRACTICAL/EXPERIMENTS	Hours
1	1	To study about different configurations of carbon.	02
2	1	Identification of simple organic compounds containing C, H, O, N, S & Cl with melting point & boiling point.	04
3	2	To study about monomers (Hydrocarbons, chlorinated monomers)	04
4	2	To study about monomers with several double bonds	02
5	3	Identification of Polymers from Solubility Tests.	04
6	3	Identification of Polymers by Flame Tests.	02
7	3	Separation and Purification of Polymer.	04
8	4	To study about free radical polymerization.	02
9	4	The Condensation Polymerization Reaction Used in the Creation of Nylon 6-10	04

6. Suggested List of Students Activities

Following is the list of student activities.

S. No.	Activity No.	Details of student activity
1	1	Prepare student reports as asked in experiments.
2	2	Perform experiments as mentioned.
3	3	Visit the nearer polymer suppliers.

7. Suggested Learning Resources

(A) Suggested Learning Resources List of Books (in tabular form)

List of Books

S.No.	Title of Books	Author	Publication
1	Organic Chemistry	P.L.Soni	Sultan Chand & Sons
2	Textbook of Organic Chemistry	Bahl & Tuli	S. C. Chand & Co., New Delhi
3	Textbook of Polymer Science	Billmeyer Jr.	John Wiley & Sons, New York
4	Polymer Science	V.R.Govariker	New Age International Delhi
5	Polymer Science of Technology	Jod R. Fried	Prentice-Hall of India Pvt. Ltd., New Delhi
6	Textbook of Organic Chemistry	R.K.Bansal	New Age Publications
7	Polymer Science and Technology of Plastics & Rubber	Pramanoy Ghosh	Tata McGraw Hill
8	Polymer Chemistry	Seymour & Carraher	CRC Press
9	Polymer Chemistry	Arora & Singh	Anmol Publications Pvt.
10	Principles of Polymer Chemistry	A Ravve	Springer

(B) List of Major Equipment/Instruments/Machines

- a. Chemicals, solvents
- b. Purification set
- c. Test tubes, 18 x 150 mm
- d. Stirring rod, glass
- e. Bunsen burner
- f. Beaker, (50 mL, 250 mL)
- g. Tongs or forceps
- h. Ring stand and ring with wire gauze
- i. Safety equipments (gloves, goggles etc)
- j. Wooden stick
- k. Styrofoam cup
- l. Thermometer

m. Capillary tube

(C) List of Relevant Software/Learning Websites

1. www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm

2. <http://www.ing.unisi.it/didattica/matdid/2187.pdf>

3. www.ing.unisi.it/didattica/matdid/2187.pdf

4. http://www.liv.ac.uk/~js1/Chem378/VITAL%20COPY%20Handouts%20Lecture15_Rannard_Chem378.pdf

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty members from Polytechnic

- **Shri Ajay Amin**, Government Polytechnic, Ahmedabad

Coordinator & Faculty members from NITTTR, Bhopal

- **Dr .Ajnu Rawley**, Professor, Applied Science Dept, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA Sem-2/ B.E. Sem-2 & 7 / B.Pharm. Sem-2 & 7/

Diploma Engineering Sem-2 & 5 (01-07-2013)

Subject Name: **Contributor Personality Development**

Subject Code: **1990001**

Table-I -For MCA/B.E. / D.E

Table-I						
Teaching Scheme				Evaluation Scheme		
Theory (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	University Exam (E)	Mid Sem Exam (Theory) (M)	Practical (Internal)
4	0	0	4	70	30	50

*For the Evaluation Scheme of Diploma Engineering Sem – 2, please refer the link

http://www.gtu.ac.in/Syllabus/New_Diploma/sem-2/Pdf/3990001.pdf

Table-I –For B.Pharm only

Table-II						
Teaching Scheme				Evaluation Scheme		
Theory (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	University Exam (E)	Mid Sem Exam (Theory) (M)	Practical (Internal)
4	0	0	4	80	0	20

Note:

- 1. This subject is compulsory.**
- 2. 4 Credits will be over and above the existing credit structure.**
- 3. This subject will be taught by faculty of English. For B. Pharm., the institute will have to nominate one faculty member for the subject.**
- 4. In Institutes, where as the load is not managed by the lecturers of English only, please nominate the other faculty for teaching the course of Contributor Personality Development.**

(A) Background

The Contributor Personality Program has been designed keeping in mind the following:

1.0 Technology students should not only be excellently trained in the technological field, they should acquire soft skills if they are to be successful. Every student must also learn about the techniques of effective participation in a group discussion. He/she must learn to prepare his/her resume and he/she should also be groomed for presenting himself/herself at an interview.

2.0 There is a great need to equip students with not only the right skill-sets but also the right mindsets.



3.0 The ‘mindsets’ needed in today’s environment must support both (i) effective action and (ii) values and service oriented behavior.

Effective action without human values can lead to personal benefits for individuals but a long-term cost to both nation and society. Human values without effective action can lead to an inability on the part of the individual to perform and flourish in today’s environment.

This combination of effectiveness with human values is crystallized in the concept of “contributor ship”.

4.0 Students who adopt and develop the right mindsets early in their professional career are able to bring about a positive and sustainable change in their overall personality.

They are able to grow the right approaches to their peers, seniors, industry, and their own future. They become more responsible and capable of shaping their own lives.

Therefore, the program may be rightly called a “Contributor Personality Development Program”.

5.0 Any program of this sort must, in order to be effective, be inspired and guided by a high ideal and principles/ practices flowing from that ideal.

The Contributor Personality Program is guided by the ideals and ideas of Swami Vivekananda – who represented in his leonine personality the highest ideals of human values combined with effective action.

The Contributor Personality



Contributor

- **Creates value - for self, for the organization, for society**
- **Takes charge and makes things happen, making a positive difference**
- **Creates opportunities and sees possibilities everywhere**
- **Is 'in demand' wherever he/she goes**
- **Seeks long-term career success and life-fulfillment**

(B) Course Outline

Topics 1-6 relate to the basic axioms or “mental models” that students carry about themselves, about success, careers, contribution, etc. The right mental models are a necessary prerequisite for developing into a Contributor.

Topics 7-12 are 6 core practices that will help a student manifest the ideal of contributor ship in one’s life.

Topics 13-15 relate to the students capability to connect into the job-market.

Topic	Course Title
1	<p>Who is a Contributor</p> <p>Student develops an appreciation of who the Contributors are and how they fundamentally differ from Non-contributors in their overall approach to work, to other human beings, to society as a whole.</p>

2	<p>The Contributor's identity</p> <p>Student develops his/ her own answer to the question “who am I?” The student becomes aware of the fact that Non-contributors usually define themselves in terms of what they have acquired in life (e.g. qualifications, position, years of experience, etc.) while Contributors define themselves in terms of what they will become or accomplish (e.g. capacity to deliver, commitment and ownership of the organization's purpose, etc.).</p>
3	<p>The Contributor's vision of success</p> <p>The student explores the meaning of success in his life. Through this exploration, the student is expected to recognize that Contributors have a wider definition of success than Non-contributors. While Non-contributors define success in terms of material success, achievement, external impact, etc., Contributors are able to widen this definition of success to include personal fulfillment, development of self-esteem, ongoing development of personal capabilities etc.</p>
4	<p>The Contributor's vision of career</p> <p>The student learns to distinguish between an “acquisitive career” and a “contributive career”. An acquisitive career is one in which the career-seeker is focused on acquiring higher position, higher salary, more benefits etc. This preoccupation with selfish interests often damages the individual's career, as well as, damages the organization and society. A contributive career is one where the career-seeker is focused on contributing, with rewards being a by-product of the contributions made.</p>
5	<p>The scope of contribution</p> <p>The student learns to perceive that in all type of work, every type of role, there is a possibility of contributing at multiple levels – contributing to self, contributing to organization, and contributing to society.</p> <p>The student also appreciates the difference between “acquisition for self” and “contribution to self” – the former being material acquisition and the latter being conscious development of oneself through the medium of one's career.</p>
6	<p>Embarking on the journey to contributor ship</p> <p>The student recognizes the fundamental “building blocks” for becoming a Contributor – the first building block being a shift from a “victim” to being a “creator of one's destiny”; the second building block being acceptance of the ideal of contributor ship; the third building block being the willingness to take full responsibility for one's own development; the fourth building block being the capacity to reflect on one's development and make appropriate modifications.</p>

7	<p>Design Solutions</p> <p>When faced with a challenge, the Contributor’s first response is: “Can we find a solution?” This is unlike a Non-contributor who may respond to the challenge by trying a little and giving up, blaming others, or finding excuses to cover up the issue.</p> <p>Whereas, the Contributor finds a solution. In other words, the Contributor develops the capacity to find solutions through continuous practice and learning from other Contributors.</p> <p>In this topic, students learn the importance of willingness and ability to find solutions.</p>
8	<p>Focus on value</p> <p>What does creating value mean? It means making a positive difference, a tangible impact, a specific contribution to any situation. This positive difference or impact can be in the form of achieving a specific goal, creating a product, creating ‘human touch’ in a particular interaction, or enhancing one’s own capacity, or the capacity of one’s colleagues and team- mates.</p> <p>Contributors are therefore extremely result-focused, but the result is measured in terms of value created.</p> <p>In this topic, students learn to clarify the meaning of the word “value” and how value is created in various situations.</p>
9	<p>Engage deeply</p> <p>Contributors are instantly distinguished by the way they approach work. They get involved. They are enthusiastic. They go deep into the subject. In short, Contributors love what they do.</p> <p>This is in direct contrast to Non-contributors who want to do only what they love - an approach that seems reasonable until you realize that life and workplaces have so much variety that you may very often be called upon to do tasks that seem unpleasant or boring until you get involved.</p> <p>In this topic, students learn the importance of engaging deeply with whatever work they do – at work, in study, in personal life.</p>
10	<p>Think in Enlightened Self-interest</p> <p>Contributors think in Enlightened Self-Interest. In every situation they get into, they find a way to create something good for self and for all at the same time – including team mates, bosses, customers and their organization.</p> <p>Contrasting to this is the mindset of a Non-Contributor. Such a person is only concerned with his/ her own self-interest in a situation. He/she is not concerned about the impact (positive or negative) on the other person. This leads to unpleasant</p>

	<p>situations, broken relationships, unhappy team-mates, subordinates, and bosses, and lower trust in any situation.</p> <p>Students are expected to learn to appreciate the importance of thinking win-win for all stakeholders and also in various situations.</p>
11	<p>Practice Imaginative Sympathy</p> <p>One of the unique qualities of Contributors is their ability to appreciate and understand others' life situation, others' mental condition, and others' point of view. How do they do this?</p> <p>They have consciously developed a 'way of thinking' called 'Imaginative Sympathy'. In this way of thinking, they are able to give due importance to the human aspects of a situation, and not just the technical or commercial aspects.</p> <p>But this is not all. Imaginative Sympathy goes beyond looking at the human aspects of the situation. It also means that Contributors are able to anticipate possible interactions or reactions, they are able to take a multi-dimensional view of a situation and they are able to bring about changes or results while taking everybody along with them.</p> <p>Imaginative Sympathy translates itself into active concern for others. Students will learn the importance and consequences of Imaginative Sympathy in a workplace situation.</p>
12	<p>Demonstrate Trust Behavior</p> <p>Contributors recognize that they are able to achieve results and make contributions with the help of other human beings. They receive this help if and only if they are trusted and, in turn, trust. Contributors practice trust behavior from very early in their career, thereby building a huge trust balance (like a bank balance) over their career and relationships.</p> <p>The term Trust Behavior may be described as character-in-action. This includes keeping one's word and commitments, staying with a task, acting with integrity in every situation, making sure that there is complete transparency in one's actions and interactions, etc.</p> <p>Students are expected to learn to develop a deep appreciation of trust behavior and how it is practiced.</p>
13	<p>Resume Building</p> <p>In this topic, students learn to develop a resume for the job-market. Students will learn to develop both a generic resume and resumes specific to some types of jobs. Students learn about best practices and common errors in developing their resume.</p>

	Most important, students learn to analyze the jobs offered and present themselves in terms of their potential / willingness to contribute to the job.
14	<p>Group Discussions (GDs)</p> <p>In this topic, students learn (i) how to participate in a group discussion from the contributor's view-point (i.e. how to speak) (ii) how to contribute to the development of the topic (i.e. what to speak) and (iii) to develop the Contributor's view-point on various GD topics (i.e. how to interpret a topic of discussion from the point of view of a contributor)</p>
15	<p>Interview Skills</p> <p>In this topic, students learn about (i) common interview questions and how to develop answers (ii) typical challenges faced in interviews beyond the questions (such as body language, grooming, presentation) (iii) most important, the student learns the importance of trust building and creating confidence in the interview.</p>

(C) Course Plan

The course duration is 48 hours. It can be conducted in sessions of 1 hour each or some of the sessions can be combined as 2 hours each. The course plan is as follows –

<p>Topic 1: Who is a Contributor –</p> <ul style="list-style-type: none"> – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects 	3 hours
<p>Topic 2: The Contributor's identity –</p> <ul style="list-style-type: none"> – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects 	3 hours
<p>Topic 13: Resume Building</p> <ul style="list-style-type: none"> – 2 hours for Concepts, Tools, and Techniques – 2 hours for Projects 	4 hours
<p>Topic 3: The Contributor's vision of success –</p> <ul style="list-style-type: none"> – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects 	3 hours
<p>Topic 4: The Contributor's vision of career –</p> <ul style="list-style-type: none"> – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects 	3 hours
<p>Topic 5: The scope of contribution –</p> <ul style="list-style-type: none"> – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects 	3 hours

Topic 6: Embarking on the journey to contributorship – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol I) – 1 hour Presentations and Projects	3 hours
Topic 14: Group Discussions (GDs) – 2 hours for Concepts, Tools, and Techniques – 2 hours for Projects and Practice	4 hours
Topic 7: Design Solutions – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 8: Focus on value – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 9: Engage deeply – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 10: Think in Enlightened Self-interest – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 11: Practise Imaginative Sympathy – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 12: Demonstrate Trust Behavior – – 2 hours Theory and practice exercises based on Contributor Personality Program Workbook (Vol II) – 1 hour Presentations and Projects	3 hours
Topic 15: Interview Skills – 2 hours for Concepts, Tools, and Techniques – 2 hours for Projects and Practice	4 hours
TOTAL	48 hours

(D) Examination Approach

Total marks: 150. Break-up of marks -

- (i) Final exam : 70 marks (equal weightage for topics 1-15)
- (ii) Presentations and projects for topics 1-12: 30 marks
- (iii) Projects for topics 13-15: 50 marks

(E) Instructional Strategy

1.0 The entire course will use a three-level instructional strategy

- Level I: Classroom Explorations
- Level II: Projects and Presentations
- Level III: Self-study by students

2.0 Level I: Classroom Explorations

1. The Classroom Explorations will be organized around the ‘Contributor Personality Program – Study Book’.

The Study Book may be downloaded by the student from the resource site produced by GTU.

2. The Classroom Explorations involves two kinds of explorations:
 - (i) Exploration of key concepts / frameworks such as “contributors vision of success” etc.
 - (ii) Exploration of the examples provided in the CPP Study Book.
3. The Classroom Explorations will be supported by Session Guide Sheets available online in the CPP ActivGuide.

3.0 Level II: Projects & Presentations

1. The entire Classroom Exploration process will be supplemented by projects and presentations.
2. Session Guides will provide sample topics for projects and presentations. Individual instructors will be free to develop their own projects/ presentation topics also.
3. This will not only enhance conceptual clarity but also build presentation, public-speaking, report writing, and group discussion skills of the students.

4.0 Level III: Self Study by students

1. Students will be given extensive learning support (upto 400 learning units) in the ActivGuide website. This will include videos, presentations, tests, etc.
2. Students can refer to ActivGuide on their own time through internet.

(F) Reference Material

Basic Study Material

SN	Author/s	Name of Reference	Publisher	Edition
1	Illumine Knowledge Resources Pvt. Ltd. (Downloadable from the internet)	Contributor Personality Program Workbook (Vols I & II)	Illumine Knowledge Resources Pvt. Ltd	Latest
2	Illumine Knowledge Resources Pvt. Ltd. (will be made available to all students on the Internet)	Contributor Personality Program ActivGuide	Illumine Knowledge Resources Pvt. Ltd	Latest

Reference Books

Topic	Course Title	Reference
1	Who is a Contributor	1. On Contributors, Srinivas V.; Illumine Ideas, 2011 2. Enlightened Citizenship and Democracy; Swami Ranganathananda, Bharatiya Vidya Bhavan, 1989 3. Personality Development, Swami Vivekananda; Advaita Ashrama
2	The Contributor's identity	1. To have or to be, Erich Fromm; Continuum International Publishing Group, 2005 2. The art of being, Erich Fromm; Continuum International Publishing Group, 1992 3. Raja Yoga, Swami Vivekananda; Advaita Ashrama
3	The Contributor's vision of success	1. Eternal Values for a Changing Society – Vol IV (Ch 25, 35), Swami Ranganathananda; Bharatiya Vidya Bhavan, 1993 2. Karma Yoga, Swami Vivekananda; Advaita Ashrama
4	The Contributor's vision of career	1. Six Pillars of Self Esteem , Nathaniel Branden; Bantam, 1995 2. Mindset: The New Psychology of Success, Carol S. Dweck; Random House Publishing Group, 2007
5	The scope of contribution	1. Awakening India, Swami Vivekananda; Ramakrishna Mission, New Delhi, 2011 2. Eternal Values for a Changing Society – Vol IV

		<p>(Ch 35), Swami Ranganathananda; Bharatiya Vidya Bhavan, 1993</p> <p>3. Lasting Contribution: How to Think, Plan, and Act to Accomplish Meaningful Work, Tad Waddington; Agate Publishing, 2007</p>
6	Embarking on the journey to contributor ship	<p>1. Vivekananda: His Call to the Nation, Swami Vivekananda; Advaita Ashrama</p> <p>2. Eternal Values for a Changing Society – Vol IV (Ch 33), Vol III (Ch 19, 21, 30) Swami Ranganathananda; Bharatiya Vidya Bhavan, 1993</p> <p>3. Lectures from Colombo to Almora, Swami Vivekananda; Advaita Ashrama</p>
7	Design Solutions	<p>1. Why not?: how to use everyday ingenuity to solve problems big and small, Barry Nalebuff, Ian Ayres; Harvard Business School Press, 2003</p> <p>2. How to Have a Beautiful Mind, Edward De Bono; Vermilion, 2004</p>
8	Focus on value	<p>1. The value mindset: returning to the first principles of capitalist enterprise (Ch 8 & 9); Erik Stern, Mike Hutchinson; John Wiley and Sons, 2004</p> <p>2. Managing for Results, Peter F. Drucker; HarperCollins, 2009</p>
9	Engage deeply	<p>1. The Power of Full Engagement: Managing Energy, Not Time, is the Key to High Performance and Personal Renewal, Jim Loehr, Tony Schwartz; Simon and Schuster, 2003</p>
10	Think in Enlightened Self-interest	<p>1. The 7 Habits of Highly Effective People, Stephen R. Covey; Simon and Schuster, 2004</p> <p>2. Creating Shared Value, Michael E. Porter and Mark R. Kramer; Harvard Business Review; Jan/Feb2011, Vol. 89 Issue 1/2</p>
11	Practice Imaginative Sympathy	<p>1. Eternal Values for a Changing Society – Vol IV (Ch 8, 10, 23, 35, 37), Swami Ranganathananda; Bharatiya Vidya Bhavan, 1993</p> <p>2. Eternal Values for a Changing Society – Vol III (Ch 18), Swami Ranganathananda; Bharatiya Vidya Bhavan, 1993</p>
12	Demonstrate Trust Behavior	<p>1. The Speed of Trust: The One Thing That Changes Everything, Stephen M. R. Covey, Rebecca R. Merrill, Stephen R. Covey; Free Press, 2008</p> <p>2. Integrity: The Courage to Meet the Demands of</p>

		Reality, Henry Cloud; HarperCollins, 2009 3. Responsibility at work: how leading professionals act (or don't act) responsibly, Howard Gardner; John Wiley & Sons, 2007
13	Resume Building	1. What Color Is Your Parachute? 2012: A Practical Manual for Job-Hunters and Career-Changers, Richard Nelson Bolles; Ten Speed Press, 2011 2. The what color is your parachute workbook: how to create a picture of your ideal job or next career, Richard Nelson Bolles; Ten Speed Press, 2011
14	Group Discussions (GDs)	1. Effective Group Discussion: Theory and Practice, Gloria J. Galanes, Katherine Adams; McGraw-Hill, 2004
15	Interview Skills	1. What Color Is Your Parachute? 2012: A Practical Manual for Job-Hunters and Career-Changers, Richard Nelson Bolles; Ten Speed Press, 2011 2. The what color is your parachute workbook: how to create a picture of your ideal job or next career, Richard Nelson Bolles; Ten Speed Press, 2011

General References:-

SN	Author/s	Name of Book	Publisher	Edition
1	Swami Ranganathananda	Universal Message of the Bhagavad Gita (Vol 1-3)	Advaita Ashrama, Kolkata	Latest
2	Swami Ranganathananda	Eternal Values for a Changing Society (Vol 1-4)	Bharatiya Vidya Bhavan	Latest
3	Asim Chaudhuri	Vivekananda: A Born Leader	Advaita Ashrama, Kolkata	Latest
4	Swami Vivekananda	Complete Works of Swami Vivekananda (Vol 1-9)	Advaita Ashrama, Kolkata	Latest
5	Swami Vivekananda	Letters of Swami Vivekananda	Advaita Ashrama, Kolkata	Latest

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

HUMAN RESOURCE MANAGEMENT (Code: 3330001)

Diploma Programmes in which this course is offered	Semester in which offered
Bio Medical Engg., Mechanical Engg., Mechatronics Engg., Metallurgy Engg., Power Electronics, Plastic Engg., Printing Technology, Ceramic Engg., Textile Manufacturing Technology, Textile Processing Tech., Textile Designing,	3 rd Semester

1. RATIONALE

Human resources are very crucial for effective achievement of changing goals of the organization. They have tremendous level of untapped potential which can be utilised by professional supervisor using human resource management abilities. In changing environment the role of the supervisor and people becomes crucial to success. Working conditions may create stress and conflict which could be managed effectively using various tools and techniques related to training, guidance, counselling, mentoring and coaching. In the present era of globalisation, human resource is considered as a dynamic asset which in turn contributes for achieving the excellence and delighting the customers.

This course aims at developing intra-personal, inter-personal and social competencies in the polytechnic students so as to enable them to perform their future role of supervisor effectively.

2. COMPETENCIES (Programme Outcomes according to NBA Terminology)

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.

- i. **Manage people effectively to achieve organizational goals**
- ii. **Foster values, positive attitude and interpersonal relations.**
- iii. **Facilitate employees for effective achievement of personal goals**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
2	0	0	2	70	30	0	0	

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

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit I Introduction	1.a Appreciate importance of human resource	1.1 Need and scope of human resource management in industrial environment. 1.2 Impact of human factors on productivity and industrial harmony. 1.3 Importance of providing need based training to the man power. 1.4 Qualities of a good supervisor.
Unit II Human needs, relations and values	2.a Identify human motivations.	2.1 Importance of human resources in Indian philosophy. 2.2 X and Y theory. 2.3 Maslow's hierarchy, its importance in managing human resources.
	2.b Appreciate values and ethics for relationships.	2.4 Need of human relations and human values in the industry, inter department and intra department. 2.5 Good relations with the suppliers and clients. 2.6 Desirable human values and their importance including ethics and morale values.
Unit III Behavioural dynamics	3.a Analyse self for interpersonal behaviour.	3.1 Need for interpersonal competence. 3.2 Determinants of interpersonal behaviour. 3.3 Concept of interpersonal orientation and attractions and its importance in human behaviour.
	3.b Develop team spirit and positive attitude.	3.4 Concept of group dynamics. 3.5 Dynamics of group formation. 3.6 Types of groups. 3.7 Role of teams in an organization. 3.8 Desirable characteristics of a team member. 3.9 Concept & importance of positive attitude and openness of mind. 3.10 Do's and don'ts for developing positive attitude. 3.11 Importance of mental health.
Unit IV Leadership Development	4.a Use leadership qualities. 4.b Develop subordinates by motivations & training. 4.c Develop decision	4.1 Various definitions of leadership. 4.2 Situational approach to leadership. 4.3 Quality of a good leader. 4.4 Power influence and compliance. 4.5 Influence of Leadership. 4.6 Techniques to deal people effectively. - case studies.

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	making ability.	4.7 Importance of resource management (human, machine, material, method, money, time (moment), information (message)). 4.8 Need, importance & types of organisational training. 4.9 Need and importance of motivations. 4.10 Changing role of supervisor as facilitator & motivator. 4.11 Need, importance and use of guidance, mentoring, coaching and counselling. 4.12 Importance of problem solving and decision making in context of productivity, quality, cost consciousness, human relations and goal achievement. 4.13 Factors affecting decision making. 4.14 Types and process of decision making. 4.15 Make the decisions for given case/situation. - case studies.
Unit V Change and stress management.	5.a Identify need for change and barriers to change. 5.b Suggest strategies for any change. 5.c Resolve conflicts.	5.1 Need for change. 5.2 Barriers to change. 5.3 Strategies and tools to manage change. (Effective implementation and management of change). - case studies. 5.4 Trade unions and their objectives. 5.5 Constructive role of trade unions in goal setting, achievement and change management. 5.6 Causes of conflicts and techniques to resolve conflicts - case studies.
	5d. Analyse stress situation 5e. Manage stress.	5.7 Concept of stress. 5.8 Causes of stress. 5.9 Stress measuring techniques. 5.10 Need for relieving stress. 5.11 Techniques to manage the stress- case studies. 5.12 Self-management techniques

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	02	02	03	00	05
II	Human needs, relations and values	04	05	05	00	10
III	Behavioural dynamics	08	06	07	07	20
IV	Leadership Development	08	05	05	10	20
V	Change and stress management	06	02	08	05	15
Total		28	20	28	22	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. LIST OF EXERCISES/PRACTICAL

Not Applicable

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- a: Name the students with whom you have very good relations. Also list the reasons for that.
- b: Name the students with whom you have very bad relations. Also list the reasons for that.
- c: List the factors/situations which motivate you.
- d: Identify the situations which cause stress to you. Also state reasons for that.
- e: Visit institute's canteen, workshop and administration departments and identify the ways how people manage stress during peak hours.
- f: Visit nearby hotels, hospitals, malls, workshops, industries and draw the organisational structure followed in these organisations. Also prepare a list of documents that are commonly used by them for effective and smooth working of these organisations.
- g: Visit nearby hotels, hospitals, malls, workshops, industries and prepare a report on how they are dealing with day to day grievances and customer complaints.
- h: Visit different organisations and prepare a report on various unions exist in these.
- i: Each student should search the web and prepare biography of one leader from any field and try to identify the leadership traits he/she possesses.
- j: Participate in team building exercises
- k: Prepare a plan to develop yourself for achieving excellence

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Strategies	Purpose
1	I	Live examples/movies on productivity and harmony.	Importance of productivity and harmony can be understood.
2	II	a: Group discussion for Maslow's hierarchy. b: Case study/ case movie which appreciate importance of values and ethics.	To identify human motivations and to appreciate values and ethics for relationships.
3	III	a: Presentation on self characteristics. b: Tasks assignments to deal in team. c: Case study/movie. d: Group discussion.	To analyse self for interpersonal behaviour and develop the ability to work in team. Also to develop self confidence and openness of the thoughts.
4	IV	a: Case study-leadership. b: Role play-leadership. c: Group discussion-case for decision making. d: Group discussion for the case which require solution.	To make students aware of the techniques to deal different types of people effectively. Also to develop the ability to identify the factors affecting decision making.
5	V	a: Case study/Movie. b: Group discussion.	To know the causes of conflicts and to find out the resolution techniques of conflicts. Also to know the techniques to manage the stress.

9. SUGGESTED LEARNING RESOURCES**(A) List of Books:**

Sr. No.	Title of Books	Author	Publication
1.	Managing people at work.	Ahuja, Jain & Chhabra.	Dhanpatrai and Sons.
2.	Human Resource Management	D.R.Patel, Y.R.Joshi	Atul Prakashan.
3.	Human Resource Management	Biswajeet Pattanayak	PHI
4.	Human Resource Management	K. Aswathappa	Tata McGraw Hill
5.	Human Resource Management	V. S. P. Rao	
6.	Seven Habits of successful people	Stephen R. Covey	Free Press
7.	Competency Framework for HRM	B.L. Gupta	Concept Publishing Company, New Delhi, First Edition 2011
8.	Designing and Managing human resources systems.	Pareek, Udai and Rao T.V.	Oxford and TBH Publishing Co., New Delhi 1981
9.	Behavioural processes in organisation.	Pareek, Udai and Rao T.V.	Oxford and TBH Publishing Co., New Delhi 1981

(B) List of Software/Learning Websites:

- a. www.cipd.co.uk/NR/rdonlyres/29D9D26D.../9781843982654_sc.pdf
- b. www.slideshare.net/kumaravinash23/chapter-12-2634971
- c. www.tutor2u.net/business/people/motivation_theory_mcgregor.asp
- d. www.mindtools.com
- e. kalyan-city.blogspot.com/.../maslow-hierarchy-of-needs-theory-of.html
- f. www.enotes.com › Health
- g. www.youtube.com/watch?v=RwZ4-GTSNUI
- h. www.entrepreneur.com/article/204248
- i. ceocommunity.ning.com/forum/attachment/download?id...
- j. www.facultyfocus.com/...leadership/improve-your-decision-making-skill...
- k. www.nap.edu/catalog.php?record_id=13188
- l. nearyou.gwu.edu/hrdl-hr/hrd-ld-hr_brochure.pdf
- m. www.hrinz.org.nz/Site/Resources/...Base/.../Change_Management_.aspx
- n. <http://www.youtube.com/watch?v=OD6-dBymmjk>
- o. <http://www.youtube.com/watch?v=SJR-MRVd1okhttp://www.youtube.com/watch?v=pbxpg6D4Hk8>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. Shah Bhaskar K.** Lecturer in Mechanical Engineering, Butler Polytechnic, Vadodara.
- **Prof. A.M. Talsaniya**, Lecturer in Mechanical Engineering, Sir Bhavsinhji polytechnic institute, Bhavnagar.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. B.L.Gupta**, Professor and Head, Department of Management.
- **Prof. Sharad Pradhan**, Associate Professor and Head Department of Mechanical Engineering.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

BASIC MOULD DESIGN (Code: 3332301)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 rd semester

1. RATIONALE

Mould design is the heart of plastic engineering. The quality of any plastic component lies in the accurate design of plastic mould. Every plastic diploma engineer has to invariably handle different types of moulds and the materials required for their manufacture in small scale or large scale plastic industries. S/he will have to identify, analyse and choose the most relevant mould for different applications. Moreover s/he will also have use different types of hand or machine operated plastic moulding equipment. Hence, this course has been designed to develop such competency and skills.

2. COMPETENCY (Programme Outcome according to NBA Terminology)

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

- **Select different types of plastic moulds for various applications.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Hand Injection Mould and Machine Injection Mould	1a. Describe functions various mould components. 1b. Sketch different mould parts as well as mould assembly	1.1 Basic concept of: Part drawing, Parting line, Core and cavity Runner and gate, Ejection Back plate, Dowel, Socket headed screw, Sprue, sprue bush, Runner and gate, Locating ring plate, Knock out rod, Guide pin and guide bush, Venting, Cooling channel, Ejector assembly
	1c. Distinguish the features between hand mould and machine mould	1.2 Assembly sketch of hand mould 1.3 Assembly sketch of machine mould
Unit– II Parting Surfaces	2a. Discriminate between flat parting surface and non-flat parting surface.	2.1 Concepts: Flat parting surface and Non-flat parting surface
	2b. Distinguish between Stepped, Profiled and Angled parting surfaces	2.2 Stepped, Profiled and Angled parting surface.
	2c. For a given situation select the relevant parting surface	2.3 Complex edge forms
Unit– III General Mould Construction	3a. Distinguish between integer and core plates	3a. Core and cavity: Integer cavity and core plates, Inserts and local inserts
	3b. Discriminate between inserts and local inserts	
	3c. For the given situation, choose the relevant insert	
Unit – IV Feed System	3b. Differentiate between solid, strip and chase type bolster plates.	3c. Types of bolster plates: Solid type, Strip type, Frame type, Chase type
	3c. State the features of the guide bush	3d. Guide bush and guide pillar: Leader pins, Standard, Spigotted, Surface fitting, Pull-back
	4a. Explain feeding system 4b. Differentiate between Sprue and runner	4.1 Sprue 4.2 Runner : Runner section and size, Runner layout, Balancing of runner system
	4c. State the function and location of gate	4.3 Types of gate and location of gate
Unit – V Ejection	5a. State the need for the ejector grid	5.1 Ejector grid 5.2 Ejector plate assembly

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
System	5b. Distinguish between ejector and retaining plate	Ejector plate, Retaining plate, Ejector rod and bush, Assembly return systems 5.3 Ejector elements and ejection systems
	5c. State the need for sprue puller	5.4 Sprue puller
Unit – VI Cooling system	6a. Justify the need for a cooling system.	6.1 Need for cooling
	6b. Select the most appropriate cooling integer for a given situation with relevant justification	6.2 Cooling integer: Cavity plate cooling - U-circuit, Rectangular circuit, Z-circuit; Core plate cooling - Angle hole system, Baffled hole system, Stepped circuit
	6c. Distinguish between cooling cavity rectangular and circular insert	6.3 Cooling cavity inserts: Rectangular and Circular insert
6d. Differentiate between helical core, Heat pipe and Heat rod and Baffle cooling	6.4 Cooling core insert: Helical core cooling, Deep chamber design, Heat pipe cooling, Heat rod cooling 6.5 Baffle cooling	

5. SUGGESTED SPECIFICATION TABLE FOR THEORY

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Hand Injection and Machine Injection Mould	07	07	03	03	13
2.	Parting Surface	03	02	03	00	05
3.	General Mould Construction	08	07	03	03	13
4.	Feed System	08	06	04	03	13
5.	Ejection System	08	07	03	03	13
6.	Cooling System	08	06	03	04	13
	Total	42	35	19	16	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective**)

domain) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours Required
1	I	Draw plan and sectional elevation of different injection moulded parts with actual dimensions	08
2		Draw plan and sectional elevation of various components of different injection mould	08
3		Draw assembly drawing of hand injection mould for given plastic products	08
4		Draw detail drawing of hand injection mould for given plastic products	08
5	II	Sketch various types of parting surfaces	08
6	V	Sketch ejector plate assembly, ejector elements, ejector systems and various types of sprue puller	08
7	VI	Draw different cooling designs	08
Total			56

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect injection moulded articles and measure its weight and volume.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby mould making industry.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Visit to nearby plastic industries
- ii. Video/Animation films on working of different type of molding machines may be shown.
- iii. Mini project on study of different type of molding machines and design of moulds may be given to students.

9. SUGGESTED LEARNING ACTIVITIES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Injection mould design	R.G.W. Pye.	Longman, 1989
2.	Fundamentals of injection mould design	A.B. Glenvil L and Denton	Industrial Press, 1965 (The University of California)
3.	Plastics mould Engineering handbook	Prible and Drebois	Springer (1987)
4.	How to make injection mould	Henser publication	Henser publication

B) List of Major Equipment/ Instrument with Broad Specifications

- i. Hand injection mould – (write broad specifications)
- ii. Machine injection mould – (write broad specifications)
- iii. Injection mould components – (write broad specifications)
- iv. Digital weighing scale – (write broad specifications)
- v. Measuring instruments – (write broad specifications)

C) List of Software/Learning Websites

- i. <http://www.ferris.edu/htmls/academics/course.offerings/hillm/MYWEB7/index.htm>
- ii. <http://mould-technology.blogspot.in/search/label/Mold%20Construction>
- iii. http://webhotel2.tut.fi/projects/caeds/tekstit/mould/mould_structure.pdf
- iv. <http://mould-technology.blogspot.in/2008/02/basic-functions-of-mold-base-parts.html>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

COMPRESSION TRANSFER AND INJECTION MOULDING (Code: 3332302)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 rd semester

1. RATIONALE

A plastic diploma engineer has to supervise operations of injection moulding machines. This competency requires the knowledge of compression transfer and the working principle of different kinds of plastic moulding machines. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. LIST OF COMPETENCIES (Programme Outcome according to NBA Terminology):

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

- Operate injection moulding machines for relevant applications

3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Compression moulding process	1a. Describe compression moulding machine parts	1.1 Basic principle of compression moulding, Compression moulding press, Type, Manual, Semi automatic, Fully automatic, Constructional details, Heating system, Steam heating, Electric heating, Oil heating.
	1b. Select appropriate material for product	1.2 Material selection criteria, Fillers and additives, Preheating, Bulk factor and performs
	1c. State the steps to operate compression moulding machine	1.3 Moulding process, Complete moulding cycle, Moulding cycle v/s time diagram, Process variables, Post curing, cooling fixtures and finishing, Advantages and disadvantages, Trouble shooting, Start-up and shut down procedure.
	1d. Apply compression moulding techniques on different systems.	1.4 Applications of compression moulding
Unit– II Compression mould	2a. Distinguish different types of compression mould	2.1 Hand compression mould, Mould parts, Function, Types, Open flash mould, Positive mould, Landed positive mould, Semi-positive mould.
	2b. Design compression mould as per requirements	2.2 Assembly and detail drawing, Automatic compression mould, Land length, Pressure pad, Powder well, Core pins and loose parts, significance, Methods of ejection.
	2c. Calculate powder well	2.3 Volume calculation, Height calculation, Press tonnage requirement for mould.
	2d. Distinguish between stripper plate mould and side-ram moulds	2.4 Stripper plate mould, side-ram moulds
Unit– III Transfer moulding process	3a. Describe the concepts of transfer moulding. 3b. Describe the Machine parts of transfer moulding. 3c. State the steps to operate transfer moulding machine for different applications	3.1 Basic principle of transfer moulding process 3.2 Transfer moulding machine, Constructional details, Types, Pot transfer, Plunger transfer, Screw transfer 3.3 Moulding process, Process steps, Process variables, Advantages and disadvantages, Trouble shooting, Start- up and shut down procedure, Applications of transfer moulding

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	3d. Compare the compression moulding and transfer moulding.	3.4 Compression moulding process
Unit – IV Transfer moulds	4a. Distinguish different types of transfer mould	4.1 Introduction, Integral pot transfer mould, Mould parts, Function, Factors to be considered for determining pot dimensions, Plunger transfer mould, Types, Top plunger, Bottom plunger
	4b. Design transfer mould as per requirements	4.2 Mould parts, Function, Transfer chamber calculation, Chamber depth, Transfer pressure, Compare Integral Pot transfer mould and Plunger transfer mould
	4c. Design the various components for transfer mould	4.3 Venting, gate and runner designs for transfer mould
	4d. Explain cull removing techniques	4.4 Cull and its removal
Unit – V Injection moulding	5a. Describe injection moulding machine parts	5.1 Basic principle of injection moulding, Constructional details of injection moulding machine
	5b. Stated the steps to operate injection moulding machine	5.2 Moulding process, Process steps, Process variables, Advantages and disadvantages, Trouble shooting, Start-up and shut down procedure, Applications of injection moulding process
	5c. Discriminate compression, transfer and injection moulding process	5.3 Comparison with injection moulding of thermoplastics, Comparison with compression and transfer moulding process.

5. SUGGESTED SPECIFICATION TABLE

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Compression moulding process	12	08	04	04	16
2.	Compression mould	09	04	06	04	14
3.	Transfer moulding process	08	06	04	04	14
4.	Transfer mould	07	04	04	04	12
5.	Injection moulding of thermosets	06	07	04	03	14
	Total	42	29	22	19	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours required
1	I	Identify the different parts of compression moulding machine	04
2		Adjust the settings of a compression moulding machine for producing a particular product	04
3		Calculate compression moulding pressure for Urea formaldehyde(UF)	04
4	II	Use a hand compression mould to produce a given product	04
5		Operate an automatic compression mould for a given product safely	04
6	III	Identify the different parts of transfer moulding machine	04
7		Calculate transfer moulding cycle time for a given product	04
8		Operate a transfer moulding machine for a given product safely	04
9		Calculate transfer moulding temperature for Phenol formaldehyde(PF)	04
10	IV	Design to produce integral pot transfer mould for a given product	04
11		Design plunger transfer mould for a given product	04
12	V	Identify the parts of an injection moulding machine	04
13		Operate an injection moulding machine safely	04
14		Plan in detail sequence of operations required for making a given product using injection moulding	04
Total			56

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect moulded products of thermosets material and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby thermosets processing industry.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Lecture and demonstration
- ii. Practical exercises
- iii. Mini project

9. SUGGESTED LEARNING ACTIVITIES

A) List of Books

Sr. No.	Title of Book	Author	Publication
1.	Plastic Materials and Processes	Goodman	
2.	Injection Moulding	Irvin I. Rubin	
3.	Thermosetting Plastics	J.F. Monk	
4.	Plastic Engineering Handbook	Berins	
5.	Injection Moulding Handbook	Rosato and Rosato	
6.	Moulding of Plastics	Bikales	
7.	Compression Moulding	Davis	
8.	Injection Moulding Handbook	Fredoz	
9.	Injection/Transfer Moulding Of Thermosetting Plastics	Wright	
10.	Plastics Mould Design	Bebb	
11.	Plastics Mould Engineering Handbook	Dubois and Pribble	
12.	Handbook of Plastic Technology	Allen and Baker	

B) List of Major Equipment/ Instrument with Broad Specifications

- i. Compression moulding machine
- ii. Compression hand mould
- iii. Compression automatic mould
- iv. Measuring instrument
- v. Transfer moulding machine
- vi. Transfer mould
- vii. Injection moulding machine
- viii. Injection mould

C) List of Software/Learning Websites

- i. http://www.plenco.com/plenco_processing_guide/Sect%2014%20Preforming%20and%20Preheating.pdf

- ii. http://www.efunda.com/processes/plastic_molding/molding_transfer.cfm
- iii. http://www.eng.su.ac.th/che/old53/faculty_and_staff/sirirat/slide_polymer_processing_pdf/polymer_processing_10.pdf
- iv. <http://www.standardplasticscorp.com/pages/products.htm>
- v. <http://www.longmold.com/more.php?id=14>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, G.P., Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, G.P., Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

MOULD FABRICATION TECHNOLOGY-I

(Code: 3332303)

Diploma Programmes in which this course is offered	Semester in which offered
Plastic Engineering	3 rd Semester

1. RATIONALE

A plastic diploma engineer has to use various metal alloys and basic machine tools for selected mould materials. This competency requires the knowledge of ferrous metals and alloys and non ferrous metals and alloys- their structures and properties for selection of materials for fabricating machine components and mould used in plastics industries. This may help to understand different heat treatments and other advanced mould fabrication techniques. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes. This is an important course for plastic engineers.

2. LIST OF COMPETENCIES (Programme Outcome according to NBA Terminology):

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

- Operate various basic machine tools for selected mould materials.

3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

4.DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Introduction to Engineering Materials	1a. Describe various engineering materials	1.1 Introduction 1.2 Classification of engineering materials 1.3 Properties of engineering materials 1.4 Applications of engineering materials
Unit– II Ferrous Metals and Alloys	2a. Describe different types of steel 2b. Explain effect of various alloying elements on properties of steel	2.1 Basics of steel, Types of steels. 2.2 Composition and uses of cast iron. Effect of silicon, sulphur and phosphorus on properties of steels. Effects of alloying elements on steels such as chromium, nickel, manganese, tungsten, vanadium, molybdenum. Composition of tool steels/alloy steels.
Unit– III Non Ferrous Metals and Alloys	3a. Describe the non ferrous metal alloys 3b. Select appropriate non ferrous metals and alloys	3.1 Introduction, Properties of non-ferrous metals, Aluminium & its alloys, Copper & its alloys 3.2 Application of non-ferrous metals & Alloys
Unit – IV Heat Treatment of Steel	4a. State the need of heat treatment 4b. Distinguish different heat treatment processes	4.1 Principle of heat treatment. 4.2 Annealing & process annealing, Normalising Hardening, Tempering, Case hardening (Pack carburising & gas carburising), Nitriding Cyniding (Cabonitriding), Flame hardening
Unit – V Basic Machine Tools	5a. Classify basic machine tools 5b. Describe working principle and various machine tools 5c. Select proper machine tool for mould fabrication	5.1 Classification of basic machine tools. 5.2 Working principle, types, constructional features, operations, advantages and disadvantages, 5.3 applications of: Lathe machine, Drilling machine, Shaping machine, Milling machine, Boring machine

5.SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Introduction to Engineering Materials	05	05	02	00	07
2.	Ferrous Metals and Alloys	08	05	05	04	14
3.	Non Ferrous Metals and Alloys	03	04	03	00	07
4.	Heat Treatment of Steel	08	04	08	02	14
5.	Basic Machine Tools	18	04	20	04	28
	Total	42	22	38	10	70

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Notes: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise/Experiment (Course Outcomes in Psychomotor Domain according to NBA terminology)	Approx Hours Reqd.
1	I	Collect one sample of each engineering material and list their properties	04
2	IV	Perform hardening of mould steel using oil as quenching media. Measure change in hardness.	04
3		Perform Tempering process for the above hardened component and measure change in properties/hardness.	04
4		Perform Annealing treatment for the given job and measure the change in hardness.	04
5		Perform Normalising treatment for the given job and measure the change in hardness.	04
6		Perform Case hardening treatment for the given component.	04
7		V	Prepare guide pin on lathe machine
8	Prepare core insert for given product		04
Total			32

7. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect information related to the experiment through internet.
2. Students will visit nearby mould making industry.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Visit to nearby industries/workshops/metal treatment plants
- ii. Video/animation films on working of different type of machine tools.
- iii. Video/animation film on different treatments of metals.

9. SUGGESTED LEARNING ACTIVITIES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Elements of Workshop Technology	Hajra & Choudhary	
2.	Elements to Metallurgy	Swaroop	
3.	Material Science & Processes	Hajra & Choudhary	
4.	Material Science & Metallurgy	O.P.Khanna	
5.	Basic Engineering Metallurgy	Keyser	
6.	Code of designation of steel	IS 1962-61	
7.	A textbook on Metallurgy	Biley	
8.	Workshop Technology Vol 1 & 2	Hajra Choudhary	
9.	Production Technology	Jain and Gupta	
10.	Production Technology	Rusinoff	
11.	Manufacturing Processes	Began	
12.	Production Technology	Lindsburg	

B. List of Major Equipment/ Instrument

- i. Lathe machine
- ii. Drilling machine
- iii. Shaping machine
- iv. Milling machine
- v. Boring machine
- vi. Grinding machine
- vii. Metallurgical microscope
- viii. Hardness tester
- ix. Induction furnace

C. List of Software/Learning Websites

- i. <http://www.lathemachinesindia.com/lathe-machine.html>
- ii. <http://www.hnsa.org/doc/pdf/lathe.pdf>
- iii. <http://www.hnsa.org/doc/pdf/milling-machine.pdf>
- iv. <http://uhv.cheme.cmu.edu/procedures/machining/CH8.PDF>
- v. http://www.efunda.com/processes/heat_treat/introduction/heat_treatments.cfm
- vi. http://web.iitd.ac.in/~suniljha/MEL120/L4_Heat_Treatment_of_Metals.pdf
- vii. <http://www.technologystudent.com/equip1/heat1.html>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawlley**, Professor, Dept. of Applied Sciences
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

PLASTIC MATERIALS-I (Code: 3332304)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 rd Semester

1. RATIONALE

The course deals with structures, properties & applications of plastic materials prepared by various polymerization techniques and compounding. The course will help students to understand uses of plastic materials for various applications in different industries as well as replacement of other engineering materials. It will also help to understand advance plastic materials and plastic product design in future.

2. COMPETENCY (Programme Outcome according to NBA Terminology):

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

- **Select the relevant plastic materials to produce specified plastic product**

3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Rheology	1a. Distinguish different types of plastic flow	1.1 Basics of plastic flow, Types of flow, Newtonian, Non-Newtonian, Pseudo-plastic, Dilatants, Bingham.
	1b. Understand rheology of material by model demonstration	1.2 Rheological properties, Temperature viscosity relation, Maxwell's Model
Unit– II Thermo Plastics	2a. Classify thermoplastic materials 2b. Co-relate structure and properties of thermoplastic material 2c. List applications of thermoplastic	2.1 Structure, properties and applications of the following Thermoplastic material a. Olefins: Polyethylene(LDPE,HDPE), Polypropylene (PP) b. Vinyls : Polyvinyl chloride (PVC), Polyvinyl acetate(PVAc), Polyvinyl alcohol(PVA) c. Styrenics: Polystyrene, Styrene acrylonitrile(SAN), Acrylonitrile butadiene styrene(ABS) d. Acrylics :Polymethyl methacrylate (PMMA), Polyacrylo nitrile(PAN) e. Cellulosics: Cellulose nitrate(CN), Cellulose acetate (CA)
Unit– III Thermo Sets	3a. Classify thermo set materials 3b. Co-relate structure and properties of thermo set material 3c. List applications of thermo sets	3.1 Structure, properties and applications of following Thermo set material a. Phenol formaldehyde(PF) b. Melamine formaldehyde(MF) c. Urea formaldehyde(UF) d. Epoxy e. Silicones f. Polyesters g. Furan h. Polyurethane resin(PUR) i. Diallyl phthalate(DAP)
Unit – IV Engineering Plastics	4a. Classify thermo engineering plastic materials 4b. Compare properties of various engineering plastic material 4c. List applications of engineering plastic	4.1 Structure, properties and applications of following engineering plastic materials: a. Polyamides(nylon-6,6-6,6-12) b. Polytetrafluoroethylene(PTFE) c. Polyesters(PET,PBT) d. Polyurethane resin(PUR) e. Acetal(POM) f. Polycarbonate(PC)
Unit – V High Performance and Heat	5a. Classify High performance and heat resistant polymers	5.1 Introduction, Structure, properties and applications of following High performance and heat resistant polymers: a. Polyetherketones(PEK)

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Resistant Polymers	5b. Compare properties of various High performance and heat resistant polymers 5c. List applications of High performance and heat resistant polymers	b. Polyetheretherketones(PEEK) c. Polyethersulfone(PES) d. Polyphenyl sulfone(PPS) e. Polyphenylene Oxide(PPO) f. Polyvinyl dichloride(PVDC)
Unit – VI Compounding	6a. Explain necessity of compounding	6.1 Introduction of compounding, Significance
	6b. Explain function of additives	6.2 Additives, Types, Function
	6c. Describe compounding equipments	6.3 Compounding equipments, Constructional detail, Process, High speed mixer, Ribbon mixer, Ban burry mixer, Two roll mill

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level I	U Level I	A Level I	Total Marks
1.	Rheology	04	02	04	00	06
2.	Thermo Plastics	12	10	05	03	18
3.	Thermo Sets	08	08	03	03	14
4.	Engineering Plastics	08	08	03	03	14
5.	High Performance and Heat Resistant Polymers	06	05	03	02	10
6.	Compounding	04	02	03	03	08
	Total	42	35	21	14	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise/Experiment (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours Required
1	I	Demonstrate Maxwell's model	04
2	II	Perform identification tests of high density polyethylene(HDPE)	02
3		Perform identification tests of Polystyrene(PS)	02
4	III	Perform identification tests of Epoxy	02
5		Perform identification tests of Urea formaldehyde(UF)	02
6	IV	Perform identification tests of Polycarbonate(PC)	02
7		Perform identification tests of Polyester	02
8	V	Perform identification tests of Polyphenyl sulfone(PPS)	02
9		Perform identification tests of Polyphenylene Oxide(PPO)	02
10	VI	Perform compounding of Polyvinyl chloride(PVC)	04
11		Perform compounding of Polypropylene(PP)	04
Total			28

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect different plastic raw materials as well as moulded products and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby plastic raw material suppliers shop.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Demonstration of samples of different type of materials in the class while teaching about the concerned material.
- ii. Mini projects to students about comparison of different type of materials.

9. SUGGESTED LEARNING ACTIVITIES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Plastics Material	J. A. Brydson	Butterworth-Heinemann 1982
2.	Plastics Material and Processes	S. S. Schwartz	
3.	Engineering Polymer source book	Margolis	
4.	PVC compounding	Swan	
5.	PVC compounding	Tittow	
6.	PVC compounding	A. S. Athaley	

B. List of Major Equipment/ Instrument

- i. Burner (Bunsen Burner)
- ii. Test tube (10 ML)
- iii. Beaker (250 ML)
- iv. Titration sets (Burette 50ML; Pipette 10ML.)
- v. High speed mixer
- vi. Ribbon mixer
- vii. Ban burry mixer
- viii. Two roll mill

C. List of Software/Learning Websites

- i. <http://www.curbellplastics.com/technical-resources/pdf/plastic-material-selection.pdf>
- ii. http://www.okw.co.uk/technical/Material_Specs.pdf
- iii. <http://faculty.ksu.edu.sa/othman/CHE498/General%20Properties%20of%20Plastics.pdf>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, Govt. polytechnic, Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences,
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

Technology for Injection Moulding (Code: 3332305)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 rd Semester

1. RATIONALE

The course enables the learning of the most widely used processing technique for plastic materials. It will help students to understand the injection moulding machines as well as process, troubleshoot processing problems, and produce a moulded product and finishing the product using post moulding operations. The course will help to understand other advance injection moulding processes. It is therefore one of the most important courses for plastic engineers.

2. LIST OF COMPETENCIES (Programme Outcome according to NBA Terminology):

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

- Operate an injection moulding machine safely.

3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Injection Moulding Machines	1a.Explain various parts of injection moulding machine	1.1 Specifications & glossary of terms viz, Injection unit, Clamping unit, Machine types/ classification,Types, Constructional Features and Function of Injection unit a.Hopper b.Screw(terminology) c.Barrel d.Nozzle e.Screw tips f.Drive systems & its comparison (hydraulic & electrical) g.Heating & cooling of screw & barrel
	1b.Compare different clamping mechanism	1.2Clamping unit, Clamping mechanism (hydraulic & toggle) and their comparison
Unit– II Injection Moulding Process	2a.Select proper material	2.1 Material selection criteria
	2b.Operate injection moulding machine 2c.Trouble shoot the injection moulding process 2d.Apply Injection moulding process for various products	2.2 Injection moulding process, Process steps Injection moulding cycle diagram, Process variables. 2.3 Trouble shooting, Start-up and shut-down process steps, Advantages & disadvantages 2.4 Injection moulding applications
	2e. Perform post moulding operations	2.5 Post moulding operations
Unit – III Auxiliary Equipments	3a.Explain working of various auxiliary equipments	3.1Basics of auxiliary, Hopper loader, Hopper drier 3.2Chilling plant, Cooling tower, Heat exchangers 3.3Scrap grinders, Magnetic separators

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Injection moulding machines	20	14	12	08	34
2.	Injection moulding process	14	08	10	04	22
3.	Auxiliary equipments	8	04	06	04	14
	Total	42	26	28	16	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Notes: - This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise/Experiment (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours Required
1	I.	Study of an injection moulding machine	04
2		Compare hydraulic and toggle clamping mechanism	04
3	II.	Operate an injection moulding machine	08
4		Determine cycle time of injection moulding machine for given product	04
5		Measure the effect of process variables(temperature/pressure) on quality of end product in injection moulding process	08
6		Measure the effect of process variables(suck-back/Reduced Injection Pressure) on quality of end product in injection moulding process	08
7		Observe the processing problems and provide their remedies	08
8	III.	Demonstrate various auxiliary equipments	08
9		Grind scrap materials	04
Total			56

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect injection moulded products and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby injection moulding industry.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Visit to nearby plastic industries engaged in injection moulding.
- ii. Video/Animation films on working of different type of injection moulding machines may be shown.
- iii. Mini project may be given to students on different defects in the products, reasons for these defects and possible remedies.

9. SUGGESTED LEARNING ACTIVITIES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Injection Moulding	Irvin I Rubin	Wiley,1973(The University of Michigan)
2.	Injection Moulding Machines	Whealan	Elsevier Applied Science Publishers, 1984(The University of Michigan)
3.	Injection Moulding Machines	Jhonnabeer	Hanser Gardner Publications
4.	Handbook of Plastic Processing Technique	D.V. Rosato	Springer
5.	Plastics Engineers Handbook	J. Fradeos	Springer
6.	Injection Moulding Handbook	D V Rosato	Kluwer Academic Publishers

B. List of Major Equipment/ Instrument

- i. Injection moulding machine
- ii. Scrap grinders
- iii. Crane
- iv. Moulds
- v. Chilling unit
- vi. Weighing scale
- vii. Cooling tower
- viii. Hopper loader

C. List of Software/Learning Websites

- a. www.technologystudent.com
- b. www.paulsontraining.com
- c. www.traininteractive.com/knowledge/previews/injection/
- d. www.people.bath.ac.uk/en3hl/inject

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ENTREPRENEURSHIP DEVELOPMENT
(Code: 3340001)

Diploma Programme in which this course is offered	Semester in which offered
Bio-Medical ,Ceramic ,Plastic engineering	4 th Semester

1. RATIONALE

Entrepreneur creates new business establishments or transforms old business establishments thus they work as engines of growth and play an important role in the development of economy. Our fast growing economy provides ample opportunities for diploma engineers to become successful entrepreneur. As entrepreneurship requires distinct skill set which could not be developed while teaching technical subjects a separate course has been introduced for the same. This course aims at developing competencies in the polytechnic students for becoming a successful entrepreneur. After successfully completing this course some students may develop qualities of a successful entrepreneur and can set up their own manufacturing industry/ service industry/ business/ to become self employed. Thus they can generate wealth and share profits of the company to the share holders and provide employment to others. Thus it is an important course for all to learn.

2. COMPETENCIES

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Foster need for excellence orientation along with skill set for an entrepreneur.**
- **Identify a business opportunity and plan for its establishment.**

3. COURSE OUTCOMES:

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

- i. Appreciate role of intrapreneurs and entrepreneurs in society.
- ii. Develop passion, creativity, initiative, independent decision making, calculated risk taking, assertiveness, persuasion, persistence, information seeking, commitment to work contract.
- iii. Innovate, prototypes or ideas by applying theory into practice.
- iv. Explain process of setting up of service unit/industry.
- v. Describe about support institutions and schemes.
- vi. Develop and complete a comprehensive business plan.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
3	0	0	3	ESE	PA	ESE	PA	
				70	30	00	00	

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

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Entrepreneurship Development - Concept & Scope	1a. Define intrapreneur/ entrepreneur. 1a1. Appreciate benefits of becoming an intrapreneur/ entrepreneur 1b. Identify various avenues of entrepreneurship. 1c. Develop qualities of intrapreneur/ entrepreneur.	1.1 Charms of becoming an intrapreneur/ entrepreneur. 1.2 Entrepreneurship : scope in local and global Market. Steps in setting up of a business. 1.3 Traits of successful intrapreneur/ entrepreneur.
Unit – II Facility Planning	2a. Describe the importance of Product selection 2a1 Select a business opportunity. 2b Explain product life cycle 2b 1. Identify appropriate process for manufacturing/ delivery. 2c. Locate suitable place for setting up industry/ service unit. 2d. Estimate the capacity of a plant	2.1 Selection of Product/ Service, core competence, product life cycle, new product development process, mortality curve, creativity and innovation in product modification/development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection. 2.3 Factors affecting selection of location for an industry. Importance of material handling and its relevance with facility location. 2.4 Calculate capacity of plant and its relation with economies of scale. Including flexibility in capacity.
Unit – III Support agencies for MSME	3a. Differentiate between MSM Enterprises & ancillary industries . 3b. Describe role of support agencies 3b1. Analyse different entrepreneurship, technical, marketing and financial support agencies.	3.1 Categorisation of MSME, ancillary industries 3.2 Support agencies for entrepreneurship guidance, training, registration. 3.3 Support agencies for technical consultation, technology transfer and quality control. 3.4 Support agencies for marketing and finance.
Unit – IV Managing critical resources	4a. List sources of finance 4a1 Describe type of finance sources 4a2 Explain methods of cost control 4a1. Compare suitability of financial institutes for an industry/ service unit. 4b. Apply MRP/JIT in production and services. 4c. Utilise time efficiently. 4d. Develop MIS.	4.1 Managing finance: Sources of finance- types, advantages and disadvantages, methods of cost control & importance, managing working capital. 4.2 Materials Management: MRP, JIT 4.3 Time management: art of managing time 4.4 Information system: Developing suitable information systems.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit– V Project planning	5. Prepare business plan and project reports	5.1 Preparation of business plan and techno economic feasibility study. 5.2 Breakeven point, return on investment and return on sales.
Unit –VI Managing enterprise	6. List the steps to execute Marketing and supply chain plans .	6.1 Identifying a USP, developing a marketing plan, 6.2 Developing supply chain, planning for initial orders
Unit –VII Risk Management	7. Manage risk in business 7a1. Describe planning for calculated risk	7.1 Planning for calculated risk taking, initiation with low cost projects 7.2 Integrated futuristic planning, angel investors, and role of incubation centres.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Entrepreneurship Dev. Concept & Scope	07	2	4	6	12
II	Facility Planning	07	4	4	2	10
III	Support agencies for MSME	06	2	4	6	12
IV	Managing critical resources	08	2	3	7	12
V	Project planning	06	0	5	5	10
VI	Managing enterprise	05	0	4	4	08
VII	Risk Management	03	0	3	3	06
Total		42	10	27	33	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

-----Not applicable-----

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed activities, students should prepare a portfolio of the completed activities for future use:

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

- vii. Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- viii. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- ix. Choose any advertisement and analyse its good and bad points.
- x. Decide any product and analyse its good and bad features.
- xi. Select any product and prepare its cost sheet.
- xii. Choose any product and study its supply chain.
- xiii. Arrange brainstorming sessions for improvement of any product.
- xiv. Study schemes for entrepreneurship promotion of any bank.
- xv. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business.
- xvi. Open a savings account and build your own capital.
- xvii. Organise industrial visit and suggest modifications for process improvement.
- xviii. Interview at least four entrepreneurs or businessman and identify
 - a. Charms of entrepreneurship and Traits of successful entrepreneurs.
- xix. Analyse case studies of any two successful entrepreneurs.
- xx. Perform a survey and identify local resources available for setting up of an enterprise.
- xxi. Engage in marketing of products.
- xxii. Carry out a demand supply gap analysis for a particular product.
- xxiii. Organise a prototype development competition.
- xxiv. Arrange fairs, events in the institute and try for sponsorships.
- xxv. Select any performance criteria and continuously compete with yourself.
- xxvi. On any performance criteria continuously compete with others.
- xxvii. Foresee your dream and make a long term plan for its accomplishment.
- xxviii. Dream for something unique.
- xxix. Read articles, books on creativity.
- xxx. Using morphological analysis technique, reduce cost or increase quality of a product.
- xxxi. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix etc.
- xxxii. Prepare a business plan and organize a business plan competition.
- xxxiii. Select a social cause, set objectives, plan and work for its accomplishment.
- xxxiv. Video graph as many as possible from the above and upload on your website, YouTube, facebook etc.

9. SPECIAL INSTRUCTIONAL STRATEGIES

- i.** Instructors should emphasise more on deductive learning.
- ii.** Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- iii.** Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students.
- iv.** Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- v.** They must be encouraged to surf on net and collect as much information as possible.
- vi.** Each student should complete minimum twenty activities from the suggested list. Minimum possible guidance should be given for the suggested activities.

- vii. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- viii. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- ix. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.

10. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Entrepreneurship	Robert D. Hisrich	McGraw-Hill
2	Entrepreneurship and Small Business Management	S.S. Khanka	Sultanchand and Sons
3	Organisational Behaviour	A K Chitale	PHI Learning
4	Managerial Practices	Nishith Dubey	Shiva Publication
5	Entrepreneurship Development Small Business Entrepreneurship	Poornima Charantimath	Pearson Education India
6	Entrepreneurship Development	S Anil Kumar	New Age International Publishers
7	Entrepreneurship Development	Nishith Dubey	PHI Learning
8	The Entrepreneurial Instinct	Monica Mehta	McGraw-Hill
9	Jugaad Innovation	Navi Radjou,	Random House India
10	Product Design & Manufacturing	A K Chitale	PHI Learning
11	Product Policy & Brand Management	Ravi Gupta	PHI Learning
12	Materials Management	R C Gupta	PHI Learning

B. List of Major Equipment/Materials

-----Not applicable-----

C. List of Software/Learning Website

niesbud.nic.in/	www.entrepreneur.com	https://www.nabard.org/
ecell.in/nec	nenonline.org	businesstoday.intoday.in
www.ediindia.org	www.isb.edu/node/3461	www.entrepreneur.com/businessplan
www.nstedb.com	www.tataises.com	www.dcmsme.gov.in/
www.nimsme.org	www.kvic.org.in/	msme.gov.in/
http://www.du.ac.in/fileadmin/DU/Academics/course_material/EP_01.pdf		
http://users.ipfw.edu/todorovz/teaching/eee-lectureslides.htm		
xa.yimg.com/kq/groups/20603649/2012869496/.../Entrepreneurship		
ocw.mit.edu › ... › Managing Innovation and Entrepreneurship		
ww.smallbusinessbc.ca/starting-a-business/how-write-a-business-plan		

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof Niyaz A Mansuri**, Lecturer in Mechanical Engineering, GP, Gandhi nagar

Coordinator and Faculty Member from Nitttr Bhopal

- **Dr. Nishith Dubey**, Professor, Department of Vocational and Entrepreneurship Education

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: BLOW ROTATIONAL AND THERMOFORMING PROCESS (Code: 3342301)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	4 th Semester

1. RATIONALE

In almost every plastic plant or industry dealing with the production of hollow and thin walled plastic products, Blow moulding, Rotational moulding and Thermoforming processes have to be performed. A diploma plastic engineer has to understand and operate the machines, perform processes troubleshoot, deal with processing problems and finally produce a moulded product. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes in the students.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Plan and supervise the blow, rotational and thermoforming process.**

3. COURSE OUTCOMES

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

- i. Design various moulding process.
- ii. Select appropriate material for different moulding process.
- iii. Operate blow moulding process.
- iv. Operate rotational and thermoforming.
- v. Differentiate between blow moulding, rotational and thermoforming.
- vi. Troubleshoot processing problems in blow moulding, rotational and thermoforming.
- vii. Apply the safety rules.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	4	70	30	40	60	

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

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT I: Blow Moulding	1a. Describe basic principle Blow moulding processes. 1b. List types of Blow moulding process 1c. Compare Injection Blow moulding & Extrusion Blow moulding 1d. State the Advantages & disadvantages of process Applications of Blow moulding process	1.1 Blow Moulding Process 1.1.1 Basic principle of Blow moulding 1.1.2 Types of Blow moulding Process Injection Blow Moulding Extrusion Blow moulding- intermittent & continuous 1.1.3 Compare Injection Blow moulding & Extrusion Blow moulding 1.1.4 Advantages & disadvantages of process 1.1.5 Applications of Blow moulding process
	1e. List the Polymer selection criteria 1f. State the various types of materials 1g. Various types of materials for blow moulding	1.2 Materials For Blow Moulding 1.2.1 Polymer selection criteria 1.2.2 Various types of materials
	1h. Explain various parts of Blow moulding machine. 1i. Describe the Extruder & its requirements	1.3 Blow Moulding Machine 1.3.1 Extruder & its requirements 1.3.2 Die head & parison die 1.3.3 Die orifice and mandrel design
	1j. List the Parison blowing systems 1k. Describe the calibration steps of Mandrel inflation-Top mandrel, Bottom mandrel systems 1l. Explain parison blowing systems. 1m. Describe the Control of parison wall thickness by programming	1.4 Parison 1.4.1 Parison formation 1.4.2 Parison blowing systems 1.4.3 Needle inflation 1.4.4 Mandrel inflation-Top mandrel, Bottom mandrel, Top mandrel with calibration 1.4.5 Parison programming and Parison wall thickness control
	1n. Describe the various process parameters for Blow moulding process 1o. List the effects of process variables such as raw material, parison die, air entrance, mould cooling & parison wall thickness control 1p. Describe Post moulding operations	1.5 Processing Parameters 1.5.1 Various Blow moulding processing parameters 1.5.2 Effects of process variables such as raw material, parison die, air entrance, mould cooling & parison wall thickness control 1.5.3 Post moulding operations 1.5.4 Trouble shooting

	1q. List the fault in Blow Moulding 1r. Describe the Solutions for Blow Moulding processing problems	
UNIT II: Rotational Moulding	2a. Describe Rotational moulding process. 2b. State the Advantages and disadvantages of Rotational moulding 2c. List the Applications of Rotational moulding	2.1 Rotational Moulding Process 2.1.1 Process steps 2.1.2 Advantages and disadvantages of Rotational moulding 2.1.3 Applications of Rotational Moulding
	2d. List Types of moulding materials 2e. Describe Moulding material requirements 2f. Select the appropriate material for Rotational moulding	2.2 Materials 2.2.1 Moulding material requirements 2.2.2 Types of moulding materials
	2g. Identify various parts of Rotational moulding machine	2.3 Rotational Moulding Machine 2.3.1 Rock and roll machine 2.3.2 Clamshell 2.3.3 Vertical machine 2.3.4 Shuttle machine 2.3.5 Fixed arm Carousel type machine 2.3.6 Independent arm type machine 2.3.7 Oil jacketed machine 2.3.8 Electrically heated machine
	2h. Describe the steps of Design of various Rotational moulds 2i. List the Mould materials 2j. State the importance of Heating & cooling of mould	2.4 Rotational Moulds 2.4.1 Rotational molds design 2.4.2 Mould materials 2.4.3 Heating & cooling of mould
	2k. Set processing parameters 2l. Solve processing problems in Rotational moulding 2m. Differentiate the blow moulding and rotational moulding	2.5 Part Design 2.6 Process Variables 2.7 Trouble Shooting 2.8 Comparison With Blow Moulding
UNIT III Thermo Forming	3a. Classify the Thermoforming processes. 3b. Describe the Various stages of thermoforming process 3c. Explain various methods of forming 3c.1 Vacuum Forming 3c.2 Pressure forming 3d. State the Advantages and disadvantages of thermoforming 3e. List the applications of thermoforming process	3.1 Thermoforming Process 3.1.2 Various stages of thermoforming process 3.1.3 Explain various methods of forming 3.1.4 Vacuum Forming 3.1.5 Pressure forming 3.1.6 Advantages and disadvantages of thermoforming 3.1.7 Applications of thermoforming Process

	3f Select the appropriate material for Thermoforming	3.2 Materials 3.2.1 Material requirements 3.2.2 Types of material
	3g List the types of thermoforming machines 3g.1 Describe various Thermoforming machines	3.3 Thermoforming Machines 3.3.1 Single-stage sheet fed machine 3.3.2 Multiple stage sheet fed machine 3.3.3 In-line sheet fed machine 3.3.4 Continuous roll fed machine 3.3.5 Packaging machines
	3h Explain processing requirements for thermoforming	3.4 Processing Requirements 3.4.1 Heating methods 3.4.2 Temperature control 3.4.3 Vacuum/air pressure 3.4.4 Cooling 3.4.5 Trimming
	3i Set various process parameters for Thermoforming process 3j Solve processing problems in Thermoforming 3k Differentiate the blow, rotational and thermoforming process.	3.5 Process Variables 3.6 Trouble Shooting 3.7 Comparison With Blow And Rotational Molding

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Blow Moulding	18	18	10	07	35
II	Rotational Moulding	14	08	06	06	20
III	Thermoforming	10	07	04	04	15
	Total Hrs	42	33	20	17	70

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

Notes:

This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit Number	Practical/Exercises (Outcomes' in Psychomotor Domain)	Approx Hours Reqd.
1	I	Demonstrate the constructional details of a blow moulding machine.	02
2	I	Determine cycle time for a given product for blow moulding process.	04
3	I	Set process parameters on a blow moulding machine.	04
4	I	Control wall thickness of parison by parison programming system.	04
5	I	Identify problem associate with Blow moulding process.	04
6	II	Demonstrate the constructional details of a rotational moulding machine.	02
7	II	Determine cycle time for a given product for rotational moulding process.	04
8	II	Set process parameters on a rotational moulding machine.	04
9	II	Identify various problems during Rotational moulding process.	04
10	II	Prepare comparison chart for blow moulded and rotational moulded products.	02
11	III	Demonstrate the constructional details of a Thermoforming machine.	02
12	III	Determine cycle time for a given product for Thermoforming process.	04
13	III	Set process parameters on a Thermoforming machine.	04
14	III	Identify various problems during Thermoforming process.	04
15	I	Plan preventive maintenance schedule for blow moulding machine	04
16	II	Plan preventive maintenance schedule for rotational moulding machine	04
TOTAL			56

Notes:

- a. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by teacher.
- b. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.
- c. Term work report content of each experience should also include following.
 - i. Experience description / data and objectives.
 - ii. Drawing of experience / setup with labels/nomenclature to carry out the experience.
 - iii. The specifications of machines / equipments / devices / tools /instruments /items/elements which is / are used to carry out and to check experience.
 - iv. Process parameters / setup settings' values applied to carry out experience.
 - v. Steps / Process description to execute experience.

- d. Mini project and presentation topic/area has to be assigned to the student in the beginning of the term by batch teacher. This may be assigned individually or in the group of maximum 2 to 3 students.
- e. For ESE, students are to be assessed for competencies achieved.

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Students will collect Blow moulded, Rotational moulded and Thermoformed products like bottle, jar, jerry can disposable dish etc. and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby industry having blow, rotational and thermoforming operations.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Visit to nearby plastic industries engaged in Blow, Rotational and Thermoforming.
- ii. Video/Animation films on working of different type of Blow, Rotational and Thermoforming process may be shown.
- iii. Mini project may be given to students on different defects in the various Blow, Rotational and Thermoforming products, reasons for these defects and possible remedies.

10. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr no.	Title of Books	Author	Publication
1.	Blow Moulding of Plastics	E. G. Fisher	The Plastics Institute
2.	Blow Moulding Handbook	Rosato & Rosato	Hanser Publishers
3.	Plastic Blow Moulding Handbook	Norman Lee	Van Nostrand Reinhold Company
4.	Rotational Moulding	Glenn Beall	Hanser verlag
5.	Rotational Moulding of Plastics	R.J.Crawford	Plastics Design Library William Andrew Publishing
6.	Moulding of Plastics	Norbert Bikales	Wiley Interscience
7.	Handbook of Plastic Technology	Allen & Baker	CBS Publishers & Distributors
8.	Plastic Materials and Processes	S.S.Schwartz & S.H.Goodman	Van Nostrand Reinhold Company
9.	Plastic Engineering Handbook	J.L.Frados	Van Nostrand Reinhold Company
10.	SPI Plastic Engineering Handbook	M Berins	Springer
11.	Technology of Thermoforming	J.L.Throne	Hanser Publishers
12.	Thermoforming- A Plastics Processing Guide	G.Gruenwald	Technomic Publishing AG

B. List of equipments:

- i. Blow moulding machine with parison programming system
- ii. Rotational moulding machine
- iii. Thermoforming machine with heating system for sheet
- iv. Scrap grinder

- v. Weighing scale
- vi. Stop watch

C. List of Software/Learning Websites:

- i. <http://www.bpf.co.uk/>
- ii. <http://www.youtube.com>
- iii. <http://www.technologystudent.com/>
- iv. <http://www.notesandsketches.co.uk/Index.html>
- v. <http://www.paulsontraining.com>
- vi. <http://www.traininteractive.com>
- vii. <http://www.tecni-form.com/moulding-animation.php>
- viii. http://www.rotomolding.net/rotomolding_demo.html
- ix. http://en.wikipedia.org/wiki/Rotational_molding
- x. <http://rotomolding.blogspot.in/2007/09/great-rotational-molding-animation.html>
- xi. <http://people.bath.ac.uk/en3hl/blow.html>
- xii. <http://www.kenplas.com/project/pet/petblow.aspx>
- xiii. <http://www.4spe.org/online-store/ten-fundamentals-thermoforming-videodvd-program>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: DESIGN FOR INJECTION MOULD

(Code: 3342302)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	4 th Semester

1. RATIONALE

A Plastic diploma engineer has to plan and supervise operations and maintenance of injection moulds. This competency requires the knowledge of different kinds of Injection Moulds. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competencies:

- **Design and draw machine Injection mould for a given product.**
- **Develop 2D and 3D mould drawings using AUTOCAD software.**

3. COURSE OUTCOMES (COs)

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

- i. Draw different views of injection mould.
- ii. Design the ejection system and cooling system for the given mould.
- iii. Estimate the movement of split in the mould.
- iv. Design mould on CAD software.
- v. Animate the design.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

5. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes(in cognitive domain)	Topics and Sub-topics
Unit – I Injection Mold Materials	1a. Describe the selection requirement for mould materials. 1b. List the types of Mould Materials	1.1 Introduction of Injection Mould 1.2 Mould Material Selection Requirements : 1.2.1 Product Design Requirements 1.2.2 Mould Design Requirements 1.2.3 Mould Making Requirements 1.2.4 Moulding Requirements 1.3 Types of Mould Materials
Unit- II General Mould Design Considerations	2a Explain various design considerations for injection mold 2b Describe the Mould Assembling Procedure 2c State the Mould Designer's Check List 2d Describe the Mould Maintenance procedure 2e Estimate the Mould Cost Estimation	2.1 Injection Machine Requirements for fitment of mould 2.2 Number of impressions 2.3 Shrinkage Calculation - Linear and Volumetric Shrinkage 2.4 Venting Methods 2.5 Taper Location Recess in Core & Cavity Plate 2.6 Limits, Fits & Tolerances For Mould Parts 2.7 Mould Cost Estimation 2.8 Mould Assembling Procedure 2.9 Mould Designer's Check List 2.10 Mould Maintenance
Unit – III Two Plate and Three Plate Injection Moulds	3a. Differentiate the two-plate and three plate injection mould. 3b. Draw two-plate and three plate mould. 3c. Describe the construction of Two Plate Mould	3.1 Two-Plate Mould: 3.1.1 Introduction of Two Plate Injection Mould 3.1.2 Constructional Details of Two Plate Mould 3.2 Three-Plate Mould: 3.2.1 Introduction 3.2.2 Construction and Working : Stripper Plate Mould, Double Daylight Underfeed Mould, Double Daylight Underfeed-Stripper Plate Mould 3.2.3 Opening Control Devices 3.2.4 Runner Ejection Techniques 3.2.5 Comparison with Two Plate Mould
Unit – IV Split Moulds	4a. Explain constructional details for split mould. 4b. Draw the split mould.	4.1 Significance of Split Mould Design 4.2 Sliding Splits & Guiding Plate Designs 4.3 Constructional Details of Split Mould : 4.3.1 Split Actuation Methods 4.3.2 Split Locking Methods 4.3.3 Split Safety Arrangements
Unit – V Specialized	5a. Classify the specialized injection moulds.	5.1 Moulds For Threaded Components 5.1.1 Introduction 5.1.2 Methods for Internally Threaded

Unit	Major Learning Outcomes(in cognitive domain)	Topics and Sub-topics
Moulds		Components: Fixed Threaded Core Design, Stripping Method, Loose Threaded Core and Unscrewing Method. 5.1.3 Methods for Externally Threaded Components: Fixed Threaded Cavity Design, Automatic Unscrewing, Stripping Method and Threaded Splits. 5.2 Hot Runner Moulds 5.2.1 Introduction 5.2.2 Internally Heated Hot Runner Systems 5.2.3 Externally Heated Hot Runner Systems 5.2.4 Insulated Hot Runner Molding System 5.2.5 Advantages and Disadvantages 5.3 Introduction of Stack Moulds 5.4 Introduction of Interchangeable Insert Moulds

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Injection Mold Materials	4	4	4	0	8
II	General Mould Design Considerations	8	4	5	4	13
III	Two Plate and Three Plate Injection Moulds	14	7	8	8	23
IV	Split Moulds	8	4	5	4	13
V	Specialized Moulds	8	4	5	4	13
	Total	42	23	27	20	70

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit Number	Practical/Exercises (Outcomes' in Psychomotor Domain)	Approx Hours Reqd.
1	III	Design sectional elevation, plan and inverted plan of Two Plate and Three Plate machine mould.	16
2	III	Draw detail drawing of mold drawn in sheet 1.	12
3	III	Design the sectional elevation, plan and inverted plan of Split Mold.	12
4	III	2D and 3D drawing of hand injection/machine injection mold using AUTOCAD.	16
TOTAL			56

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect different shaped injection molded articles and analyze the type of mould suitable for that product.
- ii. Students will collect information related to mould through internet.
- iii. Students will visit nearby mould making industry.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Show video/animation films and photographs depicting process of producing different plastic objects using different types of injection moulding machines.
- ii. Arrange visit to nearby injection moulding industry and discuss the various defects in moulded objects and remedial measures for the same.

10. SUGGESTED LEARNING RESOURCES

A. List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Injection Mould Design	R.G.W. Pye	Longman Scientific & Technical
2	The Complete Part Design Handbook	Alfredo Campo	Hanser Gardner Publications (2006)
3	Plastics Mold Manufacturing Handbook	Dubois & Pribble	Van Nostrand Reinhold
4	Plastics : Product Design and Process Engineering	Harold Belofsky	Hanser-Gardner Publications
5	Injection Mould Design Fundamentals	Denton & Glenvill	Industrial Press
6	Injection Moulding	Irvin I. Rubin	Wiley
7	Plastic Materials & Processes	S.S.Schwartz & S.H.Goodman	VanNostrand Reinhold
8	Plastic Engineering Handbook	M Berins	Van Nostrand
9	Injection Moulding Handbook	Rosato & Rosato	Kluwer Academic Publishers
10	Workshop Technology	Khurmi & Gupta	S. Chand Limited

B. List of Major Equipment/Instruments

Injection Moulding Machine (Educational/training Model)

C. List of Software/Learning Websites:

- i. AutoCAD
- ii. <http://www.ferris.edu/htmls/academics/course.offerings/hillm/myweb7/Basic%20Molds/Basic%20Molds.htm>
- iii. http://en.wikipedia.org/wiki/Injection_molding

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur.** Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh,** Assistant Professor, Department of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: HYDRAULIC & PNEUMATIC SYSTEMS

(Code: 3342303)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	4 th Semester

1. RATIONALE

A Plastic Diploma engineer has to supervise operations and maintenance of various molding machines like injection molding, blow molding, thermoforming, extruder, rotational molding. This competency requires the knowledge of construction and working of different components of hydraulic and pneumatic systems. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Identify and solve various Hydraulic and Pneumatic problems.**

3. COURSE OBJECTIVES (COs)

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

- i. Draw symbols used in hydraulic systems.
- ii. Operate different types of valves used in hydraulic systems
- iii. Classify the valves used in hydraulic systems.
- iv. Maintain different valves and auxiliaries.
- v. Assemble pumps and motors to rectify problems.
- vi. Develop efficient hydraulic circuits.
- vii. Maintain the pneumatic and hydraulic system

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Concepts of Hydraulics	1a. Define various concepts of hydraulics.	1.1 Introduction & Definitions of important terms like Hydraulics, Pressure, Force, Vacuum etc. 1.2 Pascal's Law and its Application to Hydraulics 1.3 Bernoulli's Principle 1.4 Hydraulic Jack 1.5 Hydraulic Symbols 1.6 Advantages and Disadvantages of Hydraulic System. 1.7 Hydraulic Oil 1.7.1 Purpose of Hydraulic Oil 1.7.2 Ideal Characteristics of Hydraulic Oil 1.7.3 Maintenance of Hydraulic Oil
Unit- II Accessories of Hydraulic System	2a. Classify the accessories use in hydraulic system	2.1 Connectors 2.1.1 Steel pipe 2.1.2 Tubing 2.1.3 Hose 2.2 Gauges 2.3 Packing & Seals 2.4 Filters & Strainers 2.5 Hydraulic Tank
Unit – III Hydraulic Valves And Auxiliaries	3a. Identify various valves and auxiliaries. 3b. Rectify the problems.	3.1 Directional Control Valves 3.2 Pressure Control Valves 3.3 Flow Control Valves 3.4 Pressure Intensifiers 3.5 Accumulators 3.6 Cartridge Valves
Unit – IV Hydraulic Pumps and Motors	4a. Describe the constructional details of pumps and motors. 4b. Identify the problems.	4.1 Pump Specifications 4.2 Construction & Working of 4.2.1 Gear Pump 4.2.2 Vane Pump 4.2.3 Radial Piston Pump 4.3 Pump Maintenance & Trouble Shooting 4.4 Hydraulic Motor Specifications 4.5 Construction & Working of 4.5.1 Gear Motor

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		4.5.2 Vane Motor 4.5.3 Radial Piston Motor
Unit – V Hydraulic Circuits	5a Classify the hydraulic circuits. 5b Develop Hydraulic Circuits.	5.1 Clamp Control Circuit 5.2 Injection Control Circuit 5.3 Reciprocating Screw Circuit 5.4 Oil Filtration Circuit 5.5 Deceleration Circuit 5.6 Prefill Circuit 5.7 Hydraulic Motor Circuit 5.8 Hi-Low Pump Circuit
Unit – VI Pneumatics	6a. Identify various components of pneumatic system. 6b. Differentiate pneumatic and hydraulic system.	6.1 Pneumatics 6.2 Comparison with Hydraulic System 6.3 Air Compressors: Single Acting and Double Acting 6.4 Components of Pneumatic System 6.5 Air receiver and pressure control 6.6 Stages of Air Treatment 6.6.1 Intercooler 6.6.2 Lubricator 6.6.3 Filter 6.6.4 Air dryer 6.7 Pneumatic Circuit for Plastic Processing Machine

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Concepts of Hydraulics	8	4	6	4	14
II	Accessories of Hydraulic System	5	3	4	0	7
III	Hydraulic Valves And Auxiliaries	12	7	7	7	21
IV	Hydraulic Pumps and Motors	5	2	3	2	7
V	Hydraulic Circuits	8	0	7	7	14
VI	Pneumatics	4	3	4	0	7
	Total Hrs	42	19	31	20	70

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx Hours Req'd
1	I	Draw graphical symbols.	2
2	I	Demonstrate application of Pascal's law in hydraulic system.	2
3	II	Demonstrate various accessories and their uses in hydraulic system.	2
4	III	Demonstrate use of directional control valves	4
5	III	Demonstrate use of pressure control valves.	4
6	III	Demonstrate use of pressure intensifier.	2
7	III	Demonstrate application of flow control valves.	2
8	IV	Demonstrate applications of various types of pumps.	2
9	IV	Demonstrate use of hydraulic motors.	2
10	V	Demonstrate application of injection control circuit.	2
11	V	Demonstrate use of clamp control and reciprocating screw circuits.	2
12	VI	Demonstrate application of single stage compressors.	2
TOTAL			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will prepare chart of different hydraulic symbols.
- ii. Students will collect information related troubleshooting various problems.
- iii. Students will search animations on internet for understanding functioning of various hydraulic and pneumatic components.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

Show video/animation films depicting working principles, constructional features and maintenance procedures of different hydraulic and pneumatic devices and systems.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Title Of Book	Authors	Publication
1	Industrial Hydraulic Manual	-	Vickers (Second Edition)
2	Injection Moulding	Irvin I. Rubin	Wiley
3	Hydraulics and Pneumatics	Andrew Parr	Elsevier (Third Edition)
4	Injection Moulding Machine	Whelan	Elsevier Applied Science
5	Hydraulic and Pneumatic Power and Control	Franklin D. Yeaple	McGraw-Hill

B. List of major equipment/instruments

- i. Hydraulic Jack
- ii. Hydraulic Trainer

C. List of Software/Learning Websites

- i. www.redoaksys.com (for animations)
- ii. www.boschrexroth.com
- iii. www.eaton.in (Vickers)
- iv. www.compair.com/products/compressor_training_animations.aspx

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: PLASTICS EXTRUSION TECHNOLOGY
(Code: 3342304)

Diploma Programmes in which this course is offered	Semester in which offered
Plastic Engineering	4 th Semester

1. RATIONALE

Plastics extrusion technology is the most widely used processing technique for plastic materials. A polytechnic diploma engineer has to use this technology in the extrusion machines and production process of various extruded products. The knowledge of extrusion technology will also help to understand and develop advance extrusion processes. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Operate various extrusion plants to obtain production of desired quality (by setting process parameters)**

3. COURSE OUTCOMES

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

- i. Sketch the extruder.
- ii. Set up the process parameters
- iii. Operate the extruder machine.
- iv. Design extruder screws for different plastic materials.
- v. Calculate the capacity of an extruder.
- vi. Judge the quality of an extrudate.
- vii. Perform finishing operations.
- viii. Operate auxiliary equipments.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	4	7	70	30	40	60	200

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

5. DETAILED COURSE CONTAINTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Extruder Machine	1a. Classify extruder machine. 1b. Identify various parts of an extruder machine.	1.1 Machine Specification and glossary of terms 1.2 Classification of Extruder Machines. 1.3 Types, Constructional Features and Function of 1.3.1 Screw 1.3.2 Barrel 1.3.3 Thrust bearing 1.3.4 Drive system 1.3.5 Hopper 1.3.6 Screen 1.3.7 Breaker plate 1.3.8 Heating system of screw and barrel 1.3.9 Cooling system of screw and barrel
Unit – II Extrusion Process	2a. Select appropriate material. 2b. Operate an extruder. 2c. Apply extrusion process for various products. 2d. Identify the problems during extrusion process	2.1 Material characteristics and selection criteria 2.2 Types of Extrusion process: Dry and Wet 2.3 Melting process 2.4 Equation of output 2.5 Process variables 2.6 Start-up and Shut-down of extruder 2.7 Post extrusion techniques 2.8 Trouble shooting of Manufacturing Process 2.9 Applications – Products of Extrusions
UNIT III: Extrusion Plants	3a. Operate various extrusion plants.	3.1 Manufacturing Processes and Line Diagram of : 3.1.1 Film 3.1.2 Pipe 3.1.3 Sheet 3.1.4 Profile 3.1.5 Wire/cable 3.1.6 Monofilaments 3.1.7 Coating-lamination 3.1.8 Palletizing
UNIT IV: Auxilliary Equipments	4a. Explain working of various auxiliary equipments.	4.1 Automatic feeding 4.2 Automatic Screen 4.3 Rotating Die 4.4 Oscillating haul-off

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Extruder machine	16	10	10	08	28
II	Extrusion process	12	10	06	04	20
III	Extrusion plants	10	08	04	03	15
IV	Auxiliary equipments	04	04	03	00	07
	Total Hrs	42	32	23	15	70

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs. Required
1	I	Study of an extruder machine and prepare a report on it.	04
2		Prepare specifications of extruder machines available in the laboratory.	04
3	II & III	Operate pipe extrusion plant with changing various process parameters.	08
4		Identify processing problems on an extrusion pipe plant and suggest solutions.	04
5		Operate blown film extrusion plant with changing various process parameters.	08
6		Identify processing problems on blown film plant and suggest their solutions.	04
7		Operate pelletizing plant with changing various process parameters.	08
8		Identify processing problems on pelletizing plant and suggest solutions.	04

9		Set process parameters on sheet plant and operate it.	08
10		Identify processing problems on sheet plant and suggest solutions for it.	04
11	IV	Demonstrate various auxiliary equipments used in extrusion plant.	04
12		Grind scrap materials.	04
Total			64

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- i. Students will collect various extruded products like pipe, tube, wire/cable, film, monofilament etc. and would comment on their quality.
- ii. Students will collect information related to the extrusion process through internet.
- iii. Students will visit nearby extrusion industry.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Visit to nearby plastic industries engaged in extrusion.
- ii. Video/Animation films on working of different type of extrusion plant may be shown.
- iii. Mini project may be given to students on different defects in the various extruded products to find out reasons for these defects and possible remedies.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication
1.	Extrusion of plastics	E.G. Fisher	The Plastics Institute
2.	Extrusion	Allen Griffith	
3.	Plastics Extrusion technology handbook	S.Levy	Industrial Press Inc., 1989
4.	Handbook of Plastic Processing Technology	D.V.Rosato	Springer
5.	Plastics Extrusion Technology	Fried helm Hence	Hanser Publishers
6.	Polymer Extrusion	Chris Rauwendaal	Hanser Verlag
7.	Plastics Engineering Hand book	J. Fradeos	Van Nostrand Reinhold Company
8.	Plastics Engineering Hand book	M Berins	Springer
9.	Plastic materials and processes	S.S.Schwartz & S.H.Goodman	Van Nostrand Reinhold Company

B. List of Major Equipment/ Instrument with Broad Specifications

- i. Extrusion plants (Pipe, blown film, pelletizing/sheet plant)
- ii. Scrap grinders
- iii. Crane
- iv. Dies
- v. Chilling unit
- vi. Weighing scale
- vii. Cooling tower
- viii. Automatic feeder

C. List of Software/Learning Websites

- i. <http://www.bpf.co.uk/>
- ii. <http://www.youtube.com>
- iii. <http://www.technologystudent.com/>
- iv. <http://www.notesandsketches.co.uk/Index.html>
- v. <http://www.paulsontraining.com>
- vi. <http://www.traininteractive.com>
- vii. http://en.wikipedia.org/wiki/Plastics_extrusion
- viii. http://en.wikipedia.org/wiki/Plastics_extrusion

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: PROCESS INSTRUMENTATION AND MAINTENANCE (PIM)

(Code: 3342305)

Diploma Programmes in which this course is offered	Semester in which offered
Plastics Engineering	4 th Semester

1. RATIONALE

Plastic engineering machineries and processes are now very much automated. And hence, the knowledge of instruments is essential for a plastic engineer. This subject provides the knowledge of measurement and control of plastic processing parameters. Moreover, the subject also deals with maintenance methods for machinery and helps plastic diploma holders in appreciating safety rules and do the routine maintenance. Hence this course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Troubleshoot and maintain different plant machineries and various instruments safely**

3. COURSE OUTCOMES

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

- Operate various measuring and controlling instruments
- Explain the fundamentals of servomechanism and PLC systems
- Perform plant maintenance and break- down maintenance.
- Apply preventive maintenance schedule
- Maintain lubricating mechanisms for prevention of wear, corrosion.
- Organize safety equipments/aids that are to be used during plastic processing.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

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

5. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Instrumentation fundamentals	1a. Select appropriate measuring instrument 1b. Rectify the instrumental errors. 1c. Draw the diagram of instrument system	1.1 Introduction to instrumentation 1.2 Selection of measuring instruments 1.3 Errors in instruments 1.4 Block diagram of instrumentation system
UNIT- II Process Instrumentation	2a. Differentiate between measuring instruments. 2b. Utilize various measuring instruments. 2c. Calibrate various instruments. 2d. Use the transducers	2.1 Temperature measurement and scales 2.2 Thermocouple & resistance thermometer 2.3 Pressure measurement instruments 2.4 Transducers
UNIT- III Servo mechanisms & PLC system	3a. Differentiate open and close loop controls systems 3b. Apply servomotors 3c. Describe the working of PLC systems	3.1 Open & close loop control system 3.2 Regulators & servo-mechanism 3.3 Servomotors 3.4 PLC control system
UNIT- IV Plant maintenance	4a. Classify various maintenances 4b. Prevent equipments from beak down 4c. Manage maintenance schedules 4d. Repair the machine	4.1 Types of maintenance 4.2 Fault finding methods 4.3 Planning & Scheduling of maintenance work 4.4 Maintenance cost and economy 4.5 Service life of equipments
UNIT - V Wear, Corrosion & Lubrication	5a. Apply various techniques to reduce wear 5b. Select appropriate preventive material for corrosion 5c. Predict the quantity lubricants. 5d. Apply the lubrication methods.	5.1 Wear types and reduction techniques 5.2 Corrosion and its types 5.3 Corrosion prevention techniques 5.4 Function and types of Lubricants 5.5 Lubrication methods
UNIT-VI Maintenance of Plastics processing machines	6a. Organize maintenance activities for any plastic processing plant. 6b. Prepare maintenance chart. 6c. Identify the faults.	6.1 Maintenance of an Extruder 6.2 Maintenance of an Injection Moulding machine 6.3 Maintenance of Moulds & dies 6.4 Maintenance of cooling / chilling plants 6.5 Maintenance of Hydraulic & pneumatic systems
UNIT-VII: Safety	7a. Appreciate the need of safety 7b. Apply safely rules 7c. Organize various safety awareness programmes 7d. Prevent accidents 7e. Use various protective equipments	7.1 Importance of safety 7.2 Major safety measures in plastics processing plants 7.3 Management responsibilities 7.4 Accidents and its prevention 7.5 Activities related to promotion of safety 7.6 Safety awareness measures 7.7 Personal Protection Equipments

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Instrumentation fundamentals	04	02	03	00	05
II	Process Instrumentation	08	05	05	05	15
III	Servo mechanisms & PLC system	06	05	05	00	10
IV	Plant maintenance	06	02	02	06	10
V	Wear, Corrosion & Lubrication	06	05	03	02	10
VI	Maintenance of Plastics processing machines	06	03	02	05	10
VII	Safety	06	03	03	04	10
	Total	42	19	23	22	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical /Exercises (Outcomes in Psychomotor Domain)	Approx Hours required
1	II	Demonstrate working principle and constructional features of Bi-metallic thermometer	02
2	II	Calibrate a given thermocouple.	02
3	II	Calibrate a RTD.	02
4	III	Carryout plant maintenance of Moulds & dies	04
5	III	Carryout plant maintenance of Hydraulic & pneumatic systems	02
6	IV	Prepare list of activities of preventive maintenance.	02
7	IV	Perform preventive maintenance of Injection molding machine	02
8	IV	Find and resolve the problems in any plastic processing machine	02
9	IV	Apply lubrication to IMM, extruder	02
10	VI	Carryout plant maintenance of extrusion plant.	04
11	VI	Carryout plant maintenance of Injection molding machine	04
Total			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i.measurement of pressure and temperature
- ii.calibrate instruments
- iii.greasing machines
- iv.Removing rust from machines, molds, dies.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Show video/animation films depicting the working principle and their constructional features of different process instrumentations being used in plastic industry.
- ii. Arrange a visit to nearby plastic industry and show them different preventive and breakdown maintenance activities being carried out.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication
1.	Industrial Instrumentation & Control	S.K.Singh	Tata McGraw Hill Publications Co.Ltd
2.	Industrial Instrumentation	Donald P.Eckman	Wiley Eastern Ltd
3.	Hand Book of Instrumentation and control	H.P.Kallen	McGraw Hill Company Ltd.
4.	Maintenance Engineering Hand Book	Higgins & Morrow	McGrow Hill
5.	Plastics Industry Safety Hand Book	Dominick V.Rosato & John R. Lawrence	Cahners Books,Boston
6.	Industrial safety, Health and Environment Management system	R. K. Jain & Sunil S. Rao	Khanna Publishers
7.	Electrical Safety, Fire Safety Engineering and Safety management	S. Rao & Prof. H.L. Saluja	Khanna Publishers

B. List of Major Equipment/ Instrument with Broad Specifications

- i.Thermocouple
- ii.RTD

C. List of Software/Learning Websites

- i.<http://orien.ncl.ac.uk/ming/dept/Swot/connotes.htm>
- ii.<http://nirmauni.ac.in/process-instrumentation-and-control---1ecd03/course-contents/lecture-notes>
- iii. www.processinst.com
- iv.<http://www.automation.siemens.com/mcms/automation/en/sensor-systems/process-instrumentation/Pages/Default.aspx>
- v.www.scribd.com/doc/62796183/Instrumentation-Presentation
- vi.http://pc-education.mcmaster.ca/Instrumentation/go_inst.htm

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences

GUJARAT TECHNOLOGICAL UNIVERSITY

COURSE CURRICULUM

Course Title: INDUSTRIAL TRAINING-I
(Code: 3352301)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	5 th

1. RATIONALE

The diploma engineers are required to work in industry related to plastic processing, machine manufacturing, plastic raw material manufacturing, mold and die making, testing, recycling, designing etc. This course has been designed to fulfill need of industrial exposure, where they experience industrial environment.

2. LIST OF COMPETENCIES

The course is designed and implemented with the aim to develop different types of skills leading to achieve following competencies:

Perform many activities/skills and get information pertaining to plastic industry in areas of process, equipment, material and instruments.

3. COURSE OUTCOMES

- Experience real life working environment and practices.
- Gain practical knowledge, new skills and be aware of current technologies.
- Provide opportunities to students to be as prospective employees.
- Analyze problems and find/suggest possible solutions.
- Present a project report both in oral and written form based on work experiences.

4. TEACHING AND EXAMINATION SCHEME

Course Code	Course Title	Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
		L	T	P		Theory Marks		Practical Marks		
					ESE	PA	ESE	PA		
3352301	INDUSTRIAL TRAINING-I	0	0	30	30	00	00	300	500	800
Total		0	0	30	30	00	00	300	500	

Legends:

L-Lecture; T-Tutorial; P-Practical; ESE – End Semester Exam., PA-Progressive Assessment,

5. EVALUATION PATTERN

Evaluation for PA by the Internal examiner: - Evaluation of 500 marks for PA will be done by the internal examiner at institute level, mainly based on weekly diary, follow up report, progress report and final training report as follows:

<p>INDUSTRIAL TRAINING</p> <p>20 - 20</p> <p>DEPARTMENT: PLASTIC ENGINEERING</p> <p>NAME OF STUDENT:-</p> <p>SEMESTER: - 5TH</p> <p>ENROLLMENT NUMBER :</p> <p>NAME OF INDUSTRY:-</p> <p>ADDRESS:-</p>

<p>JOINING REPORT</p> <p style="text-align: right;">FROM: (Name of company).....</p> <p style="text-align: center;">.....</p> <p style="text-align: center;">.....</p> <p>TO,</p> <p>PRINCIPAL</p> <p>(Name of institute)</p> <p>Subject: - Joining report for industrial training of 5th semester. As per your letter no. :-</p> <p>_____</p> <p>Dated / / 201 , I have reported for training at _____ on _____. The weekly off day of the industry is _____.</p> <p>Thanking you.</p> <p>Yours' faithfully</p> <p>(.....)</p> <p>Signature and Stamp of Training Officer</p>
--

(To be send immediately after joining the industry)

DETAIL OF THE INDUSTRY

1. NAME OF INDUSTRY:-
2. ADDRESS:-
3. PERIOD OF TRAINING:-
4. NAME OF TRAINING OFFICER AND DESIGNATION:-
5. WEEKLY OFF DAY:-

WEEKLY REPORT

PERIOD: - FROM / /201 =DAYS
OFF DAYS: -.....=.....DAYS
LEAVE ENJOYED ON=.....DAYS
TOTAL DAYS ATANDED.....=.....DAYS
DETAILS OF WORKING:-

SIGNATURE
(TRAINING OFFICER)

SIGNATURE
(STUDENT)

MONTHLY REPORT

PERIOD: - FROM / /201 TO / /201 =.....DAYS

OFF DAYS: -=.....DAYS

LEAVE ENJOYED ON.....=.....DAYS

TOTAL DAYS ATANDED.....=.....DAYS

EVALUATION:-

SR No.	PARTICULARS	EVALUTION BY	
		TRAINNG OFFICER (INDUSTRY)	FACULTY (INSTITUTE)
1	Punctuality		
2	Participation in work allotted		
3	Practical level attained		
4	Industrial relationship		
5	Project write - up preparation		

Any other remarks:-

SIGNATURE
(FACULTY)

PROGRESS REPORT

(Name of Institute)
 PLASTIC ENGINEERING DEPARTMENT

Name of Student :

Enrolment No. :

Name of Industry :

Address of Industry :

Comments :

1. Type of the Industry

Production

Machine Manufacturing

2. Production of :

3. Regularity of student during training

Average

Good

Excellent

4. Stipend paid per month Rs. _____

5. Industry's opinion regarding trainee

Average

Good

Excellent

Remarks :

Sign:	Training In-charge
Name of faculty:	(Industry)

Final Training Report:

<p style="text-align: center;">FORMAT OF INDUSTRIAL TRAINING REPORT</p> <ul style="list-style-type: none">➤ Title page➤ Certificate➤ Preface➤ Acknowledgement➤ Index➤ Introduction of industry➤ Industry lay out➤ Hierarchy of industry/organization chart.➤ Products➤ Raw materials➤ Types of major equipments/instruments/machines used in industry with their specification, approximate cost and specific use.➤ Manufacturing/production process➤ Faults and remedies➤ Maintenance➤ Safety features➤ My liking & disliking of work places➤ References➤ Bibliography

Evaluation for ESE by the External examiner: - Evaluation of 300 marks for ESE will be done by the external examiner on following criteria -

1. Knowledge gained-

- Products

- Raw materials
 - Types of major equipments/instruments/machines used in industry with their specification, approximate cost and specific use.
 - Manufacturing/production process
 - Faults and remedies
 - Maintenance
 - Safety features
 - Planning
2. **Skills learned-**
- Process parameter setting of various plastics machineries
 - Troubleshooting
 - Safety precautions
3. **Incidents/ cases from Experiences-**
- The students should record classic cases for learning for others, such as
- Tricky problems and their solutions,
 - Typical fault diagnosis and their solutions,
 - Tricky symptoms and their solutions.
 - Part modifications.
 - System modifications.
 - Cost reduction cases.
 - Quality improvement.
 - Improvement Method

6. SUGGESTED WORK LOAD

- As per the Board of Apprenticeship, faculty of the parent institute has to visit industry at least once in a month for evaluating student's activity and their progress.
- The number of industry which provides training and number of students are varying every year. In this consequence and considering role of faculty in training, workload is allotted to faculty for industrial visit.
- Work load allotted to faculty per batch of 20 students is 30 Hrs / week. Institute has to prepare time table of the staff in such a manner that one faculty must be remain free for one whole day for industrial visit/counseling of the trainee. Trainee should be distributed equally among the faculty involved and the faculty will be considered guide/counselor for those students. Progressive assessment will be carried out by that guide/counselor.

7. GUIDELINES FOR SANDWICH APPRENTICESHIP INDUSTRIAL TRAINING-I

- **Duration of the training:** Six months. It should start **within three weeks** from the date of completion of GTU examination of the semester IV.
- **Eligibility:** Student will be allowed for training subject to GTU eligibility criteria for particular semester.
- **Apprenticeship Board:** The training will be covered under the Apprenticeship Act 1973 and as per current rule; the trainee will be eligible for a stipend of Rs. 2070/- per month out of which 50% will be paid by the employer and 50% will be reimbursed by Board of Apprentice Training (BOAT), Western Region, Mumbai. Stipend will be revised periodically by Board of Apprentice.

- **Training Area :** Students can be trained in Plastic Processing, Machine Manufacturing, Raw Material Manufacturing, Mould/die making, Testing, Recycling and Designing industries. Students should be sent to industry strictly based on merit.

A. ROLE OF DEPARTMENT

- Department has to send training request letter to various industries well in advance before commencement of training.
- After getting sufficient number of seats from the industries, students will be placed in different industries for their 5th semester training.
- Students will have to fill up training contract form (uploaded on B.O.A.T. web site) in three copies with photographs sealed and signed by the authorities.
- Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
- During the training period, the head of the department will maintain a schedule for follow-up of industrial training and according to it send the faculty to various industries.
- The faculty will check the progress of the student in the training, attendance; discipline and project report preparation and also give necessary guidance to students.
- The department has to prepare Progress Report of the trainee for the industrial training.
- At the end of the training, concerned faculty will do assessment of the work done by trainee.

B. ROLE OF INDUSTRY

- Industry will give effective training to the students for improving their practical skills.
- Industry may provide training in-charge for the group of the students under training.
- Training in-charge has to evaluate each student every week and signed weekly diary with appropriate remarks.
- Industry may allot project to individual or group of students under training and students has to prepare report on the same project.
- Training in-charge has to guide students for preparing their project report.
- Industry has to maintain attendance for the student under training and report for any irregularity of the students to their parent institute.

C. GUIDE LINE FOR STUDENTS

- Students have to fill the contract forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry.
- During the training period students will keep record of all the useful information and maintain the weekly diary.
- He/she will prepare a detailed training report about the whole process and will submit it to the department at the time of examination.

8. SUGGESTED LEARNING RESOURCES

- Students may visit websites as their learning tool during industrial visit.
- Source of learning websites are already given during previous semesters.
- Search videos, animations for preparation of training report during the training period.

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, Govt. polytechnic, Chhotaudepur

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: INDUSTRIAL MANAGEMENT
(COURSE CODE: 3361903)**

Diploma Programme in which this course is offered	Semester in which offered
Mechanical Engineering	Sixth

1. RATIONALE.

Technicians of mechanical engineering disciplines are expected to work during most of their career at middle level. They are also expected to deal with workforce and management problems. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues. This course aims to deal effectively with such issues along with familiarization of acts and laws applied to industries.

2. COMPETENCY.

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competencies.

- **Recognize organization structure, human resource issues in industries and major provisions of factory acts.**
- **Plan, use, monitor and control resources optimally and economically.**

3. COURSE OUTCOMES (COs).

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

- i. Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
- ii. Explain material requirement planning and store keeping procedure.
- iii. Plot and analyze inventory control models and techniques.
- iv. Prepare and analyze CPM and PERT for given activities.
- v. List and explain PPC functions.

4. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)				Total Credits (L+T+P)	Examination Scheme			
					Theory Marks		Practical Marks	
L	T	P	C	ESE	PA	ESE	PA	100
3	0	0	3	70	30	0	0	

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

5. COURSE CONTENT DETAILS.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<p>Unit – I.</p> <p>Introduction.</p>	<p>1a. Describe the types of organization structure.</p> <p>1b. Identify factors affecting moral.</p> <p>1c. Explain important provisions of factory act and labour laws.</p>	<p>1.1 System- concept, definition, types, parameters, variables and behavior.</p> <p>1.2 Management – definition and functions.</p> <p>1.3 Organization structure:</p> <ul style="list-style-type: none"> i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. <p>1.4 Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management.</p> <p>1.5 Organizational culture and climate – meaning, differences and factors affecting them.</p> <p>1.6 Moral-factors affecting moral.</p> <p>1.7 Relationship between moral and productivity.</p> <p>1.8 Job satisfaction- factors influencing job satisfaction.</p> <p>1.9 Important provisions of factory act and labor laws.</p>
<p>Unit – II</p> <p>Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT).</p>	<p>2a. Draw CPM and PERT diagrams based on given conditions and data.</p> <p>2b. Determine critical path on CPM and PERT.</p> <p>2c. Calculate floats on CPM and PERT.</p>	<p>2.1 CPM & PERT-meaning, features, difference, applications.</p> <p>2.2 Understand different terms used in network diagram.</p> <p>2.3 Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples).</p> <p>2.4 Determination of critical path on network.</p> <p>2.5 Floats, its types and determination of floats.</p> <p>2.6 Crashing of network, updating and its applications.</p>

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – III Materials Management.	3a. Apply the procedure for purchase. 3b. Practice the store keeping procedures. 3c. Interpret given inventory model. 3d. Derive Economic Order Quantity for given data. 3e. Identify applications of Material Requirement Planning (MRP).	3.1 Material management-definition, functions, importance, relationship with other departments. 3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. 3.3 Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. 3.4 Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. 3.5 Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)-concept, applications and brief details about software packages available in market.
Unit – IV Production planning and Control (PPC).	4a. Schedule the operations based on available data using PPC techniques. 4b. Schedule using critical ratio scheduling technique 4c. Identify the factors and resources	4.1 Types and examples of production. 4.2 PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. 4.3 Scheduling- meaning and need for productivity and utilisation. 4.4 Gantt chart- Format and method to prepare. 4.5 Critical ratio scheduling-method and numeric examples.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	affecting the bottlenecking. 4d. Schedule using Gantt chart with the help of Annexure-I for given data.	4.6 Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking- meaning, effect and ways to reduce.
Unit – V Value Analysis (VA) and Cost Control.	5a. Apply value analysis and cost control techniques for given case.	5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. 5.3 DARSIRI method of VA. 5.4 Case study of VA-at least two. 5.5 Waste-types, sources and ways to reduce them. 5.6 Cost control-methods and important guide lines.
Unit – VI Recent Trends in IM.	6a. Describe recent practices being adopted in industrial management.	6.1 ERP (Enterprise resource planning) - concept, features and applications. 6.2 Important features of MS Project. 6.3 Logistics- concept, need and benefits. 6.4 Just in Time (JIT)-concept and benefits. 6.5 Supply chain management-concept and benefits.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY).

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction.	6	6	4	0	10
II	Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT).	10	4	6	7	17
III	Materials Management.	8	6	4	4	14
IV	Production Planning and Control (PPC).	10	6	4	7	17
V	Value Analysis (VA) and Cost Control.	4	4	2	0	6
VI	Recent Trends in IM.	4	6	0	0	6
	Total	42	32	20	18	70

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy).

Notes:

- This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.
- If mid-sem test is part of continuous evaluation, unit numbers I, II (Up to 2.4 only) and IV (Up to 4.7 only) are to be considered.
- Ask the questions from each topic as per marks weight age. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

7. SUGGESTED LIST OF PRACTICAL/EXERCISE

.....**Not Required**.....

8. SUGGESTED LIST OF STUDENT ACTIVITIES.

Sr. No.	Activity
i.	Given the data, prepare the network diagram and determine critical path, EPO, LPO and floats.
ii.	Given the data, prepare the scheduling using Gantt chart.
iii.	Perform value analysis for given case.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any).

Sr. No.	Unit	Unit Name	Strategies
i.	I	Introduction.	Video movies.
ii.	II	Critical path method (CPM) and pre evaluation review technique (PERT).	Video movies, solving tutorials, real life industries situation, industrial visits.
iii.	III	Materials management.	Video movies, real life industries situation, industrial visits.
iv.	IV	Production planning and control (PPC).	Video movies, solving tutorials, real life industries situation, industrial visits.
v	V	Value analysis (VA) and cost control.	Analyzing real cases, video movies.
vi	VI	Recent trends in IM.	Industrial visits, movies.

10. SUGGESTED LEARNING RESOURCES.**A. List of Books:**

S. No.	Title of Book	Author	Publication
i.	CPM & PERT principles and Applications.	L.S.Srinath.	
ii.	Modern Production Management.	Buffa.	
iii.	Materials Management.	N. Nair.	
iv.	Industrial Engineering & Management.	O. P. Khanna.	
v.	Value Analysis.	Mikes.	

B. List of Major Equipment/ Instrument with Broad Specifications:

Sr. No.	Resource with brief specification.
1	Necessary freeware-other softwares.

C. List of Software/Learning Websites.

- i. www.youtube.com/watch?v=SF53ZZsP4ik
- ii. www.youtube.com/watch?v=iPZlQ3Zx5zc
- iii. web.stanford.edu/class/cee320/CEE320B/CPM.pdf
- iv. www.criticaltools.com/pertchartexpertsoftware.htm
- v. en.wikipedia.org/wiki/Program_evaluation_and_review_technique
- vi. www.netmba.com/operations/project/pert/

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics.**

- **Prof. A. M. Talsaniya**, Lecturer in Mechanical Engineering, Sir BPI, Bhavnagar.

Coordinator and Faculty Members from NITTTR Bhopal.

- **Dr. Vandna Somkuwar**, Associate Professor, Department of Mechanical Engineering,
- **Dr. A.K. Sarathe**, Associate Professor; Department of Mechanical Engineering.

ANNEXURE – I

A. GIVE DETAILS OF EACH PART IN FOLLOWING FORMAT.

PART NUMBER		PART NAME		
MATERIAL		BATCH QUANTITY		
OP.NO.	PROCESS	SETTING TIME / BATCH (MIN).	OP. TIME / PIECE (MIN).	MACHINE

B. RESOURCE DETAILS:

NAME OF MACHINE	NUMBER OF MACHINES	MACHINE AVAILABLE FOR NUMBER OF HOURS / DAY (TOTAL FOR ALL SHIFTS).	NUMBER OF WORKING DAYS / MONTH.	TOTAL HOURS AVAILABLE PER MONTH

SUGGESTED QUESTION PAPER FORMAT

(This is for reference only and is in suggestive form. Paper setter may opt for other marks distribution pattern maintaining distribution of marks as per specification table)

Q.NO.	SUB Q.NO.	QUESTION	MARKS DISTRIBUTION			UNIT
			R	U	A	
1		Answer ANY seven from following.				14
	i.		2			I
	ii.		2			I
	iii.		2			II
	iv.		2			II
	v.		2			III
	vi.		2			III
	vii.		2			IV
	viii.		2			IV
	ix.			2		V
	x.		2			VI
2	a.		4			I
		OR				
	a.		4			I
	b.			4		I
		OR				
	b.			4		I
	c.			3		II
		OR				
	c.			3		II
	d.			3		II
		OR				
	d.			3		II
3	a.		4			III
		OR				
	a.		4			III
	b.				4	III
		OR				
	b.				4	III
	c.		3			IV
		OR				
	c.		3			IV
	d.		3			VI
		OR				
	d.		3			VI
4	a.	Given the data, prepare network diagram and determine critical path. Number of events should not be more than 7.			7	II
		OR				
	a.	Given the data, prepare network diagram. Calculate EPO and LPO at each node. Number of events should not be more than 7.			7	II
	b.			4		III
	c.			3		IV
5	a.	Given the data, prepare the scheduling using Gantt chart. Number of the components should not be more than 4.			7	IV
	b.		4			V
	c.		3			VI

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**COURSE TITLE: DESIGN FOR BLOW AND THERMOFORMING MOULDS
(COURSE CODE: 3362301)**

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	Sixth

1. RATIONALE

The changing demands of customers with respect to shape and dimensions of containers and disposable items led the plastic engineers for developing various kinds of moulds. A Plastic Diploma engineer has to monitor operations and maintenance of Blow and Thermoforming moulds. This competency requires the knowledge of constructional details of Blow and Thermoforming Moulds. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency-

- **Design and manufacture blow and thermoforming moulds based on requirements.**

3. COURSE OUTCOMES (COs)

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

- Select suitable mould materials.
- Explain design considerations for blow moulds.
- Use Mould cooling channels for various sections of mould and ancillary elements for blow mould.
- Employ thermoforming mould materials for prototype and production tooling.
- Design thermoforming moulds for different shaped products.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	4	7	70	30	40	60	200

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Blow Mould Materials	1a. Identify blow mould materials requirements 1b. Classify mould materials	1.1 Introduction of Blow Mould 1.2 Mould Material Selection Requirements : 1.3 Types of Mould Materials
Unit- II Blow Mould Design Considerations	2a. Design injection blow mould. 2b. Design Extrusion blow moulds. 2c. Describe Flash removal methods 2d. Describe Mould cleaning methods	2.1 Injection Blow Mould 2.1.1 Mould Construction, Injection Blow Mould Design, Core rods/Parison Stick Design 2.2 Extrusion Blow Mould 2.2.1 Design procedure of Extrusion Blow Mould. 2.2.2 Mould Cavity Design 2.2.3 Method for deciding clamping force 2.2.4 Design consideration for mould parting line 2.2.5 Mould finish and Mould Venting 2.2.6 Cavity surface considerations 2.2.7 Welding edges & flash pockets in pinch-off 2.2.8 Neck insert design considerations 2.2.9 Radii and corner edge designs 2.2.10 Moulded holes and handle design 2.2.11 Shrinkage considerations 2.2.12 Blow and swell ratio 2.2.13 Moulds for undercut products (moving section moulds) 2.2.14 Flash removal methods 2.2.15 Mould cleaning methods
Unit – III Blow Mould Cooling and Ancillary Elements	3a. Draw cooling channels for various sections of mould. 3b. Describe ancillary elements for blow mould.	3.1 Mould Cooling 3.1.1 Significance of mould cooling. 3.1.2 Cooling designs for neck, pinch-off and main body. 3.2 Ancillary Elements 3.2.1 Base plates 3.2.2 Alignment pins 3.2.3 Striker plates 3.2.4 Ejection Methods
Unit – IV Thermoforming Mould Materials	4a. Describe thermoforming mould materials requirements 4b. Classify mould materials for prototype and production tooling	4.1 Thermoforming Mould Materials 4.1.1 Introduction of Thermoforming Moulds 4.1.2 Mould Material requirements 4.1.3 Types of mould materials for prototype and production tooling
Unit – V Thermoforming Mould Design	5.a. Describe various components of thermoforming moulds.	Design criteria for thermoforming moulds. Design Considerations 5.1 Vent Holes/Vacuum Holes-Number of vents ,Size, Position and types

Unit	Major Learning Outcomes	Topics and Sub-topics
Considerations	5.b. Design thermoforming mould. 5.c. Describe Mould cooling designs. 5.d. Describe mould ejection techniques. 5.e. Describe application of Mould Releasing Agents. 5.f. Describe Multi-impression Moulds methods.	5.2 Shrinkage and Draft Angle Considerations 5.3 Plug Design (For Plug Assist Mould)- Plug material, Shape of plug, Plug design concepts 5.4 Sheet clamping mechanisms 5.5 Draw ratios and its importance 5.6 Chamfers and radii 5.7 Surface treatments 5.8 Surface texture 5.9 Mould cooling designs 5.10 Use of moving elements - collapsing cores, `Unscrewing devices, cammed sections and slides 5.11 Ejection techniques 5.12 Application of Mould Releasing Agents 5.13 Moulds for undercuts 5.14 Multi-impression Moulds, factors to be considered for deciding correct impression layout, method of determining the number of impressions for a given forming platform size and product size, Design and draw thermoforming mould for multi-impressions.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Blow Mould Materials	4	2	4	0	6
II	Blow Mould Design Considerations	16	6	6	14	26
III	Blow Mould Cooling and Ancillary Elements	6	3	4	3	10
IV	Thermoforming Mould Materials	4	2	4	0	6
V	Thermoforming Mould Design Considerations	12	4	4	14	22
TOTAL		42	17	22	31	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (outcomes in psychomotor domain)	Approx Hours Required
1	II	Design and draw sectional elevation, plan and inverted plan of blow moulds. (For different shapes to be casted, number of sheets would depend upon complexity of shapes. Faculty should give enough number of sheets to students to justify the time allocated)	28
2	II	Draw detail drawings of mould drawn in above.	14
3	V	Design and draw sectional elevation, plan and inverted plan of Thermoforming mould. (For different shapes to be casted, number of sheets would depend upon complexity of shapes. Faculty should give enough number of sheets to students to justify the time allocated)	14
		TOTAL	56

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Collect different shaped blow moulded articles and analyze the type of mould suitable for that product.
- ii. Collect different shaped thermoformed articles and analyze the type of mould suitable for that product.
- iii. Collect information related to mould technology through internet.
- iv. Visit nearby mould making industry.
- v. Prepare journals based on practical performed in laboratory.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Arrange expert lectures.
- ii. Arrange visit to nearby mould making industry.
- iii. Show relevant video/animations.
- iv. Give as many mould drawing exercises as possible.

10. SUGGESTED LEARNING RESOURCES**(A) List of Books:**

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Blow Moulding Handbook	Rosato/Rosato	Van Nostrand Reinhold
2	Plastic Blow Moulding Handbook	Norman Lee	Van Nostrand Reinhold
3	Blow Moulding	Fisher	Butterworth & Co.
4	Technology of Thermoforming	James L. Throne	Hanser Gardner Publications
5	Fundamentals of Plastics Thermoforming	Peter Klein	Morgan & Claypool Publishers

(B) List of Software/Learning Websites:

- i. <http://www.custom-pak.com/product-design-development/blow-moulding-design-guide/#d>
- ii. https://techcenter.lanxess.com/scp/americas/en/docguard/Part_and_Mould_Design_Guide.pdf?docId=77015
- iii. http://www.plastiglas.com.mx/images/content/PLASTIGLAS_INST/uploads/1168103546998Thermoforming.pdf
- iv. http://www.thermoform.com/temp/site/profileFlip/PP_designguide.pdf
- v. <http://www.multifab-inc.com/guidelines.pdf>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics:**

- **Prof. A. S. Amin**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. J. R. Desai**, LPE, Government Polytechnic, Valsad.
- **Smt. S. R. Shah**, LPE, Government Polytechnic, Valsad.
- **Prof. M. K. Thakarar**, LPE, Government Polytechnic, Valsad.
- **Prof. B. I. Oza**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. N. C. Suvagya**, LPE, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat
- **Dr. Abhilash Thakur**, Associate Professor, Department of Applied Sciences.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM COURSE TITLE: MOULD FABRICATION TECHNOLOGY - II (COURSE CODE: 3362302)

Diploma Programme in which this course is offered	Semester in which offered
Plastics Engineering	Sixth

1. RATIONALE

To be in line with global developments the fabricators require faster, precise and economical fabrication techniques to produce moulds and other accessories associated with Plastic industries. A Plastic diploma engineer must be aware with modern fabrication techniques to cope up with recent fabrication requirements. This competency requires the knowledge of advanced fabrication techniques to produce intricate parts which are difficult to produce through conventional techniques. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Fabricate different parts of mould using appropriate fabrication method/machine**

3. COURSE OBJECTIVES (COs)

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

- i. Identify needs of fabrication techniques.
- ii. Compare fabrication techniques with respect to part production.
- iii. Select suitable process for given shape, size and material of mould part..
- iv. Fabricate mould part based on selected method/machine

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction	1a. Identify Conventional Fabrication Techniques. 1b. Compare Conventional And Advanced Fabrication Techniques.	1.0 Introduction 1.1 Introduction To Conventional Fabrication Techniques 1.2 Advancements In Fabrication Techniques 1.3 Advantages Of Advance Fabrication Techniques
Unit- II Electronic Discharge Method (EDM)	2a. Identify Needs For EDM. 2b. Select Proper EDM Process.	2.1 Spark Erosion Process 2.1.1 Working Principle 2.1.2 Construction & Working 2.1.3 Dielectric Medium 2.1.4 Different Tool Materials 2.1.5 Advantages And Disadvantages 2.2 Wire-Cut EDM 2.2.1 Working Principle 2.2.2 Construction & Working 2.2.3 Advantages And Disadvantages
Unit – III Copying Lathe and Copying Milling	3a. Identify Needs Of Copying Lathe. 3b. Identify Needs Of Copying Milling.	3.1 Copying Lathe 3.1.1 Types Of Attachments-Electronics, Hydraulic And Mechanical 3.1.2 Construction & Working 3.1.3 Advantages And Disadvantages 3.2 Copying Milling 3.2.1 Types Of Attachments-Electronics, Hydraulic And Mechanical 3.2.2 Construction & Working 3.2.3 Advantages And Disadvantages
Unit – IV Pantograph Die Sinking Machine	4a. Identify Needs Of Pantograph Machine.	4.1 Pantograph Die Sinking Machine 4.1.1 Basic Working Principle 4.1.2 Construction & Working 4.1.3 Advantages And Disadvantages
Unit – V Jig Boring Machines	5a. Identify Needs Of Jig Boring Machine.	5.1 Jig Boring Machine 5.1.1 working Principle Of Jig Boring Machine 5.1.2 Construction & Working 5.1.3 Comparison With Vertical Milling Machine

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – VI Cold Hobbing Process	6a. Identify Needs Of Cold Hobbing Process. 6b. Classify Hob Materials.	6.1 Cold Hobbing Process 6.1.1 Characteristics Of Mould Materials 6.1.2 Types Of Hob Materials 6.1.3 Process 6.1.4 Advantages And Disadvantages
Unit – VII Electroforming Process	7a. Identify Needs Of Electroforming Process.	7.1 Electroforming Process 7.1.1 Basic Working Principle 7.1.2 Process 7.1.3 Advantages And Disadvantages
Unit – VIII Polishing Methods	8a. Identify Needs Of Polishing. 8b. Classify Polishing Materials. 8c. Select Proper Polishing Method.	8.1 Polishing Methods 8.1.1 Need And Significance Of Polishing 8.1.2 Types Of Polishing Materials 8.1.3 Types Of Polishing Methods
Unit – IX Fundamentals of CNC machines	9a. Compare CNC With Conventional Machines.	9.1 Fundamentals Of CNC Machines 9.1.1 CAM – Concept And Definition. 9.1.2 Components Of CNC Machines 9.1.3 Advantages Over Conventional Machines
Unit – X Rapid Prototyping Processes	10a. Classify Various Processes. 10b. Select Proper Prototyping Process.	10.1 Rapid Prototyping Processes 10.1.1 Need And Significance 10.1.2 Types Of Processes And Applications i. Stereo Lithography ii. Selective Laser Sintering iii. Fused Deposition Method iv. Laminated Object Manufacturing v. 3 D Printing

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	3	3	0	0	3
II	Electronic Discharge Method (EDM)	7	3	3	4	10
III	Copying Lathe and Copying Milling	4	3	2	2	7
IV	Pantograph Die Sinking Machine	3	3	2	2	7

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
V	Jig Boring Machines	3	2	2	2	6
VI	Cold Hobbing Process	3	2	2	2	6
VII	Electroforming Process	4	3	2	2	7
VIII	Polishing Methods	5	2	3	3	8
IX	Fundamentals of CNC Machines	5	3	3	3	9
X	Rapid Prototyping Processes	5	3	4	0	7
TOTAL		42	27	23	20	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise	Approx Hours Required
1	II, III VIII	Manufacture any two mould parts. (parts having different shapes, number of parts to be fabricated may be more than two, it would depend upon complexity of shapes. Faculty should give enough number of shapes for fabrication to students to justify the time	40

		allocated)	
2	II	Fabricate parts with EDM process. (with help of industries)	16
TOTAL			56

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Collect information and prepare chart for advanced fabrication techniques.
- ii. Collect information about CNC and rapid prototyping machines through internet.
- iii. Visit nearby mould making industry.

9. SPECIAL INSTRUCTIONAL STRETEGIES (If any)

- i. Arrange expert lecture (may be faculty from Mechanical Engineering Department of same polytechnic)
- ii. Arrange visit to nearby machining/fabrication industry having state of art machines.
- iii. Show video/animation of different machining/fabrication operation

10. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr. No.	Title Of Book	Authors	Publication
1	Elements of Workshop Technology	Hazra Choudhary	Media Promoters and Publishers Pvt. Ltd.
2	Workshop Technology	W. Chapman	Elseveir
3	Injection Mould Design	R.G.W Pye	Van Nostrand Reinhold
3	CNC Fundamentals and programming	P. M. Agrawal	Charotar Publishing
4	Rapid Prototyping	Andreas Gebhardt	Hanser Publications
5	A Textbook of Manufacturing Technology: Manufacturing Processes	R. K. Rajput	Laxmi Publications

(B) List of Software/Learning Websites:

- i. <http://nptel.ac.in/courses/112105127/pdf/LM-23.pdf>
- ii. http://web.iitd.ac.in/~pmpandey/MEL120_html/RP_document.pdf
- iii. http://www.reliableedm.com/Complete%20EDM%20Handbook/Complete%20EDM%20Handbook_1.pdf
- iv. <http://www.automationmag.com/images/stories/LWTechfiles/91%20Electrical%20Discharge.pdf>
- v. <http://www3.nd.edu/~rroeder/ame50542/slides/rapidprototyping.pdf>
- vi. [www.wikieducator.org/Workshop_Technology_\(Mechanical\)](http://www.wikieducator.org/Workshop_Technology_(Mechanical))
- vii. <http://www.ignou.ac.in/upload/Unit-3.pdf>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics:**

- **Prof. A.S.Amin**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. J.R.Desai**, LPE, Government Polytechnic, Valsad.
- **Smt. S.R.Shah**, LPE, Government Polytechnic, Valsad.
- **Prof. M.K.Thakarar**, LPE, Government Polytechnic, Valsad.
- **Prof. B.I.Oza**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. N.C.Suvagya**, LPE, Government Polytechnic, Chhota Udepur.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: PLASTIC MATERIALS - II
(COURSE CODE: 3362303)**

Diploma Programmes in which this course is offered	Semester in which offered
Plastics Engineering	Sixth

1. RATIONALE

To satisfy the need of end user, many advanced polymers have been developed. Diploma Plastic engineer has to deal with the production as a responsible technician and first line supervisor in the industries. Thus he should be acquainted with various high performance, specialty plastics, alloys & blends used in high performance applications. Hence the course has been designed to develop these competencies and its associated cognitive, practical and effective domain learning outcomes.

2. COMPETENCIES

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Select appropriate advanced materials correlating the properties of the material and high performance required in end product.**

3. Course Outcomes (COs)

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

- Describe the need of high quality plastics.
- Categorize the polymers used in specialty applications.
- Explain the importance of polymer alloys and blends.
- Categorize and compare various biopolymers.

4. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I High Performance Plastics	1a. Compare properties of various high quality plastics. 1.b List out the applications of high quality plastics	1.1 Polyimides 1.2 Polyetherimide 1.3 Poly(amide-imide) 1.4 Polyarylates 1.5 Chlorinated Polyether
Unit – II Speciality Polymers	2b. List out the areas of applications in specific areas 2c. Identify various polymers used in speciality applications and their properties	2.1 List of Polymers, Properties & Applications of : <ul style="list-style-type: none"> • High Temperature Polymers • Fire resisting polymers • Biomedical Polymers • Barrier Polymers • Electrically Conductive Polymers • Thermoplastic Elastomers • Liquid Crystal Polymers 2.2 Introduction to Polymer Nanocomposites
Unit – III Polymer Alloys & Blends	3a. Define various terms for Alloy and Blends 3b. Characterize Alloy and Blends 3c. Select the Blend components. 3d. Differentiate various Blend Preparation techniques	3.1 Introduction & definitions of terms related to Alloys & Blends. 3.2 Importance of Polymer alloys & blends 3.3 Selection of blend components. 3.4 Steps in polymer blend design. 3.4 Blend Preparation techniques <ul style="list-style-type: none"> - Melt blending - Solution blending - Latex or dispersion mixing 3.5 Properties and applications of alloys and blends, PP/EPDM, PC/ABS, PC/PBT (Xenoy), PPO/Nylon, PPO/PS (Noryl), ABS/PVC
Unit – IV Biodegradable Polymers	4a. Define Biodegradable polymers 4b. Classify biopolymers 4c. Compare properties of different biopolymers 4d. List out factors affecting biodegradability	4.1 Introduction & definition of related terms. 4.2 Classification of biodegradable polymers 4.3 Properties and applications of biodegradable polymers: <ul style="list-style-type: none"> - Natural polymers (starch , cellulose) - Microbial polyesters (PHA,PHB) - Polylactic acid (PLA) - Polycaprolactone (PCL) - Water soluble polymers 4.4 Factors affecting biodegradability
Unit –V Polymers in Sectorial Applications	5a. Introduction 5b. Know various areas of applications 5c. Identify various polymers used in those areas as per requirement	5.1 Polymers in Packaging 5.2 Polymers in Building and Construction 5.3 Polymers in Automotive Applications 5.4 Polymers in Aerospace Applications 5.5 Polymers in Agriculture

Unit	Major Learning Outcomes	Topics and Sub-topics
		5.6 Polymers in Medical Applications 5.7 Polymers in Sports

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	High Performance Plastics	04	03	04	00	07
II	Speciality Polymers	10	03	10	04	17
III	Polymer Alloys & Blends	10	03	10	05	18
IV	Biodegradable Polymers	09	03	07	04	14
V	Polymers in Sectorial Applications	09	03	03	08	14
		42	15	34	21	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hours Required
1	I	Study and identify structure, properties and applications of PAI.	02
2	I	Study and identify structure, properties and applications of PI.	02
3	I	Study and identify structure, properties and applications of PEI.	02
4	II	Study and identify properties and applications of various speciality polymers.	02
4	III	Design a polymer blend.	02
6	III	Demonstrate blend preparation techniques.	
7	III	Identify and compare properties and applications of PC/ABS & PC/PBT blends	02
8	III	Identify and compare properties and applications of	02

		PPO/PS and PPO/Nylon blends	
9	IV	Study and explain the factors affecting biodegradability	02
10	IV	Study and identify various natural polymers and their properties	02
11	V	Explore and identify the uses of various polymers used in agricultural applications	02
12	V	Explore and identify the uses of various polymers used in medical applications	02
13	V	Explore and identify the uses of various polymers used in sports applications	02
14	V	Explore and identify the uses of various polymers used in automotive applications	02
Total			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- Fetch new polymers used in specialty applications.
- Identify new areas of applications of polymers.
- Prepare list of properties and applications of high quality polymers.
- Prepare list of properties and applications of polymer alloys and blends.
- Explore the importance of biodegradable polymers and latest trends in it with the help of internet.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Arrange expert lecture (may be faculty from chemistry department of same polytechnic)
- Give different type of polymers as topic to group of students (3 to 4) and ask them to prepare ppt by exploring internet and ask them to present in the class seminar.
- Ask students to explore the market and prepare the report (with samples of polymers) about their specification, utility, cost etc.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Hand Book Biodegradable Polymers	Catia Bastioli	Rapra Technology Limited
2.	Green Plastics	Stevens	Princeton University Press
3.	Biodegradable polymers for industrial applications	Ray Smith	Woodhead Publishing Limited
4.	Plastics Materials	Brydson	Butterworth-Heinemann
5.	Polymer Alloys & Blends	R.P.Singh	Asian Books
6.	Engineering Thermoplastics	James Margolis	CRC Press
7.	Plastics Technology Handbook	Manas Chanda & Roy	CRC Press
8.	Principles of Polymer Science	Bahadur & Sastry	Alpha Science International

9.	Polymers Blends & Alloys	L.A.Utracki	Hanser Publications
10.	Engineering Polymers	Dyson	Chapman & Hall

(B) List of Software/Learning Websites

- i. www.en.wikipedia.org
- ii. <http://cdn.intechopen.com/pdfs-wm/34065.pdf>
- iii. http://ed.iitm.ac.in/~shankar_sj/Courses/ED5312/Materials_for_Automobiles17.pdf
- iv. www.europeanplasticfilms.eu/docs/AustralianReportonBiodegradablePlastics.pdf
- v. <http://www.sdplastics.com/ensinger/aerodef.pdf>
- vi. www.icmpp.ro/sustainableplastics/files/Biodegradable_plastics_and_polymers.pdf
- vii. web.stanford.edu/cheme160/lectures

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. Ajay Amin**, Lecturer, Government Polytechnic, Ahmedabad.
- **Prof. J. R. Desai**, Lecturer, Government Polytechnic, Valsad.
- **Prof. (Mrs) S.R.Shah**, Lecturer, Government Polytechnic, Valsad.
- **Prof. M. K. Thakarar**, Lecturer, Government Polytechnic, Valsad.
- **Prof. B. I. Oza**, Lecturer, Government Polytechnic, Ahmedabad.
- **Prof. N.C. Suvagya** Lecturer, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****COURSE TITLE: PLASTICS TESTING AND QUALITY MANAGEMENT
(COURSE CODE: 3362304)**

Diploma Programmes in which this course is offered	Semester in which offered
Plastics Engineering	Sixth

1. RATIONALE

Plastics being widely used in diversified applications, it is necessary to test the material properties before deciding to use them for each application. By testing of plastics, the product design and the area of application can be explored. Diploma Plastic engineer has to deal with the production of various types of plastics as a responsible technician and first line supervisor in the industries. Hence the course has been designed to develop these competencies and its associated cognitive, practical and effective domain learning outcomes. This course also aims to create awareness about quality control and quality management methods.

2. COMPETENCIES

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Test plastics and analysis various properties.**
- **Maintain quality of production using SQC and SPC techniques.**

3. COURSE OUTCOMES (COs)

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

- Identify factors affecting the tests.
- Perform various tests.
- Interpret the test results.
- Select appropriate material
- Explain SQC Procedures
- Explain SPC Procedures

4. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Introduction	1a. Define testing 1b. List out the standards 1c. List out the purpose of specifications 1d. List out the organizations for standards and quality 1e. Explain conditioning procedure	1.1 Definition 1.2 Reasons for testing 1.3 Purpose of standard & specification 1.4 various organization dealing with standards and quality 1.5 Conditioning of samples
Unit – II Mechanical Properties	2a. Operate various Testing equipments. 2b. Determine/calculate strength of plastic materials. 2c. Compare materials	2.1 Tensile strength test 2.2 Stress-Strain curve 2.5 Creep & stress relaxation 2.4 Flexural strength test 2.4 Impact strength test 2.4.1 Izod impact 2.4.2 Dart impact test 2.6 Hardness & Abrasion resistance
Unit –III Thermal Properties	3a. Perform the standard test procedures 3b. Interpret test results. 3c. Classify the material.	3.2 Determination of Heat Deflection Temperature (HDT) 3.3 Determination of Vicat Softening Temperature (VST) 3.3 Thermal expansion test
Unit – IV Electrical and Optical Properties	4a. Measure electric properties 4b. Classify materials based on electrical properties 4c. Apply optical properties in selection of material	4.1 Die electric strength 4.2 Die electric constant 4.3 Arc resistance 4.4 Definition of volume resistance and surface resistance 4.5 Refractive index 4.6 Definition of light transmission, haze, gloss, clarity
Unit – V Miscellaneous Tests	5a. Understand flow behavior of plastics 5b. Identify flow behavior of thermosets. 5c. Perform ESCR test. 5d. Identify the flame resistance. 5e. Measure the density of material. 5f. Measure the weather resistance of the material. 5g. Differentiate between conventional and non destructive testing	5.1 Melt flow index 5.2 Cup flow test and Spiral flow test 5.3 Environmental Stress Cracking Resistance 5.4 Oxygen index test 5.5 Specific gravity test 5.6 Outdoor and accelerated weather resistance tests. 5.7 Non destructive test -Ultrasonic testing

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit - VI Failure Analysis and Quality Control	6a. Classify failures 6b. Analyze failures 6c. Explain meaning and purpose of quality control 6d. Explain SPC and SQC procedures.	6.1 Types of failures 6.2 Failure Analysis techniques 6.1 Importance of quality control 6.2 Statistical Quality Control(SQC) 6.3 Quality assurance manual 6.4 Statistical Process Control (SPC)

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	03	03	03	00	06
II	Mechanical Properties	10	04	03	09	16
III	Thermal Properties	03	02	02	02	06
IV	Electrical and Optical Properties	08	03	03	06	12
V	Miscellaneous Tests	08	03	03	08	14
VI	Failure Analysis and Quality Control	10	04	08	04	16
	Total	42	19	22	29	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx Hours. Required
1	II	Measure the tensile strength of a given plastic.	02
2	II	Measure the flexural strength of a given plastic.	02
3	II	Measure the impact strength of a given plastic.	02
4	II	Measure the hardness of a given plastic.	02
5	III	Measure the HDT of a given plastic.	02

6	III	Measure the VST of a given plastic.	02
7	IV	Measure the Dielectric strength of a given plastic.	02
8	V	Measure the ESCR of a given plastic.	02
9	V	Measure the Melt Flow Index of a given plastic.	02
10	V	Measure the Oxygen Index of a given plastic	02
11	V	Measure the Specific Gravity.	02
12	VI	Interpret process control charts. (for two different cases)	04
13	VI	Interpret given test data and take decisions based on SQC techniques	02
Total			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Study the test results of various tests on different samples and find out the reasons for variation in results (beyond expectation variation if any) and try to find out the reasons for these variations.
- ii. Study the SQC and SPC procedures being adopted by different plastic product manufacturers and prepare a report.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange expert lecture on SQC and SPC by Quality Manager/Engineer of a plastic industry.
- ii. Arrange a visit to nearby plastic industry and show students different testing procedure being carried out there.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Hand Book of Plastics Testing Technology	Vishu Shah	Wiley Inter-science publication
2.	Hand Book of Polymer testing	R.P.Brown (roger brown)	Marcel- Dekker Inc.
3.	Statistical Quality Control	O.P.Khanna	Khanna publishers
4.	Hand book of plastics & elastomers	C.A.Harper	Wiley publication
5.	Plastics processing data hand book	D.V.Rosato	Springer Berlin Heidelberg

B) List of Major Equipment/ Instrument with Broad Specifications

1. Universal Testing Machine
2. Rockwell Hardness Tester
3. Abrasion tester
4. Dielectric strength and constant tester
5. HDT cum VST tester
6. MFI tester
7. Viscometer
8. Refractometer
9. Oxygen Index tester

C) List of Software/Learning Websites

- i. <http://www.ipolytech.com/>
- ii. <http://www.ulttc.com/>
- iii. www.intertek.com
- iv. <http://www.labtesting.com/>
- v. www.nslanalytical.com/testing/polymer
- vi. <http://www.exova.com/capabilities/polymer-testing/>
- vii. <http://www.chemir.com/plastic-polymer-testing.html>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. A. S. Amin**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. J .R. Desai**, LPE, Government Polytechnic, Valsad.
- **Smt. S. R. Shah**, LPE, Government Polytechnic, Valsad.
- **Prof. M .K. Thakarar**, LPE, Government Polytechnic, Valsad.
- **Prof. B. I. Oza** , LPE, Government Polytechnic, Ahmedabad.
- **Prof. N. C. Suvagya**, LPE, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM
COURSE TITLE: SECONDARY PROCESSING TECHNIQUES
(COURSE CODE: 3362305)**

Diploma Programme in which this course is offered	Semester in which offered
Plastics Engineering	Sixth

1. RATIONALE

The changing demands of end users with respect to products led the plastic engineers for developing various kinds of processes. A plastic diploma engineer has to monitor operations of many specialized processes. This competency requires the knowledge of these specialized processes. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Develop plastic products using appropriate specialized (secondary processes) techniques.**

3. COURSE OUTCOMES (COs)

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

- Identify needs of specialized fabrication techniques.
- Compare specialized fabrication techniques
- Identify manufacturing requirements of various processes.
- Analyse and compare various processes.
- Select suitable process for production of articles.
- Carry out different secondary processes on plastic products

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	4	7	70	30	40	60	200

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Calendering Process	1a. Identify And Select Raw Material Composition 1b. Select Suitable Calendar Arrangement. 1c. Compare Similar Processes.	1.1 Introduction 1.2 Raw Material Selection And Types Of Additives 1.3 Material And Material Preparation (Premix, Blending, Gelation) 1.4 Roll Construction 1.5 Types Of Rolls – Cored And Drilled Rolls 1.6 Types Of Calenders a. Superimposed Calenders b. Offset Calenders c. Z Calenders 1.7 Heating And Lubrication Systems For Calendar Rolls 1.8 Calendaring Process With Plant Layout 1.9 Start-Up And Shut-Down Procedure 1.10 Trouble Shooting 1.11 Post Calendaring Processes 1.12 Compare With Sheet Extrusion. 1.13 Application 1.14 Advantages And Disadvantages
Unit – II Casting And Encapsulati on	2a. Select Appropriate Material For Casting And Encapsulation 2b. Compare Similar Processes	2.1 Casting 2.1.1 Introduction 2.1.2 Casting Material And Additives 2.1.3 Casting Mold Materials 2.1.4 Casting Process 2.1.5 Casting Applications 2.1.6 Advantages And Disadvantages 2.2 Encapsulation 2.2.1 Materials For Encapsulations 2.2.2 Encapsulation Process 2.2.3 Applications

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – III Fiber Reinforced Plastics	3a. Select Suitable Fiber And Material. 3b. Analyze Suitable Processes 3c. Select Proper Process 3d. Compare With Other Processes.	3.1 Introduction 3.2 Material Selection Criteria 3.3 Introduction Of Various Resins Use In Composite 3.4 Fibers – Classification, Properties And Applications 3.5 Release Agents – Internal And External 3.6 Gel Coat Preparation And Its Application 3.7 Molding Compounds <ul style="list-style-type: none"> a. DMC/BMC b. SMC c. TMC d. Prepags 3.8 Mould Materials 3.9 FRP Processes <ul style="list-style-type: none"> a. Hand Lay Up b. Spray Lay Up c. Vacuum & Pressure Bag d. Filament Winding e. Pultrusion f. Match Die Molding g. Resin Transfer Molding h. Foam Reservoir Molding i. Centrifugal Molding j. Vacuum Impregnation And Injection 3.10 Trimming And Finishing 3.11 Applications 3.12 Advantages And Disadvantages
Unit – IV Vinyl Dispersion	4a. Distinguish Vinyl Dispersion Processes. 4b. Select Molding Process.	4.1 Introduction 4.2 Resin Selection Criteria 4.3 Plastisol Preparation 4.4 Vinyl Dispersion Process <ul style="list-style-type: none"> a. Spread Coating b. Knife Coating c. Roll Coating d. Fabric Coating e. Film Casting 4.5 Molding Process <ul style="list-style-type: none"> a. Dip Coating And Dip Molding b. Hot And Cold Molding c. Slush Molding d. Rotational Molding e. Strand Coating 4.6 Applications

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Units-V Foam Processes	5a. Classify Blowing Agents. 5b. Identify Suitable Blowing Agent. 5c. Analyze Various Foam Materials. 5d. Select Proper Foam Material.	5.1 Introduction 5.2 General Production Methods 5.3 Blowing Agents a. Physical b. Chemical 5.4 Cellular Structure And Properties 5.5 Flexible And Rigid Foam of a. Polyurethane (PU) b. Poly Vinyl Chloride (PVC) c. Polystyrene (PS) d. Polyethylene (PE) e. Epoxy f. Silicone g. Urea Formaldehyde (UF) 5.6 Applications 5.7 Advantages And Disadvantages

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Calendaring Process	09	5	5	5	15
II	Casting and Encapsulation	06	4	4	3	11
III	Fiber Reinforced plastic	12	6	6	6	18
IV	Vinyl Dispersion	08	4	4	6	14
V	Foam Processes	07	4	4	4	12
TOTAL		42	23	23	24	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit Number	Practical/Exercise	Approx. Hours Required
1	I	Demonstrate calendering process.	4
2	I	Demonstrate composition, heating and lubrications of Calendering rolls.	4
3	I	Demonstrate types of calender arrangements.	4
4	II	Manufacture product utilizing casting process.	4
5	II	Demonstrate encapsulation process.	4
6	III	Demonstrate various moulding compounds for FRP.	8
7	III	Prepare FRP product using contact moulding.	4
8	III	Demonstrate filament winding process for making FRP products.	8
9	IV	Demonstrate various Vinyl Dispersion preparation processes.	4
10	IV	Demonstrate moulding processes for Vinyl Dispersion.	4
11	V	Demonstrate general production methods of Foam plastics.	4
12	V	Demonstrate production method of expandable PS Foam.	4
TOTAL			56

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Collect information about various FRP products and their manufacturing processes.
- ii. Collect information about industries related to these secondary processes by exploring internet.
- iii. Visit nearby processing industries.
- iv. Survey market and collect different plastic items and discuss in class the material and advanced processes used in making it.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Arrange expert lectures by inviting engineers from related industries
- ii. Arrange visit to nearby plastic processes industry having state of art machines.
- iii. Show video/animation of different machining/fabrication operation
- iv. Give students (in group of 3 to 4) mini project on different special/secondary processes and ask them to collect information from internet/nearby industries and present in a class seminar.

10. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr. No.	Title of Book	Authors	Publication
1	Plastic Materials and Processes	S. S. Schwartz & S. H. Goodman	Van Nostrand Reinhold Company
2	Plastic Engineering Handbook	J. L. Fredoz	Van Nostrand Reinhold Company
3	SPI Plastic Engineering Handbook	M. Bearins	Springer
4	Calendering of Plastics	Elden & Swan	American Elsevier Publishing Company
5	FRP Technology	R. G. Weatherhead	Applied Science Publisher

(B) List of Major Equipment/Instruments

- (i) Models/Charts of various special/secondary processes.
- (ii) Sample of plastic items manufactured using advance/secondary processes

(C) List of Software/Learning Websites:

- i. en.wikipedia.org
- ii. http://www.appropedia.org/Polymer_Calendering
- iii. http://www.moldedfiberglass.com/sites/default/files/docs/MFG_Selecting_FRP_Composite_for_Projects.pdf

- iv. <http://www.reichhold.com/corrosion/docs/Materials%20Selection%20Guide%20Final%20Version.pdf>
- v. http://www.lindeus.com/internet.lg.lg.usa/en/images/1776E_Foaming_with_inert_gases_brochure_hires138_74264.pdf

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. A.S.Amin**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. J.R.Desai**, LPE, Government Polytechnic, Valsad.
- **Prof (Smt.) S.R.Shah**, LPE, Government Polytechnic, Valsad.
- **Prof. M.K.Thakarar**, LPE, Government Polytechnic, Valsad.
- **Prof. B.I.Oza**, LPE, Government Polytechnic, Ahmedabad.
- **Prof. N.C.Suvagya**, LPE, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
ADVANCED PLASTIC PROCESSING TECHNIQUES
(Code: 3372301)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	7 th Semester

1. RATIONALE

The course deals with advancement in plastic processing techniques. Stretch blow molding and multi-layer blow molding are the latest technologies used for making bottles and containers for packaging. Students should be aware of recent developments in injection blow molding and extrusion blow molding as new products are coming in the market every day. With the advancement in extrusion technology many products came into existence for the mankind e.g. reinforced pipes, coextruded multilayer films & sheets, foam extruded products, nylon braided pipes etc. Also with the use of various post extrusion processes so many products like nets, corrugated sheets etc can be manufactured. Hence plastics engineer is expected to know the latest extrusion technology along with theory of technology and screw design for better quality products. The advanced injection molding technology enhances production rate as well as quality to fulfill the requirements of emerged new market. Precise computer controls and programs enable the process variables with zero defects at the lowest cost through fine tuning of machine settings.

2. COMPETENCIES

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

- Operate, set process parameters and control Blow molding machine, Extrusion plant and Injection molding machine for non conventional products.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Explain stretch blow molding process
2. Understand non conventional blow molding process
3. Differentiate various screw designs used in extrusion plants
4. Explain specialized extrusion processes for non conventional extrusion product
5. Distinguish non conventional injection molding techniques

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 1: ADVANCED BLOW MOLDING PROCESSES	1.a Understand the stretch blow molding process 1.b Differentiate various stages of process 1.c Troubleshoot the problems in co extrusion blow molding 1.d Explain various non conventional blow molding techniques and post operative operations	1. STRETCH BLOW MOLDING 1.1 Introduction 1.2 Single stage & two stage processes and its comparison 1.3 Orientation and stretch ratio 1.4 Pre-forming 1.5 Extrusion stretch blow molding 1.6 Injection orientation blow molding 2. CO-EXTRUSION BLOW MOLDING 2.1 Co-extrusion equipment 2.2 Process 3. MISCELLANEOUS BLOW MOLDING PROCESSES 3.1 Neck ring process 3.2 Drape process 3.3 Dip / displacement processes 3.4 Blow molding of irregular shaped parts
UNIT 2: ADVANCED EXTRUSION TECHNIQUES	2.a Distinguish between various screw designs 2.b List merits and demerits of co-extrusion process 2.c Explain various specialized process for non conventional extruded products	1. ADVANCED EXTRUDER MACHINE FEATURES 1.1 Twin screw extruder 1.1.1 Intermeshing and non Intermeshing 1.1.2 Counter rotating and co-rotating 1.1.3 Comparison with single screw 1.2 Vented screw extruder designs. 1.3 Internal Bubble cooling. 2. CO-EXTRUSION 2.1 Co-extrusion structures 2.2 Barrier materials & adhesives 2.3 Comparison: Feed block die and multi manifold die 2.4 Advantages of co-extrusion products.

Unit	Major Learning Outcomes	Topics and Sub-topics
		2.5 Applications of co-extruded products. 3. SPECIALIZED PROCESSES 3.1 Reinforced pipes- Nylon braided pipes 3.2 Hose pipe 3.3 Fishing net 3.4 Heat shrink film 3.5 Cling film 3.6 Corrugated sheets and pipes
UNIT 3: ADVANCED INJECTION MOLDING PROCESSES	3.a Describe the RIM process 3.b List merits and demerits of RIM process 3.c Describe Gas Assisted Injection Molding process 3.d Explain various non conventional injection molding techniques	1 REACTION INJECTION MOLDING (RIM) 1.1 Introduction to RIM process 1.2 Materials and additives 1.3 Features of RIM process and variables 1.4 Machine & auxiliary 1.5 Flow diagram of RIM process 1.6 Characteristic of RIM parts 1.7 Merits and demerits of RIM process 2 NON CONVENTIONAL INJECTION MOLDING PROCESS Material, process, advantages and disadvantages of the following processes: 2.1 Gas-assisted injection molding 2.2 Sandwich injection molding 2.3 Structural foam injection molding 2.4 Flow molding 2.5 Metal filled 2.6 Multicolor molding 2.7 Injection molding of reinforced thermoplastics

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Advanced blow molding processes	13	2	8	5	15
II	Advanced extrusion techniques	20	5	13	7	25
III	Advanced injection molding processes	23	5	15	10	30

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Total		56	12	36	22	70

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hour
1	I	Set the extrusion stretch blow mold and machine parameters	02
2		Operate stretch extrusion blow molding machine.	04
3		Operate stretch injection blow molding machine.	04
4		Find out production rate of stretch extrusion blow molding machine.	02
5		Find out production rate of stretch injection blow molding machine.	02
6		Operate co-extrusion blow molding machine for a given product	04
7		Find out production rate or co-extrusion & co-injection blow molding machine	02
8		Perform Neck ring process for given product	04
9		Perform Drape process for given product	04
10		Perform Dip/displacement process for given product	04
11	II	Operate twin screw extruder for PVC pipe plant	04
12		Study of various vented screw extruder design	02
13		Study constructional features of multilayer blown film plant	02
14		Operate multilayer blown film plant	04
15		Study manufacturing of Nylon braided pipes	02
16	III	Set mold and process parameters for given product of RIM process	02
17		Operate RIM process for given product	04
18		Operate gas assisted injection molding machine for given product	04

19		Operate sandwich injection molding machine for given product	04
20		Operate structural foam injection molding machine for given product	04
21		Operate flow molding machine for given product	04
22		Operate metal filled process for given product	04
23		Operate multi color injection molding machine for given product	04
24		Operate reinforced thermoplastic injection molding machine for given product	04
		Total	78

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Plastics Blow moulding hand book	Norman lee	Rapra Technology Limited
2	Blow moulding of plastics	E G Fisher	The Plastics Institute
3	Hand book of plastic processing technology	D. V. Rosato	Springer
4	Blow moulding hand book	Rosato & Rosato	Hanser Publishers
5	Plastics Extrusion Technology	Fried helm Hence	Hanser Publishers
6	Polymer Extrusion	Chris Rauwendaal	Hanser Verlag
7	Extrusion of Plastics	Fisher	The Plastics Institute
8	Plastics Engineering Hand book	Bearins	Van Nostrand Reinhold Company
9	Plastics processing data hand book	Rosato & Rosato	
10	Reaction injection moulding	Walter E. Becker	
11	Injection moulding theory and practice	Rubbin	Wiley-The University of Michigan
12	Developments in injection moulding	Whelen and goff.	

13	Fundamentals of RIM	Macosko	
14	Injection moulding machines	John Hapbern	
15	Plastics injection moulding	Bryce	

(B) List of Software/Learning Websites:

1. <http://www.bpf.co.uk/>
2. <http://www.paulsontraining.com>
3. <http://www.traininteractive.com>
4. <http://www.kenplas.com/project/pet/petblow.aspx>

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect various shaped and different material articles and analyze the process being used for that product.
2. Students will collect information related to processes through internet.
3. Students will visit nearby such industries for practical knowledge.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics:**

1. Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.
2. Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.
3. Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.
4. Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.
5. Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR, Bhopal

- 1.
- 2.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
DECORATING AND FINISHING OF PLASTIC PRODUCT
(Code: 3372302)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	7 th Semester

1. RATIONALE

The changing demands of customers with respect to aesthetic looks, applications, properties, protection, etc led the plastic engineers for developing various kinds of decorating processes. A diploma plastic engineer has to select appropriate process, machines and monitor operations of decorating and finishing machineries. This competency requires the knowledge of decorating process, assembling of plastic parts, use of fastening techniques and application of painting and printing. Hence the course has been designed to develop these competencies and its associated-cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

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

- Identify requirements of decoration and finishing of plastics products.
- Select appropriate decorating and finishing process to satisfy demand of end user.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Select suitable fasteners.
2. Identify appropriate bonding material and techniques.
3. Apply proper surface treatment method.
4. Compare various painting processes.
5. Distinguish the printing processes.
6. Outline the hot transfer methods.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 1: MECHANICAL FASTENERS FOR PLASTIC	1.a Identify proper fastenings 1.b Use require screw 1.c Classify the fastenings	Definition, Types and Applications of: 1. Screws 1.1 Self tapping screws 1.1.1 Thread forming screws 1.1.2 Thread cutting screws 2. Post Molded inserts and Molded-in inserts 3. Hinges 4. Rivets 5. Nuts and bolts
UNIT 2: JOINING AND ASSEMBLING TECHNIQUES	2.a Apply require cementing techniques 2.b Justify joining methods 2.c Compare thermal bonding processes. 2.d Demonstrate the welding techniques	1. SOLVENT CEMENTING TECHNIQUE 1.1 Basic principle of solvent bonding 1.2 Factors to be considered for good cementing 1.3 Types of solvents use for plastic solvent bonding 1.4 Different methods for applying solvents for solvent cementing 2. ADHESIVE BONDING 2.1 Basic principle of adhesive bonding 2.2 Types of adhesives used for plastics 2.3 Method of applying adhesives 2.4 Applications of adhesives 3. THERMAL BONDING TECHNIQUES 3.1 Introduction of plastic welding 3.2 Basic principle, equipment, working, merit, demerit and applications of : 3.2.1 Hot gas welding 3.2.2 Hot plate welding 3.2.3 Ultrasonic bonding 3.2.4 Ultrasonic spot welding

Unit	Major Learning Outcomes	Topics and Sub-topics
		3.2.5 Ultrasonic swaging 3.2.6 Ultrasonic Heat sealing 3.2.7 Vibration welding 3.2.8 Spin welding/friction welding 3.2.9 Induction welding 3.2.10 Electromagnetic Induction bonding 3.2.11 Heat sealing / Induction cap sealing 3.2.12 Dielectric heat sealing 3.3 Applications of thermal bonding
UNIT 3: SURFACE TREATMENT	3.a Compare surface treatment method. 3.b Apply surface treatment method	1. Significance of surface treatment 2. Plastic materials which necessitates surface treatment 3. Technical reasons for non-sticking of printing ink on surfaces of film/moldings 4. Surface treatments 4.1 Washing and cleaning 4.2 Mechanical abrasion 4.3 Chemical etching 4.4 Priming 4.5 Flame treatment 4.6 Corona discharge 4.7 Plasma treatment
UNIT 4: PAINTING AND COATING	4.a Select proper painting method 4.b Differentiate the painting and coating application. 4.c choose appropriate coating method	1. PAINTING 1.1 Types of paint materials 1.2 Process, Equipment and Applications of: 1.1.1 Conventional spray 1.1.2 Electrostatic spray 1.1.3 Spray and wiping 1.1.4 Roller coating 2. COATING 2.1 Materials for Powder coating 2.2 Process, Equipment and Applications of: 2.2.1 Fluidized bed coating 2.2.2 Electrostatic deposition
UNIT 5: PRINTING	5.a Classify printing process. 5.b choose appropriate printing method 5.c distinguish types of ink	Process, Merit, Demerit And Applications of: 1. Screen printing 2. Flexography printing 3. Gravure printing 4. Pad printing 5. Offset printing 6. Laser printing 7. Vinyl banner printing

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 6: HOT TRANSFER PROCESS	6.a Use require hot transfer process 6.b Select proper hot transfer process 6.c Judge best hot transfer application.	Process, Merit, Demerit And Applications of: 1. Electroplating 2. Vacuum metalizing 3. Hot stamping 4. Labels and decals 5. Water transfer process 6. Flocking 7. Laser marking 8. Embossing and Surface Texturing

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Mechanical Fasteners For Plastic	8	2	2	2	6
II	Joining And Assembling Techniques	13	4	8	4	16
III	Surface Treatment	7	4	4	4	12
IV	Painting and Coating	10	3	5	4	12
V	Printing	10	4	4	4	12
VI	Hot Transfer Process	8	2	6	4	12
Total		56	19	29	22	70

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hours
1	I	Perform any one mechanical fastening technique.	

			2
2	II	Perform the adhesive bonding process on different plastic material and products	4
3		Perform the solvent cementing process on different plastic material and products	4
4		Perform ultrasonic bonding technique.	4
5		Perform hot gas welding process.	4
6	III	Perform surface treatment method on different plastic materials.	6
7	IV	Perform the any painting method as per the product and plastic material.	6
8		Perform the any coating method as per the product and plastic material.	6
9	V	Perform the printing process as per product shape and form.	6
10		Operate the different printing machine and suggest the proper process for proper product	6
11	VI	Perform the hot transfer process as per requirement.	8
Total			56

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Handbook of Plastic Technology	Rosato/Rosato	Allen & Baker
2	Plastic Materials and Processes	Norman Lee	Goodman
3	Plastic Engineering Handbook	Fisher	J.L.Frados

4	SPI Plastic Engineering Handbook	James L. Throne	Bearins
5	Plastic Blow Moulding Handbook	Peter Klein	

(B) List of Software/Learning Websites:

1. www.ptonline.com/zones/decorating
2. www.esterline.com/Portals/13/.../WP_InMoldDecorating_6Page.pdf
3. speplasticsindustryresource.com/.../Decorating_and_Finishing/3335

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect different shaped and different material articles and analyze the type of process for that product for decorations and finishing.
2. Students will collect information related to process through internet.
3. Students will visit nearby mould making industry.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics:**

1. Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.
2. Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.
3. Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.
4. Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.
5. Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.

Coordinator and Faculty Members from NITTTR Bhopal

- 1.
- 2.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
DESIGNING OF EXTRUSION DIES
(Code: 3372303)

Diploma Programme in which this course is offered	Semester in which offered
Plastics Engineering	7 th Semester

1. RATIONALE

Extrusion is the highest plastic consuming process mainly used for continuous manufacturing of rods, profiles, tubes, pipes, films, sheets, wire and cable etc. Amongst the different items of equipment employed for the operation of extrusion process, the extruder and die are perhaps the most important. A Plastic Diploma engineer has to supervise the designing and manufacturing process of dies and monitor extrudate production using these dies. This competency requires the knowledge of various designing aspects of extrusion dies. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

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

- Identify requirements of various dies.
- Design extrusion dies.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Understand melt rheology.
2. Analyze die design factors.
3. Select proper breaker plate design.
4. Select proper die design according to shape of extrudate.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT – I POLYMER MELT RHEOLOGY	1.a Understand the terms related with rheology 1.b Identify various types of flow	1.1 Basic Definitions: shear, shear stress, shear rate & viscosity 1.2 Effect of shear stress and shear rate on viscosity of melt 1.3 Velocity profiles of Newtonian and Non-Newtonian fluids 1.4 Types of flow 1.5 Visco-elasticity, viscous flow and elastic flow
UNIT- II BASICS OF DIE DESIGN	2. a Identify Factors for die design. 2. b Analyze die design factors	2.1 Factors affecting die design 2.2 General die design rules 2.3 Materials for extrusion dies 2.4 Equation for output of Newtonian fluid through tubular cross section 2.5 Land length and its importance in die design 2.6 Die geometry 2.7 Die restriction methods and its effect on melt flow 2.8 Die streamlining methods 2.9 Melt fracture phenomenon 2.10 Die-swell and its effect on extrudate
UNIT – III DIE ADAPTOR, BREAKER PLATE & SCREEN PACK	3.a Understand die adaptor design 3.b Select proper adaptor design 3.c Understand functions of breaker plate and screen packs 3.d Analyze various breaker plate designs 3.e Select proper breaker plate design	Die Adaptor 3.1 Significance of die adaptor 3.2 Position of die adaptor and its fitting methods 3.3 Factors to be considered for adaptor design Screen Pack & Breaker Plate 3.4 Position and functions of screen pack and breaker plate 3.5 Various breaker plate designs 3.6 Factors for correct breaker plate assembly
UNIT – IV TYPES OF EXTRUSION DIES	4.a Understand constructional features of various dies 4.b Analyze various dies according to shape of extrudate 4.b Select proper die	4.1 Types of various extrusion dies with respect to melt flow direction 4.2 Straight through, crosshead, offset dies and its applications Flat and Tubular Film Dies 4.3 Tubular (blown) film dies – side fed & center fed dies 4.4 Constructional features of tubular dies 4.5 Comparison of side fed & centre fed tubular

Unit	Major Learning Outcomes	Topics and Sub-topics
		<p>dies</p> <p>4.6 Constructional features of flat film die</p> <p>4.7 Multilayer film die and its features</p> <p>4.8 Compare feed block and multi-manifold multilayer dies</p> <p>Wire Coating Die</p> <p>4.9 Pressure and tubing die</p> <p>4.10 Constructional features of wire coating die and functions of various components</p> <p>Pipe & Tube Die</p> <p>4.11 Constructional features of tube die</p> <p>4.12 Construction features of straight through and offset pipe die</p> <p>4.13 Significance of internal and external sizing calibrators</p> <p>Sheet Dies</p> <p>4.14 Constructional features of coat hanger sheet die</p> <p>4.15 Fish tail die constructional features and its applications</p> <p>Dies for Solid Sections</p> <p>4.16 Dies for Rod, tape and profiles</p>

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Polymer Melt Rheology	4	2	5	0	07
II	Basics of Die Design	12	4	12	5	21
III	Die Adaptor, Breaker Plate & Screen Pack	8	4	8	2	14
IV	Types of Extrusion Dies	18	4	14	10	28
TOTAL		42	14	39	17	70

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hours
1	IV	Draw assembly drawing of film die.	20
2		Draw detail drawing of film die drawn in first sheet.	16
3		Draw assembly drawing of pipe die.	20
		TOTAL	56

8. SUGGESTED LEARNING RESOURCES**(A) List of Books:**

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Extrusion of Plastics	Fisher	Plastics and Rubber Institute, University of Verginia
2	Extrusion Dies for Plastics and Rubbers	Walter Michaeli	Hanser
3	Dies for Plastics Extrusion	M.V.Joshi	Mcmillan
4	Polymer Extrusion	Chris Rauwendal	Hanser
5	Extruding Plastics	D.V.Rosato	Chapman & Hall

(B) List of Software/Learning Websites:

1. http://www.kostic.niu.edu/extrusion_die_design-echp-1.pdf
2. <https://web.fe.up.pt/~fpinho/pdfs/jmpt1.pdf>
3. <http://rheology.tripod.com/z11.07.pdf>
4. [http://en.wikipedia.org/wiki/Die_forming_\(plastics\)](http://en.wikipedia.org/wiki/Die_forming_(plastics))

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect information about recent trends in extrusion die design.
2. Students will prepare banners showing constructional features of various dies.

3. Students will visit nearby industries and collect information about die design.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

1. **Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.**
2. **Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.**
3. **Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.**
4. **Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.**
5. **Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.**

Coordinator and Faculty Members from NITTTR Bhopal

- 1.
- 2.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
DESIGNING OF PLASTIC PRODUCT
(Code: 3372304)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	7 th Semester

1. RATIONALE

Products made from plastics are used in a variety of applications and in many areas like electrical and electronics, medical, domestic appliances, engineering applications etc. This course will help the students to learn how to design a plastic product by understanding various design considerations, optimum material selection and process selection. It will also help to learn plastic product design with specialized properties and also understand the entire procedure for designing various plastic products by case study.

2. COMPETENCIES

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

- Design various plastic products as per the requirement and area of application.
- Acquire the ability to judge the best material and process, suitable for manufacturing a plastic product.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Learn the factors affecting product design.
2. Understand general product design considerations.
3. Select optimum material suitable for manufacturing the plastic product.
4. Select optimum process suitable for manufacturing the plastic product.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 1: INTRODUCTION TO PRODUCT DESIGN	1.a Understand the concept of product design 1.b Know the factors affecting product design 1.c Know steps in product design	1. Introduction to product design 2. Product design flow chart from concept to fabrication 3. Product Design steps 4. Factors affecting product design
UNIT 2: PRODUCT DESIGN FEATURES	2.a Know preliminary design considerations 2.b Understand general design considerations	1. Check list for product design 2. Preliminary design considerations 2.1 Designing end-use requirements 2.2 Drafting the preliminary design 2.3 Prototyping the design 2.4 Testing the design 2.5 Taking a second look 2.6 Writing meaningful specifications 2.7 Setting up production 2.8 Controlling the quality 3. General design considerations related to- 3.1 Wall thickness 3.2 Fillets and Radii 3.3 Ribs and bosses 3.4 Undercuts 3.5 Taper or draft 3.6 Holes 3.7 External and internal threads 3.8 Inserts 3.9 Parting lines 3.10 Surface treatments 3.11 Molded lettering

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 3: MATERIAL SELECTION CONSIDERATIONS	3.a Understand the concept of material selection 3.b Know the short term and long term properties of plastic materials 3.c Judge the optimum material suitable for manufacturing a product	1. Concept of material selection 1.1 Various plastic materials used for making a product 1.2 Short term and long term properties of plastic materials 1.3 Comparison of properties for various plastic materials and optimization of material
UNIT 4: PROCESS SELECTION	4.a Understand the concept of process selection 4.b Judge the optimum process suitable for manufacturing a product	1. Concept of process selection 1.1 Different plastic processing methods and its features with respect to product design 1.2 Comparison and optimization of process with respect to product shape, size, quantity, quality, cost etc.
UNIT 5: PLASTIC PRODUCT DESIGN- CASE STUDY	5.a Know the procedures for designing various plastic products used in variety of areas	1. Design procedure for plastic products like- 1.1 Pipe – for agricultural and chemical applications 1.2 Disposable cups 1.3 Water Tank 1.4 Products with molded hinges 1.5 O-rings and seals 1.6 Gear 1.7 Bearing 1.8 Contact Lens 1.9 Camera lens 1.10 Wind Mill blade 1.11 Chemical Tank/Chemical reactor 1.12 Food package.....etc

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Product Design	04	04	02	01	07

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
II	Product Design Features	14	10	08	03	21
III	Material Selection Considerations	08	08	04	02	14
IV	Process Selection	08	08	04	02	14
V	Plastic Product Design-Case Study	08	08	04	02	14
Total		42	38	22	10	70

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hours
1	I	Study and list the factors affecting product design	02
2		Study and list the steps in product design	02
3		Study product design flow chart from concept to fabrication	02
4	II	Prepare a checklist for product design	04
5		Study general design considerations related to wall thickness, fillets and radii	04
6		Study general design considerations related to ribs and bosses, undercuts and holes	04
7	III	Tabulate and compare properties of various plastic materials	04
8	IV	Tabulate various types of plastic processing methods with respect to product design	04
9	V	Study the procedure for designing a plastic product- Pipe	02

10		Study the procedure for designing a plastic product- Disposable cups	02
11		Study the procedure for designing a plastic product- Overhead water storage tank	02
12		Study the procedure for designing a plastic product- Chemical Tank	02
13		Study the procedure for designing a plastic product- Contact Lens	02
14		Study the procedure for designing a plastic product- Gears	02
		Total	40

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Product design with plastics	J.B.Dym	Industrial Press Inc. , New York
2	Plastics Product Design Hand Book	Edward Miller	Marcel Dekker , Inc., New York
3	Plastics Engineered Product Design	Dominick V Rosato and Donald V Rosato	Elsevier Advanced Technology, U.K
4	Plastics End Use Applications	Donald V Rosato	Springer (India) Private limited
5	Plastic Materials & Processes	S.S. Schwartz and S. H. Goodman	Van Nostrand Reinhold
6	Hand Book of Plastics a& Elastomers	C. A.Harper	
7	Plastics Product Design Engg. Hand Book	Levy & Dubois	Van Nostrand Reinhold
8	Plastics Product Design	R.D.Back	

(B) List of Software/Learning Websites:

1. <http://www.madehow.com/Volume-2/Contact-Lens.html>
2. <http://www.designboom.com/history/monobloc.html>
3. http://en.wikipedia.org/wiki/Water_tank
4. <http://plastics.dupont.com/plastics/pdflit/americas/general/H76838.pdf>

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect different shaped plastic products and plastic materials made from different materials and analyze the type of processing method and material required for that product.
2. Students will collect information related to product design through internet.
3. Students will visit nearby processing industry.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

1. **Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.**
2. **Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.**
3. **Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.**
4. **Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.**
5. **Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.**

Coordinator and Faculty Members from NITTTR Bhopal

- 1.
- 2.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
RECYCLING OF PLASTIC
(Code: 3372305)

Diploma Programme in which this course is offered	Semester in which offered
Plastics Engineering	7 th Semester

1. RATIONALE

Plastics are being used in practically all areas of consumer products, including construction, transportation, packaging, automobile and agriculture. In recent world more concern is on the possible damaging impact of plastics on the environment. A Plastic Diploma engineer has to identify all possible sources of plastic waste generation and do recycling of it with or without energy recovery within government norms. This competency requires the knowledge of various plastic recycling techniques. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

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

- Identify sources of plastic waste.
- Select suitable plastic recycling method.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Select waste disposal method.
2. Select proper separation method.
3. Identify primary and secondary recycling methods.
4. Analyze various tertiary and quaternary recycling methods.
5. Understand recycling methods of various plastics.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
<p align="center">UNIT – I SOURCES OF PLASTIC WASTE AND ITS MANAGEMENT</p>	<p>1.a Identify sources of plastic waste 1.b Select waste disposal method</p>	<p>1.1 Introduction to Plastics Waste 1.2 Definitions of related terms – Waste Plastic, Industrial Plastic Waste, Postconsumer Plastic Waste, Nuisance Plastic, Scrap Plastic, Primary Recycling, Secondary Recycling, Tertiary Recycling And Quaternary Recycling 1.3 Economic and environmental impact of Plastic Waste 1.4 Sources of waste – postconsumer, municipal and industrial waste 1.5 Management of plastic waste - 4 R (reduction, reuse, recycling and recovery) 1.6 Plastic cycle - flow of plastic products and plastic waste 1.7 Waste disposal a. Landfill of municipal solid waste– open dumping and sanitary landfill b. Plastics in landfill c. Future trends</p>
<p align="center">UNIT- II SEPARATION METHODS</p>	<p>2. a Identify various separation methods. 2. b Select proper separation method.</p>	<p>2.1 Size reduction by mechanical methods 2.2 Separation of plastics using physical properties 2.3 Separation using recycling codes 2.4 Separation processes specific to plastics a. Separation of paper/plastic mixtures- Application of Heat, Wet Separation Process, Electro Dynamic Separation b. Separation of plastic from plastic-coated fabric c. Separation of mixtures of plastics-Float Sink Method, Using Selective Wetting Characteristics, Solvent Separation</p>
<p align="center">UNIT – III PRIMARY & SECONDARY RECYCLING METHODS</p>	<p>3.a Identify primary and secondary recycling methods 3.b Analyze various methods 3.c Select suitable method</p>	<p>Primary Recycling 3.1 Introduction 3.2 Primary recycling methods a. Granulators b. Cryogenic grinding c. Plunger and screw type stuffer d. In-line recycling</p>

Unit	Major Learning Outcomes	Topics and Sub-topics
		Secondary Recycling 3.3 Introduction to secondary recycling 3.4 Various technical approaches for secondary recycling 3.5 Secondary recycling by mechanical reworking of plastic waste 3.6 Recycling by chemical modification of plastic waste 3.7 Secondary recycling by co-extrusion and co-injection molding 3.8 Use of plastic as a filler
UNIT – IV TERTIARY AND QUATERNARY RECYCLING	4.a Identify tertiary and quaternary recycling methods. 4.b Select proper method	Tertiary Recycling 4.1 Pyrolysis <ol style="list-style-type: none"> Introduction to pyrolysis and its advantages Introduction to pyrolysis reactors of plastics waste – Union Carbide System, Reactor by Japan Steel Works 4.2 Chemical decomposition of plastic waste <ol style="list-style-type: none"> Hydrolysis Glycolysis Quaternary Recycling 4.3 Introduction to quaternary recycling 4.4 Constructional features of incinerators 4.5 Incineration of plastic waste and its problems
UNIT – V RECYCLING METHODS OF SPECIFIC PLASTICS	5.a Understand recycling methods of various plastics.	5.1 Describe recycling methods of following plastics : <ol style="list-style-type: none"> PVC PET PMMA HDPE LDPE PS

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Sources of Plastic Waste and its Management	9	4	8	2	14
II	Separation Methods	8	4	8	2	14
III	Primary & Secondary Recycling Methods	9	3	11	0	14
IV	Tertiary And Quaternary Recycling	8	4	10	0	14
V	Recycling Methods of Specific Plastics	8	4	10	0	14
TOTAL		42	19	47	4	70

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hours
1	I	To study various sources of plastic waste.	2
2		To study waste disposal methods.	2
3	II	To perform plastic waste size reduction by mechanical method.	2
4		To carry out separation of plastics using float-sink method.	2
5		To study various separation methods of paper/plastic mixtures.	2
6	III	To perform primary recycling of plastic using granulators.	2
7		To study recycling by chemical modification of plastic waste.	2
8		To study secondary recycling by co-extrusion and co-injection molding.	2
9	IV	To study various pyrolysis reactors.	2
10		To study quaternary recycling methods.	2

11	V	To carry out depolymerisation of PMMA for recovery of monomer.	2
12		To study recycling methods of PET	2
13		To study recycling methods of PVC.	2
14		To study recycling methods of HDPE.	2
		TOTAL	28

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Plastic Waste	Jacob Leidner	Marcel Dekker
2	Feedstock Recycling of Plastic Waste	Jose Aguado & David Serrano	Royal Society of Chemistry
3	Mixed Plastic Recycling Technology	Bruce Hegberg, Gary Brenniman W.H.Hallenback	Noyes Data Corporation
4	Plastics Technology Handbook	Donald Hudgin	Taylor & Francis
5	Recycling of Plastic Materials	La Mantia	Chemtec Publishing
6	Modern Plastics Handbook	Harper	McGraw-Hill

(B) List of Software/Learning Websites:

1. <http://nzic.org.nz/ChemProcesses/environment/14E.pdf>
2. <http://www.g.eng.cam.ac.uk/impee/topics/RecyclePlastics/files/Recycling%20Plastic%20v3%20PDF.pdf>
3. <http://plasticisrubbish.com/2013/03/20/recycling-plastic-2>
4. <https://web.anl.gov/PCS/acsfuel/preprint%20archive/Files/Volumes/Vol42-4.pdf>

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect different plastic products with recycling codes.
2. Students will prepare identification chart with recycling codes.
3. Students will prepare flow chart of plastic cycle.
4. Students will visit nearby industries and collect information about recycling process.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

1. **Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.**
2. **Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.**
3. **Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.**
4. **Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.**
5. **Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.**

Coordinator and Faculty Members from NITTTR Bhopal

- 1.
- 2.

GUJARAT TECHNOLOGICAL UNIVERSITY**COURSE CURRICULUM****COURSE TITLE: INDUSTRIAL TRAINING-II
(COURSE CODE: 3382301)**

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	8 th Semester

1. RATIONALE

The diploma engineers are required to work in industry related to plastic processing, machine manufacturing, plastic raw material manufacturing, mold and die making, testing, recycling, designing etc. This course has been designed to fulfill need of industrial exposure, where they get an experience of industrial environment.

2. LIST OF COMPETENCIES

The course is designed and implemented with the aim to develop different types of skills leading to achieve following competencies:

Perform many activities/skills and get information pertaining to plastic industry in areas of process, processing equipments, materials, testing and instruments.

3. COURSE OUTCOMES

- Get experience of real life working environment.
- Gain practical knowledge, new skills and be aware of current technologies.
- Provide opportunities to students to be as prospective employees.
- Analyze problems and find/suggest possible solutions.
- Present a project report both in oral and written form based on work experiences.

4. TEACHING AND EXAMINATION SCHEME

Course Code	Course Title	Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
		L	T	P		Theory Marks		Practical Marks		
					C	ESE	PA	ESE	PA	
3382301	INDUSTRIAL TRAINING-II	0	0	0	30	00	00	300	500	800
Total		0	0	0	30	00	00	300	500	

Legends:

L-Lecture; **T**-Tutorial; **P**-Practical; **ESE** – End Semester Exam., **PA**-Progressive Assessment,

5. EVALUATION PATTERN

Evaluation for PA by the Internal examiner: - Evaluation of 500 marks for PA will be done by the internal examiner at institute level, mainly based on weekly diary, follow up report, progress report and final training report as follows:

INDUSTRIAL TRAINING 20 - 20
DEPARTMENT: - PLASTIC ENGINEERING
NAME OF STUDENT:-
SEMESTER: - 8
ENROLLMENT NUMBER:-
NAME OF INDUSTRY:-
ADDRESS:-

JOINING REPORT
FROM: (Name of company).....
TO, PRINCIPAL (Name of institute)
Subject: - Joining report for industrial training of 8 th semester As per your letter no. :- _____ dated _____. I have reported for training at _____ on _____. The weekly off day of the industry is _____.
Thanking you.
Yours' faithfully (.....)
Signature and Stamp of Training Officer (To be send immediately after joining the industry)

DETAIL OF THE INDUSTRY

- 1. NAME OF INDUSTRY:-
- 2. ADDRESS:-
- 3. PERIOD OF TRAINING:-
- 4. NAME OF TRAINING OFFICER AND DESIGNATION:-
- 5. WEEKLY OFF DAY:-

WEEKLY REPORT

PERIOD: - _____ to _____ = DAYS
OFF DAYS:- _____ =..... DAYS
LEAVE ENJOYED ON:- _____ =..... DAYS
TOTAL DAYS ATANDED _____ =..... DAYS
DETAILS OF WORKING:-

SIGNATURE
(TRAINING OFFICER)

SIGNATURE
(STUDENT)

MONTHLY REPORT

PERIOD: - FROM / /201 TO //201 =_____DAYS

OFF DAYS: -..... =_____DAYS

LEAVE ENJOYED ON..... =_____DAYS

TOTAL DAYS ATANDED..... =_____DAYS

EVALUATION:-

SR No.	PARTICULARS	EVALUTION BY	
		TRAINNG OFFICER (INDUSTRY)	FACULTY (INSTITUTE)
1	Punctuality		
2	Participation in work allotted		
3	Practical level attained		
4	Industrial relationship		
5	Project write - up preparation		

Any other remarks: -

SIGNATURE
(FACULTY)

PROGRESS REPORT

(Name of Institute)
 PLASTIC ENGINEERING DEPARTMENT

Name of Student :

Enrolment No. :

Name of Industry :

Address of Industry :

Comments :

1. Type of the Industry

Production

Machine Manufacturing

2. Production of :

3. Regularity of student during training

Average

Good

Excellent

4. Stipend paid per month Rs. _____

5. Industry's opinion regarding trainee

Average

Good

Excellent

Remarks :

Sign:

Training In-charge

Name of faculty:

(Industry)

Final Training Report:**FORMAT OF INDUSTRIAL TRAINING REPORT**

- Title page
- Certificate
- Preface
- Acknowledgement
- Index
- Introduction of industry
- Industry lay out
- Hierarchy of industry/organization chart
- Products
- Raw materials
- Types of major equipments/instruments/machines used in industry with their specification, approximate cost and specific use
- Manufacturing/production process
- Faults and remedies
- Maintenance
- Safety features
- My liking & disliking of work places
- References
- Bibliography

Evaluation for ESE by the External examiner: - Evaluation of 300 marks for ESE will be done by the external examiner on following criteria –

1. Knowledge gained-

- Products
- Raw materials
- Types of major equipments/instruments/machines used in industry with their specification, approximate cost and specific use
- Manufacturing/production process
- Faults and remedies
- Maintenance
- Safety features
- Planning

2. Skills learned-

- Process parameter setting of various plastics machineries
- Troubleshooting
- Safety precautions

3. Incidents/ cases from Experiences-

The students should record classic cases for learning for others, such as

- Tricky problems and their solutions
- Typical fault diagnosis and their solutions
- Tricky symptoms and their solutions
- Part modifications
- System modifications
- Cost reduction cases
- Quality improvement
- Improvement Method

6. SUGGESTED WORK LOAD

- As per the Board of Apprenticeship, faculty of the parent institute has to visit industry at least once in a month for evaluating student's activity and their progress.
- The number of industry which provides training and number of students are varying every year. In this consequence and considering role of faculty in training, workload is allotted to faculty for industrial visit.
- Work load allotted to faculty per batch of 15 students is 30 Hrs / week. Institute has to prepare time table of the staff in such a manner that one faculty must be remain free for one whole day for industrial visit/counseling of the trainee. Trainee should be distributed equally among the faculty involved and the faculty will be considered guide/counselor for those students. Progressive assessment will be carried out by that guide/counselor.

7. GUIDELINES FOR SANDWICH APPRENTICESHIP INDUSTRIAL TRAINING-II

- **Duration of the training:** Six months. It should start within one week from the date of completion of GTU examination of the semester VII.
- **Eligibility:** Student will be allowed for training subject to GTU eligibility criteria for particular semester.
- **Apprenticeship Board:** The training will be covered under the Apprenticeship Act 1973 and as per current rule; the trainee will be eligible for a stipend of Rs. 2890/- per month out of which 50% will be paid by the employer and 50% will be reimbursed by Board of Apprentice Training (BOAT), Western Region, Mumbai. Stipend will be revised periodically by Board of Apprentice.
- **Training Area :** Students can be trained in Plastic Processing, Machine Manufacturing, Raw Material Manufacturing, Mould/die making, Testing, Recycling and Designing industries. Students should be sent to industry strictly based on merit.

A. ROLE OF DEPARTMENT

- Department has to send training request letter to various industries well in advance before commencement of training.
- After getting sufficient number of seats from the industries, students will be placed in different industries for their 8th semester training.
- Students will have to fill up training contract form (uploaded on B.O.A.T. web site) in three copies with photographs sealed and signed by the authorities.
- Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
- During the training period, the head of the department will maintain a schedule for follow –up of industrial training and according to it send the faculty to various industries.
- The faculty will check the progress of the student in the training, attendance; discipline and project report preparation and also give necessary guidance to students.
- The department has to prepare Progress Report of the trainee for the industrial training.
- At the end of the training, concerned faculty will do assessment of the work done by trainee.

B. ROLE OF INDUSTRY

- Industry will give effective training to the students for improving their practical skills.
- Industry may provide training in-charge for the group of the students under training.
- Training in-charge has to evaluate each student every week and signed weekly diary with appropriate remarks.
- Industry may allot project to individual or group of students under training and students has to prepare report on the same project.
- Training in-charge has to guide students for preparing their project report.
- Industry has to maintain attendance for the student under training and report for any irregularity of the students to their parent institute.

C. GUIDE LINE FOR STUDENTS

- Students have to fill the contract forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry.
- During the training period students will keep record of all the useful information and maintain the weekly diary.
- He/she will prepare a detailed training report about the whole process and will submit it to the department at the time of examination.

8. SUGGESTED LEARNING RESOURCES

- Students may visit websites as their learning tool during industrial visit.
- Source of learning websites are already given during previous semesters.
- Search videos, animations for preparation of training report during the training period.

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Smt. S. R. Shah**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad