GOVERNMENT POLYTECHNIC
NASHIK

(AN ACADEMICALLY AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)

CURRICULUM - 2016

DIPLOMA PROGRAMME
IN
PLASTIC ENGINEERING

INDEX

Sr. No.	Content			Page No.
1	Preface			i
2	**Government Polytechnic Nashik**			iii
2.1	Vision			iii
2.2	Mission			iii
3	**Plastic Engineering Department**			iii
3.1	Vision			iii
3.2	Mission			iii
4	Job Profile of Plastic Engineer.			iv
5	Rationale			v
6	Programme Educational Objectives			v
7	Programme Outcomes			v
8	Programme Specific Outcomes			vi
9	Mapping of Mission and Programme Educational Objectives			vii
10	Mapping of Programme Educational Objectives and Programme Outcomes			vii
11	Mapping of Programme Specific Outcomes and Programme Outcomes			vii
12	Mapping of Programme Outcome and Courses			viii
13	Programme Structure			1-6
14	Courses For Award of Class			7
15	Sample Path Entry Level 10+			8
	Course Contents of			
16	**Level -1: Foundation Courses**			**9-52**
	Course Code		**Course Name**	
16.1	6101	CMS	Communication Skills	9
16.2	6102	DLS	Development of Life Skills	14
16.3	6103	BMT	Basic Mathematics	18
16.4	6104	EMT	Engineering Mathematics	22
16.5	6105	PHY	Applied Physics	26
16.6	6106	CHY	Applied Chemistry	34
16.7	6108	EMH	Engineering Mechanics	40
16.8	6109	WSP	Workshop Practice	45
17	**Level -2: Basic Technology Courses**			**53-100**
	Course Code		**Course Name**	
17.1	6201	CAG	Computer Aided Graphics	53
17.2	6212	EDG	Engineering Drawing	58

Sr. No.	Content			Page No.
17.3	6213	SOM	Strength of Material	61
17.4	6220	ELT	Electrical Technology	66
17.5	6221	POE	Principles of Electronics	71
17.6	6222	FHT	Fluid Flow and Heat Transfer	76
17.7	6223	PCH	Polymer Chemistry	80
17.8	6224	FCE	Fundamentals of Chemical Engineering	84
17.9	6225	PLM	Plastic Materials	88
17.10	6226	OCH	Organic Chemistry	92
17.11	6227	APP	Advanced Polymers and Product Design	97
18	**Level -3: Allied Courses**			**101-136**
	Course Code		**Course Name**	
18.1	6301	AMT	Applied Mathematics	101
18.2	6302	EVS	Environmental Studies	105
18.3	6303	IOM	Industrial Organization and Management	109
18.4	6305	SSL	Supervisory Skills	114
18.5	6306	MKM	Marketing Management	118
18.6	6307	MMT	Material Management	122
18.7	6309	EDP	Entrepreneurship Development	126
18.8	6310	RES	Renewable Energy Sources	130
18.9	6313	SDM	Solid Modeling	134
19	**Level -4: Applied Technology Courses**			**137-176**
	Course Code		**Course Name**	
19.1	6410	PPR	Professional Practices	137
19.2	6411	SEM	Seminar	141
19.3	6412	PRO	Project	144
19.4	6419	CAB	Composites and Blends	148
19.5	6420	EST	Elastomer Technology	152
19.6	6421	MDP	Moulds and Dies for Plastics	156
19.7	6422	AFP	Additives for Plastics	160
19.8	6423	PMT	Plastics Moulding Techniques	164
19.9	6424	PPT	Plastics Processing Techniques	169
19.10	6425	TOP	Testing of Plastics	173
20	**Level -5: Diversified Courses**			**177-206**
	Course Code		**Course Name**	
20.1	6521	MMF	Mould Manufacturing	177
20.2	6522	MPM	Maintenance of Plastics Processing Machines	181
20.3	6523	FTY	Fibre Technology	184
20.4	6524	TYT	Tyre Technology	188
20.5	6525	PWM	Plastics Waste Management	191

Sr. No.	Content			Page No.
20.6	6526	PPG	Plastics Packaging	195
20.7	6527	ADH	Adhesives	199
20.8	6528	PLP	Plastic Paints	203
21	**Annexures**			**207-216**
I	Rules for Registration and Examination			207
II	Evaluation Scheme for project			209
III	Committees			210
III.1	Governing Body (GB)			210
III.2	Board of Studies (BOS)			211
III.3	Programme Wise Committee (PWC)			213
III.4	Programme Curriculum Development Committee			214
	- Institute Level Curriculum Development Cell			214
	- Department Level Committee			214
	- NITTTR Committee			214
	- Contributors to Course Curriculum Development			215

PREFACE

Government Polytechnic, Nashik is established in 1980. The institute has been conferred an academically autonomous status in 1995 by Government of Maharashtra because of excellent performance.

The vision of the institute is to be a premier technical training and development institute catering to the skill and professional development in multi-domain for successful employment / self-employment by offering certified and accredited NSQF compliant programmes. The institute shall be the center for excellence in skill development and community development through different training programmes, business incubation and entrepreneurship development. For this the institute is committed to provide education for skill development, engineering diploma and continuing education programmes for enhancement of employability skills of the aspirants in the job/self-employment through continually developing quality learning systems. The institute aims at holistic and student centric education in collaboration with business, industry and having practice based education. To achieve this continuous efforts are made to design the curriculum considering the latest development in the industrial sector and technology.

The three year Diploma Programme in Plastic Engineering is being offered since 1994 under MSBTE. After academic autonomy, first curriculum was implemented in 1995 and subsequently it was revised and implemented in 2001, 2007 and 2011. The curriculum revision is a regular activity and outcome based education approach is adopted for designing the curriculum. The revised outcome based curriculum is designated as "Curriculum 2016". The implementation of Curriculum 2016 will be effective from the academic year 2016- 17.

For designing the curriculum, the various domains have been identified. For Plastic Engineering Programme these domains are Polymer Synthesis, Plastics Processing, Elastomers, Composites and Blends, Mould and Die Design, Testing and Waste Management. The questionnaire has been designed to get the responses from these domain areas from different stake holders i.e. industries, teachers and students. The feedback from different stake holders has been analysed and roles, functions, activities, tasks and attitudes necessary for Diploma Plastic Engineer have been identified. The programme structure is finalised and the content detailing of individual course has been carried out by group of experts, and approved by Programme Wise Committee (PWC), Board of Studies (BOS) and Governing Body (GB).

In this Curriculum-2016, the student has to acquire 200 credits for successful completion of Diploma Programme. The courses of curriculum are structured at different 5 levels i.e. Foundation Courses, Basic Technology Courses, Allied Courses, Applied Technology Courses and Diversified Courses.

The minimum entry level is 10^{th}. However, the curriculum provides "Multi Point Entry and Credit system (MPEC)" for the students opting admission after passing 12^{th}, ITI, MCVC. At higher entry level, the students will get exemptions in certain courses as per the rules.

There is flexibility for opting the courses as per the choice of students. The curriculum provides "Sample Path" as a guide line for selection of courses in each term for entry level as 10^{th}. The List of Courses for Award of Class after completion of Diploma Programme is prescribed separately in this curriculum.

The fulfilment of programme outcome as stated in the Curriculum-2016 will depend on its effective implementation. The teachers who are implementing the curriculum were also involved in the design process of curriculum, hence, I hope that the Curriculum-2016 will be implemented in effective way and the pass outs will acquire the requisite knowledge and skills to satisfy the needs of industry and society.

(Prof. DNYANDEO PUNDALIKRAO NATHE)
Principal
Government Polytechnic, Nashik

GOVERNMENT POLYTECHNIC NASHIK

VISION

To be a premier technical training and development institute catering to the skill and professional development in multi-domain for successful employment/self-employment by offering certified and accredited NSQF compliant programmes. The institute shall be the center for excellence in skill development and community development through different training programmes, business incubation and entrepreneurship development.

MISSION

The Government Polytechnic Nashik, an autonomous institute of Government of Maharashtra has the mission to provide education for skill development, engineering diploma and continuing education programmes for enhancement of employability skills of the aspirants in the job/self-employment through continually developing quality learning systems. The institute aims at holistic and student centric education in collaboration with business, industry and having practice based education.

PLASTIC ENGINEERING DEPARTMENT

VISION

To develop a centre for excellence in the field of plastic engineering for the development of need based manpower for business and industry. The department shall have training and development activities in collaboration with industry to address the emerging technology domain in the field of plastic engineering.

MISSION

Department of Plastics Engineering is committed,

M1. To develop employable Diploma Plastic Technicians.
M2. To create problem based learning environment for achieving academic excellence.
M3. To inculcate ethical values, entrepreneurial, environmental concern and life learning skills for sustainable development of plastics and allied industries.
M4. To provide quality learning systems through development of academic processes, projects, consultancy and industry collaboration.

JOB PROFILE OF PLASTIC ENGINEERING ENGINEER

A Diploma Technician in Plastic Engineering has to carry out various activities in various areas during implementation of his/her engineering knowledge.

Plastic Engineering job opportunities are available in following domains:

a. Polymer Synthesis
b. Plastics Processing
c. Mould and Product Design
d. Testing and Quality Control

In above domain areas Diploma Technician in Plastic Engineering has to perform following duties,

1. Supervisor at Shop floor (Processing / Tool Manufacturing)
2. Inspection and Quality Control
3. Sales, Purchase and Marketing
4. Machine and Mould Maintenance
5. Material and Production Planning
6. Entrepreneur
7. Labour Management
8. Writing Production Report
9. Mould and Product design

DIPLOMA PROGRAMME IN PLASTIC ENGINEERING

RATIONALE

We are living in the era of plastics, now this material becomes as an essential need for society and industry. Today plastic materials and related products have been used in many domestic, industrial, automotive and medical applications all over the globe. Industry requires the skilled manpower to cope up with the recent trends and to retain their status in globalization. Therefore it is essential to develop the technically skilled manpower in the field of Plastic Engineering.

This Programme offers courses to acquire supervisory skills and knowledge in basic, allied, applied and diversified fields of Plastic Engineering. This programme intends to develop skills in Plastic Engineering Technicians to solve the problems related to Plastic Engineering.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To provide the plastic engineering technicians for meeting the current and future demands of technical manpower in plastics industry/self-employment.
II. To build the fundamental knowledge in mathematical, scientific and engineering fundamentals required to formulate, analyze and solve plastic engineering and related problems.
III. To enable plastic engineering diploma technicians to undertake design, development, production, managerial and entrepreneurial activities in the fields of plastics engineering.
IV. To inculcate ethical practices, leadership skills, innovation, integrity, life-long learning skills and sensitivity to the needs of the society.

PROGRAMME OUTCOMES (POs)

After successful completion of Diploma Programme in Plastic Engineering, the passouts will be able to,

a. **Basic knowledge:** Apply knowledge of basic mathematics, science and engineering to solve the Plastic Engineering problems.

b. **Discipline knowledge:** Apply subject specific knowledge to solve core and applied Plastic Engineering problems.

c. **Experiments and practice:** Plan and perform experiments to use results to solve Plastic Engineering problems.

d. **Engineering Tools:** Apply appropriate technologies and tools in the field of Plastic Engineering with an understanding of the limitations.

e. **The engineer and society:** Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Plastic Engineering practices.

f. **Environment and sustainability:** Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

g. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Plastic Engineering practices.

h. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

i. **Communication:** An ability to communicate effectively with society and engineering community.

j. **Project Management and Finance:** Understand engineering and management principles and apply these to manage projects in multidisciplinary environment.

k. **Life-long learning**: Recognize the need and be adaptable for independent and life-long learning in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On successful completion of Diploma Programme in Plastic Engineering, the student will be able to,

PSO 1. Synthesize, characterize and select the polymer materials.
PSO 2. Manufacture plastics products using suitable processing technique and suggest appropriate recycling method.
PSO 3. Assess the quality of plastics products and design mould.

MAPPING OF MISSION AND PROGRAMME EDUCATIONAL OBJECTIVES

Sr. No.	Mission	Component of Mission Statement	PEO/s
1	M1	To develop employable Diploma Plastic Technicians.	I, II and V
2	M2	To create problem based learning environment for achieving academic excellence.	II, III, IV and V
3	M3	To inculcate ethical values, entrepreneurial, environmental concern and life learning skills for sustainable development of plastics and allied industries.	II, III, IV and V
4	M4	To provide quality learning systems through development of academic processes, projects, consultancy and industry collaboration.	I, II, III, IV and V

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOMES

Sr. No.	Programme Educational Objectives (PEOs)	Programme Outcomes (POs)
1	I. To provide the plastic engineering technicians for meeting the current and future demands of technical manpower in plastics industry/self-employment.	a, b, c, d, f, g, h, i, k
2	II. To build the fundamental knowledge in mathematical, scientific and engineering fundamentals required to formulate, analyze and solve plastic engineering and related problems.	a, b, c, d, e, h
3	III. To enable plastic engineering diploma technicians to undertake design, development, production, managerial and entrepreneurial activities in the fields of plastics engineering.	a, b, c, d, f, g, h, j, k
4	IV. To inculcate ethical practices, leadership skills, innovation, integrity, life-long learning skills and sensitivity to the needs of the society.	b, c, e, g, h, i, j

MAPPING OF PROGRAMME SPECIFIC OUTCOMES AND PROGRAMME OUTCOMES

Sr. No.	Programme Specific Outcomes (PEOs)	Programme Outcomes (POs)
1	I. Synthesize, characterize and select the polymer materials.	a, b, c, e, f, k.
2	II. Manufacture plastics products using suitable processing technique and suggest appropriate recycling method.	b, c, d, e, f, h, i, j, k.
3	III. Assess the quality of plastics products and design mould.	b, c, d, g, h, i, j, k.

MAPPING OF PROGRAMME OUTCOMES AND COURSES

Sr. No.	Programme Outcomes (POs)	Courses
a	**Basic knowledge:** Apply knowledge of basic mathematics, science and engineering to solve the Plastics Engineering problems.	Basic Mathematics Engineering Mathematics Applied Chemistry Applied Physics Engineering Mechanics Fundamentals of Chemical Engineering Organic Chemistry Applied Mathematics Strength of Material Communication Skills Computer Aided Graphics Development of Life Skills Mould Manufacturing Plastics Paints Environmental Studies
b	**Discipline knowledge:** Apply subject specific knowledge to solve core and applied Plastics Engineering problems.	Polymer Chemistry Plastics Materials Advanced Polymers and Product Design Composites and Blends Elastomer Technology Moulds and Dies for Plastics Additives for Plastics Plastics Moulding Techniques Plastics Processing Techniques Testing of Plastics Mould Manufacturing Maintenance of Plastics Processing Machines Fibre Technology Tyre Technology Plastics Waste Management Adhesives Plastic Paints Organic Chemistry Fundamentals of Chemical Engineering Engineering Mechanics Professional Practices Computer Aided Graphics Strength of Material Development of Life Skills Applied Physics Applied Chemistry Supervisory Skills Electrical Technology Principles of Electronics Environmental Studies Material Management Solid Modelling

Sr. No.	Programme Outcomes (POs)	Courses
c	**Experiments and practice:** Plan and perform experiments to use results to solve Plastics Engineering problems.	Workshop Practice Computer Aided Graphics Electrical Technology Plastics Materials Advanced Polymers and Product Design Composites and Blends Additives for Plastics Plastics Moulding Techniques Plastics Processing Techniques Testing of Plastics Mould Manufacturing Plastics Waste Management Basic Mathematics Engineering Mathematics Applied Physics Organic Chemistry Moulds and Dies for Plastics Elastomer Technology Testing of Plastics Fibre Technology Tyre Technology Adhesives Plastics Paints Fundamentals of Chemical Engineering Applied Mathematics Applied Chemistry Polymer Chemistry Supervisory Skills Renewable Energy Sources Solid Modelling Maintenance of Plastics Processing Machines
d	**Engineering Tools:** Apply appropriate technologies and tools in the field of Plastics Engineering with an understanding of the limitations.	Workshop Practice Computer Aided Graphics Polymer Chemistry Solid Modeling Plastics Moulding Techniques Plastics Processing Techniques Testing of Plastics Mould Manufacturing Maintenance of Plastics Processing Machines Plastics Waste Management Fundamentals of Chemical Engineering Engineering Drawing Applied Chemistry Composites and Blends Elastomer Technology Metrology and Quality Control Hydraulics and Pneumatics Additives for Plastics Testing of Plastics Fibre Technology

Sr. No.	Programme Outcomes (POs)	Courses
		Adhesives Plastics Paints Applied Physics Fundamentals of Chemical Engineering Supervisory Skills Organic Chemistry Material Management
e	**The engineer and society:** Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Plastics Engineering practices.	Plastics Waste Management Professional Practices Applied Physics Applied Chemistry Computer Aided Graphics Plastic Paints Additives for Plastics Moulds and Dies for Plastics Entrepreneurship Development Development of Life Skills Environmental Studies
f	**Environment and sustainability:** Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.	Environmental Studies Renewable Energy Sources Plastics Waste Management Plastic Paints Additives for Plastics Entrepreneurship Development
g	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Plastics Engineering practices.	Development of Life Skills Supervisory Skills Marketing Management Entrepreneurship Development Professional Practices Project Plastics Packaging Testing of Plastics
h	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.	Development of Life Skills Marketing Management Material Management Entrepreneurship Development Professional Practices Seminar Project Plastics Waste Management Applied Physics Plastics Processing Techniques Testing of Plastics Polymer Chemistry Organic Chemistry Plastics Moulding Techniques Fundamentals of Chemical Engineering Additives for Plastics Solid Modelling

Sr. No.	Programme Outcomes (POs)	Courses
		Maintenance of Plastics Processing Machines
i	**Communication:** An ability to communicate effectively with society and engineering community.	Development of Life Skills Communication Skills Marketing Management Supervisory Skills Entrepreneurship Development Fibre Technology Applied Physics Fluid Flow and Heat Transfer Testing of Plastics Plastics Moulding Techniques Fundamentals of Chemical Engineering Material Management
j	**Project Management and Finance:** Understand engineering and management principles and apply these to manage projects in multidisciplinary environment.	Advanced Polymers and Product Design Material Management Entrepreneurship Development Mould Manufacturing Project Marketing Management Plastics Paint Seminar Moulds and Dies for Plastics Additives for Plastics Plastics Waste Management
k	**Life-long learning:** Recognize the need and be adaptable for independent and life-long learning in the context of technological changes.	Development of Life Skills Professional Practices Seminar Communication Skills Computer Aided Graphics Entrepreneurship Development Supervisory Skills Elastomer Technology Plastics Waste Management Basic Mathematics Engineering Mathematics Applied Chemistry Fluid Flow and Heat Transfer Fundamentals of Chemical Engineering Organic Chemistry Applied Mathematics Additives for Plastics Plastics Processing Techniques Testing of Plastics Material Management Environmental Studies

DIPLOMA PROGRAMME IN PLASTIC ENGINEERING
CURRICULUM STRUCTURE
SCHEME AT A GLANCE

Level	Name Of Level	Total Number Of Courses Offered	Number of Courses to be completed	TH	TU	PR	Credits	Marks
Level-1	Foundation Courses	08	08 Compulsory	22	02	16	40	900
Level-2	Basic Technology	11	11 Compulsory	35	--	30	65	1500
Level-3	Allied Courses	09	05 (03 Compulsory + 02 Electives)	10	--	04	14	450
Level-4	Applied Technology	10	10 Compulsory	28	--	38	66	1250
Level-5	Diversified Technology	08	04 (02 Compulsory + 02 Electives)	07	--	08	15	400
TOTAL		**46**	**34 Compulsory + 04 Electives -- 38 Courses**	**102**	**02**	**96**	**200**	**4500**

Abbreviation:
TH-Theory, TU-Tutorial, PR-Practical

PROGRAMME:-DIPLOMA IN PLASTIC ENGINEERING
PROGRAMME STRUCTURE
LEVEL-1
FOUNDATION COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6101	Communication Skills	CMS	03	--	02	05	03	80	20	--	--	50	150
02	6102	Development of Life Skills	DLS	01	--	02	03	--	--	--	--	--	50	50
03	6103	Basic Mathematics	BMT	03	01	--	04	03	80	20	--	--	--	100
04	6104	Engineering Mathematics	EMT	03	01	--	04	03	80	20	--	--	--	100
05	6105	Applied Physics	PHY	04	--	02	06	02#	80#	20#	--	--	50	150
06	6106	Applied Chemistry	CHY	04	--	02	06	02#	80#	20#	--	--	50	150
07	6108	Engineering Mechanics	EMH	04	--	02	06	03	80	20	--	--	50	150
08	6109	Workshop Practice	WSP	--	--	06	06	--	--	--	--	--	50	50
TOTAL			--	**22**	**02**	**16**	**40**	--	**480**	**120**	**--**	**--**	**300**	**900**

Level: 1

Total Courses : 08
Total Credits : 40
Total Marks : 900

Abbreviations :

Abbr : Course Abbreviation, TH: Theory, TU: Tutorial, PR: Practical, OR: Oral, TW: Term Work

Course Code Indication :

Example : 6101
First digit : 6 : Indicates last digit of Year of Implementation of Curriculum
Second digit : 1 : Indicates Level
Third and Fourth digit : 01 : Indicates Course Number

Assessment of PR/OR/TW :

1) All Orals are to be assessed by external and internal examiner.
2) * Indicates TW to be assessed by external and internal examiner.
3) Other TW are to be assessed by internal examiner only.
4) # indicates online examination

PROGRAMME:-DIPLOMA IN PLASTIC ENGINEERING

PROGRAMME STRUCTURE

LEVEL-2

BASIC TECHNOLOGY

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6201	Computer Aided Graphics	CAG	--	--	04	04	--	--	--	--	--	50	50
02	6212	Engineering Drawing	EDG	02	--	04	06	04	80	20	--	--	25	125
03	6213	Strength of Material	SOM	04	--	02	06	03	80	20	--	--	25	125
04	6220	Electrical Technology	ELT	03	--	02	05	03	80	20	--	---	25	125
05	6221	Principles of Electronics	POE	03	--	02	05	03	80	20	--	---	25	125
06	6222	Fluid Flow and Heat Transfer	FHT	04	--	02	06	03	80	20	--	--	50	150
07	6223	Polymer Chemistry	PCH	04	--	04	08	03	80	20	--	25	50	175
08	6224	Fundamentals of Chemical Engineering	FCE	04	--	02	06	03	80	20	--	--	50	150
09	6225	Plastic Materials	PLM	04	--	04	08	03	80	20	--	25	50	175
10	6226	Organic Chemistry	OCH	04	--	02	06	03	80	20	25	--	25	150
11	6227	Advanced Polymers and Product Design	APP	03	--	02	05	03	80	20	--	--	50	150
TOTAL			--	**35**	**--**	**30**	**65**	--	**800**	**200**	**25**	**50**	**425**	**1500**

Level: 2

Total Courses : 11
Total Credits : 65
Total Marks : 1500

Assessment of PR/OR/TW :

1) All Orals are to be assessed by external and internal examiner.
2) * Indicates TW to be assessed by external and internal examiner.
3) Other TW are to be assessed by internal examiner only.

PROGRAMME: DIPLOMA IN PLASTIC ENGINEERING
PROGRAMME STRUCTURE
LEVEL-3
ALLIED COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
All compulsory														
01	6301	Applied Mathematics	AMT	03	--	--	03	03	80	20	--	--	--	100
02	6302	Environmental Studies	EVS	--	--	02	02	--	--	--	--	--	50	50
03	6303	Industrial Organization and Management	IOM	03	--	--	03	03	80	20	--	--	--	100
Any **ONE** from **Elective-I**														
04	6305	Supervisory Skills	SSL	03	--	--	03	03	80	20	--	--	--	100
	6306	Marketing Management	MKM	03	--	--	03	03	80	20	--	--	--	100
	6307	Material Management	MMT	03	--	--	03	03	80	20	--	--	--	100
Any **ONE** from **Elective-II**														
05	6309	Entrepreneurship Development	EDP	01	--	02	03	--	---	--	--	--	50	50
	6310	Renewable Energy Sources	RES	01	--	02	03	--	--	--	--	--	50	50
	6313	Solid Modeling	SDM	01	--	02	03	--	--	--	--	--	50	50
TOTAL			--	**10**	**--**	**04**	**14**	--	**240**	**60**	--	--	**100**	**450**

Level: 3

Total Courses : 05
Total Credits : 14
Total Marks : 450

Assessment of PR/OR/TW :

1) All Orals are to be assessed by external and internal examiner.
2) ***** Indicates TW to be assessed by external and internal examiner.
3) Other TW are to be assessed by internal examiner only.

PROGRAMME:-DIPLOMA IN PLASTIC ENGINEERING
PROGRAMME STRUCTURE
LEVEL-4
APPLIED TECHNOLOGY COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6410	Professional Practices	PPR	---	--	04	04	--	--	--	--	--	50	50
02	6411	Seminar	SEM	--	--	02	02	--	--		--	--	50	50
03	6412	Project	PRO	--	--	04	04	--	--		--	50	50*	100
04	6419	Composites and Blends	CAB	04	--	04	08	03	80	20	--	25	25	150
05	6420	Elastomer Technology	EST	04	--	04	08	03	80	20	--	25	25	150
06	6421	Moulds and Dies for Plastics	MDP	04	--	04	08	04	80	20	--	25	25	150
07	6422	Additives for Plastics	AFP	04	--	04	08	03	80	20	--	25	25	150
08	6423	Plastics Moulding Techniques	PMT	04	--	04	08	03	80	20	--	25	25	150
09	6424	Plastics Processing Techniques	PPT	04	--	04	08	03	80	20	--	25	25	150
10	6425	Testing of Plastics	TOP	04	--	04	08	03	80	20	25	--	25	150
TOTAL			--	**28**	**--**	**38**	**66**	--	**560**	**140**	**25**	**200**	**325**	**1250**

Level: 4

Total Courses : 10
Total Credits : 66
Total Marks : 1250

Assessment of PR/OR/TW :

1) All Orals are to be assessed by external and internal examiner.
2) * Indicates TW to be assessed by external and internal examiner.
3) Other TW are to be assessed by internal examiner only.

PROGRAMME:-DIPLOMA IN PLASTIC ENGINEERING
PROGRAMME STRUCTURE
LEVEL-5
DIVERSIFIED COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
All Compulsory														
01	6521	Mould Manufacturing	MMF	--	--	02	02	--	--	--	--	--	50	50
02	6522	Maintenance of Plastics Processing Machines	MPM	01	--	02	03	--	--	--	--	--	50	50
Elective III: Any **One** of the following														
03	6523	Fibre Technology	FTY	03	--	02	05	03	80	20	--	--	50	150
	6524	Tyre Technology	TYT	03	--	02	05	03	80	20	--	--	50	150
	6525	Plastics Waste Management	PWM	03	--	02	05	03	80	20	--	--	50	150
Elective IV: Any **One** of the following														
04	6526	Plastics Packaging	PPG	03	--	02	05	03	80	20	--	--	50	150
	6527	Adhesives	ADH	03	--	02	05	03	80	20	--	--	50	150
	6528	Plastic Paints	PLP	03	--	02	05	03	80	20	--	--	50	150
TOTAL			--	**07**	**--**	**08**	**15**	--	**160**	**40**	--	--	**200**	**400**

Level: 5

Total Courses : 04
Total Credits : 15
Total Marks : 400

Assessment of PR/OR/TW :

1) All Orals are to be assessed by external and internal examiner.
2) * Indicates TW to be assessed by external and internal examiner.
3) Other TW are to be assessed by internal examiner only.

PROGRAMME: DIPLOMA IN PLASTIC ENGINEERING

COURSES FOR AWARD OF CLASS

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6303	Industrial Organization and Management	IOM	03	--	--	03	03	80	20	--	--	--	100
02	6411	Seminar	SEM	--	--	02	02	--	--		--	--	50	50
03	6412	Project	PRO	--	--	04	04	--	--		--	50	50*	100
04	6419	Composites and Blends	CAB	04	--	04	08	03	80	20	--	25	25	150
05	6420	Elastomer Technology	EST	04	--	04	08	03	80	20	--	25	25	150
06	6421	Moulds and Dies for Plastics	MDP	04	--	04	08	04	80	20	--	25	25	150
07	6422	Additives for Plastics	AFP	04	--	04	08	03	80	20	--	25	25	150
08	6423	Plastics Moulding Techniques	PMT	04	--	04	08	03	80	20	--	25	25	150
09	6424	Plastics Processing Techniques	PPT	04	--	04	08	03	80	20	--	25	25	150
10	6425	Testing of Plastics	TOP	04	--	04	08	03	80	20	25	--	25	150
Any **ONE** from **Elective-III**														
11	6523	Fibre Technology	FTY	03	--	02	05	03	80	20	--	--	50	150
	6524	Tyre Technology	TYT	03	--	02	05	03	80	20	--	--	50	150
	6525	Plastics Waste Management	PWM	03	--	02	05	03	80	20	--	--	50	150
Any **ONE** from **Elective IV**														
12	6526	Plastics Packaging	PPG	03	--	02	05	03	80	20	--	--	50	150
	6527	Adhesives	ADH	03	--	02	05	03	80	20	--	--	50	150
	6528	Plastic Paints	PLP	03	--	02	05	03	80	20	--	--	50	150
TOTAL			--	**37**	**--**	**38**	**75**	--	**800**	**200**	**25**	**200**	**375**	**1600**

Total Courses : 12
Total Credits : 75
Total Marks : 1600

Assessment of PR / OR / TW :

1) All orals and practicals are to be assessed by external and internal examiners.
2) * Indicates TW to be assessed by external and internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME-DIPLOMA IN PLASTIC ENGINEERING
SAMPLE PATH
ENTRY LEVEL-10+

Nature of Course	First Year		Second Year		Third Year		Total
	Odd Term	Even Term	Odd Term	Even Term	Odd Term	Even Term	
Compulsory	6101 (05) CMS	6104 (04) EMT	6201 (04) CAG	6222 (06) FHT	6303 (03) IOM	6412 (04) PRO	
	6102 (03) DLS	6105 (06) PHY	6213 (06) SOM	6227 (05) APP	6410 (04) PPR	6419 (08) CAB	
	6103 (04) BMT	6108 (06) EMH	6220 (05) ELT	6301 (03) AMT	6411 (02) SEM	6424 (08) PPT	
	6106 (06) CHY	6212 (06) EDG	6221 (05) POE	6420 (08) EST	6421 (08) MDP	6425 (08) TOP	
	6109 (06) WSP	6226 (06) OCH	6223 (08) PCH	6422 (08) AFP	6423 (08) PMT	6522 (03) MPM	
	6224 (06) FCE	6302 (02) EVS	6225 (08) PLM	--	6521 (02) MMF	--	
Total credits (Compulsory)	**30**	**30**	**36**	**30**	**27**	**31**	**184**
Elective	--	--	--	1. Any **ONE** From **Elective-I** 6305(03)SSL, 6306(03)MKM, 6307(03)MMT **:(03)** 2. Any **ONE** from **Elective-II** 6309(03)EDP, 6310(03)RES, 6313(03)SDM **:(03)**	Any **ONE** from **Elective-III** 6523(05)FTY, 6524(05)TYT, 6525(05)PWM **:(05)**	Any **ONE** from **Elective-IV** 6526(05)PPG, 6527(05)ADH, 6528(05)PLP **:(05)**	--
Total Credits (Elective)	**Nil**	**Nil**	**Nil**	**06**	**05**	**05**	**16**
Total Courses	06	06	06	07	07	06	38
Total Credits (Compulsory + Elective)	**30**	**30**	**36**	**36**	**32**	**36**	**200**
Grand Total Credits							**200**

Note : Figures in bracket indicates total credits.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Communication Skills (CMS) **COURSE CODE** : 6101

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Proficiency in English is one of the basic needs of technical students hence this curriculum aims at developing the functional and communicative abilities of the students. As Communication skills play a decisive role in the career development and entrepreneurship this course will guide and direct to develop a good personality and effective communication too. This course is compiled with an aim of shaping minds of engineering students while catering to their needs.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand & use basic concepts of Communication in an organisation and social context.
2. Use reasonably and grammatically correct English language with reading competency.
3. Utilise the skills to be a competent communicator.
4. Develop comprehension skills, improve vocabulary, and acquire writing skills.
5. Overcome language and communication barriers with the help of effective communication techniques.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply the process and identify types of Communication for being an effective communicator
2. Identify the barriers in the communication process and apply ways to overcome them
3. Interpret graphical information precisely
4. Use formal written skills for business correspondence.
5. Exhibit listening & reading skills for improving competencies in communication.
6. Pronounce English sounds with correct stress and intonation in day to day conversations.
7. Construct correct grammatical sentences in oral and written communication.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Communication**	1a. Define communication & objectives 1b. Describe the process of Communication 1c. Differentiate between types of communication	1.1 Meaning of communication: definition, objectives and Importance of communication 1.2 Elements/Process of communication 1.3 Types of communication: Formal, Informal, Verbal, Nonverbal, vertical, Horizontal, Diagonal	04
Unit-II **Communication**	2a. Explain types of barriers 2b. Describe the	2.1 Barriers to Communication a) Physical Barrier • Environmental(time, noise, distance	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Barriers	principles of effective communication 2c. Discuss ways to overcome barriers. 2d. Identify various barriers	and surroundings) • Personal(deafness, stammering, ill-health, spastic, bad handwriting, temporary physical disabilities) b) Mechanical: Machines/means oriented c) Psychological : Day dreaming prejudice, emotional, blocked mind, generation gap, status, inactiveness, perception d) Language: Difference in language, technical jargons pronunciation and allusion 2.2 Ways to overcome barriers 2.3 Principles of effective communication	
Unit-III **Nonverbal & Graphical communication**	3a. Explain use of body language in oral conversations 3b. Label and interpret the graphical information correctly 3c. Describe the importance of graphical and nonverbal methods in technical field.	3.1 Non-verbal codes: • Proxemics • Chronemics • Artefacts 3.2 Aspects of body language(Kinesics) 3.3 Graphical communication • Advantages and disadvantages of graphical communication • Tabulation of data and its depiction in the form of bar graphs and pie charts.	06
Unit-IV **Formal Written Communication**	4a. Develop notices, circulars and emails 4b. Draft letters on given topics 4c. Prepare technical reports. 4d. Develop various types of paragraphs.	4.1 Office Drafting :Notice, Memo, Circulars and e-mails 4.2 Job application and resume 4.3 Business correspondence : Enquiry, Reply to an enquiry order, complaint, adjustment, 4.4 Technical Report Writing : Accident report, Fall in Production / survey, progress Investigation / maintenance 4.5 Paragraph writing-Types of paragraphs • Descriptive • Technical • Expository	12
Unit-V **Listening skills**	5a. Differentiate between hearing and listening. 5b. Apply techniques of effective listening.	5.1 Listening versus hearing 5.2 Merits of good listening 5.3 Types of listening 5.4 Techniques of effective listening	02
Unit-VI **Reading Skills**	6a. Describe various methods to develop vocabulary 6b. Develop reading	6.1 Reading for comprehension 6.2 Reading styles 6.3 Developing vocabulary 6.4 Methods of word formation: prefixes, suffixes, collocations, synonyms,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	competencies. 6c. Explain steps to comprehend passage	antonyms, Homophones, Homonyms. 6.5 Comprehension of unseen passages	
Unit-VII **Speaking Skills**	7a. Demonstrate Correct Pronunciation, stress and intonation in everyday conversation 7b. Develop formal conversational techniques. 7c. Deliver different types of speech	7.1 Correct Pronunciation-Introduction to sounds vowels, consonants, stress, intonation 7.2 Conversations : • Meeting & Parting • Introducing & influencing requests • Agreeing & disagreeing • Formal enquiries 7.3 Speech-Types of speech • Welcome Speech • Farewell speech • Vote of thanks	06
Unit-VIII **Language Grammar**	8a. Use grammatically correct sentence in day to day oral and written communication 8b. Distinguish between determiners & apply correctly in communicative use 8c. Use correct verb for given course. 8d. Use appropriate preposition as per time, place and direction. 8e. Transform the sentences.	8.1 Tense • Present Tense(Simple, Continuous, perfect, perfect Continuous) • Past Tense(Simple, Continuous, perfect, perfect Continuous) • Future Tense(Simple) 8.2 Determiners • Articles (A, An, The) • Some, Any, Much, Many, All, Both, Few, A few, The few, Little, A little, The little, Each, Every. 8.3 Modal Auxiliaries Can, Could, May, Might, Shall, Should, Will, Would, Must, Have to, Need, ought to 8.4 Sentence Transformation • Voice • Degree • Affirmative, Negative, Assertive, 8.5 Prepositions • Time • Place • Direction 8.6 Conjunctions	08
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Communication	--	02	04	06
II	Communication Barriers	02	02	02	06
III	Nonverbal & Graphical communication	--	02	08	10
IV	Formal Written Communication	--	04	18	22
V	Listening Skills	--	--	04	04
VI	Reading Skills	--	02	06	08
VII	Speaking Skills	02	02	04	08
VIII	Language Grammar	**--**	04	12	16
	TOTAL	**04**	**18**	**58**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Communicate on the given topic/situation.	02
2	II	Identify communication barriers	02
3	III	Non-verbal communication	02
4	IV	Business letter writing &job application	02
5	IV	Draft official letter	02
6	IV	Technical report writing on given topic	04
7	V	Attend a seminar and preparing notes	02
8	VI	Vocabulary building with different methods	02
9	VII	Language lab Experiment for correct pronunciation of sounds	04
10	VII	Write & present conversations on given situations	02
11	VIII	Grammar application-various exercises on grammar	04
12	I to VIII	Mini project (on given topic)	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts on types of communication.
2. Convert language information in graphical or nonverbal codes.
3. Maintaining own dictionary of difficult words, words often confuse, homophones & homonyms.
4. Listening daily English news on television or radio & to summarise it in their language.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Use audios of correct pronunciations.
2. Show videos about use of body language in oral formal conversations

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Effective English Communication	Krishna Mohan and Meenakshi Raman	Tata McGraw Hill Publishing Co. Ltd.
2	English for practical purpose	Z. N. Patil	Macmillan
3	Spoken English	Basal and Harrison	Orient Longman
4	Contemporary English Grammar	R. C. Jain, David Green	Macmillan
5	Business correspondence and Report writing	R. C. Sharma and Krishna Mohan	Tata McGraw Hill Publishing
6	English Communication for Polytechnics	S. Chandrashekhar & others	Orient Black Swan
7	Active English Dictionary	S. Chandrashekhar & others	Longman

B) Software/Learning Websites

1. http://www.communicationskills.co.in	2. http://www.mindtools.com
3. http://www.communication.skills4confidence	4. http://www.goodcommunication skills.net
5. http://www.free-english-study.com/	6. http://www.english-online.org.uk/
7. http://www.englishclub.com	8. http://www.learnenglish.de
9. http://www.talkenglish.com/	10. http://www.englishgrammarsecrets.com
11. http://www.myenglishpages.com/	12. http://www.effective-business-letters.com/
13. http://www.englishlistening.com/	14. http://www.class-central.com

C) Major Equipments/ Instruments with Broad Specifications

1. Digital English Language Laboratory.
2. Computers for language laboratory software
3. Headphones with microphone

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1									H		M
CO2									H		M
CO3	M								H		M
CO4		M							H		M
CO5	M								H		M
CO6		M							H		
CO7	M								H		M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL /AE / DD / ID
COURSE : Development of Life Skills (DLS) **COURSE CODE :** 6102

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	---	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

This course will develop the student as an effective member of the team in the organization. It will develop the abilities and skills to perform at highest degree of quality. It enhances his/her capabilities in the field of searching, assimilating information, handling people effectively, and solving challenging problems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team.
2. Enhance capabilities in the field of searching, assimilating information, managing the given task, handling people effectively, and solving challenging problems.
3. Understand and use personal management techniques.
4. Analyse their strengths, weaknesses, opportunities and threats.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Analyse self attitude and behaviour.
2. Acquire self learning techniques by using various information sources
3. Identify personal strengths to get future opportunities.
4. Develop presentation skills with the help of effective use of body language.
5. Enhance leadership traits and recognise the importance of team work.
6. Face interview without fear
7. Resolve conflict and solve problems by appropriate methods.
8. Set the goal for personal development.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Self Analysis**	1a. Explain types of Motivation. 1b. Differentiate between types of attitude. 1c. Describe types of behaviour 1d. Analyse SWOT of an individual	1.1 Motivation-types, need 1.2 Attitude-types, tips for developing positive attitude 1.3 Behaviour-types-passive, assertive, aggressive 1.4 Confidence building-need, importance 1.5 SWOT analysis-(significance)	02
Unit-II **Self Learning Techniques (**	2a. Explain the self learning techniques by enhancing memory and	2.1 Need & importance of SLT 2.2 Information source-Primary, secondary, tertiary 2.3 Enhancing Memory and concentration	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
SLT)	concentration 2b. Apply practical skills for effective learning 2c. Identify the information sources	2.4 Learning Practical Skills-need of Practical Skills types of practical skills-technical, organisational, human Domains of learning 1)cognitive 2)Affective 3)psychomotor 2.5 information search techniques-library search, internet search	
Unit-III **Self Development & Management**	3a. Explain the Need of self Management 3b. Set the goals for personal development	3.1 Stress management-remedies to avoid, minimize stress 3.2 Health management-importance of Diet & exercise 3.3 Time management-time planning, tips for effective time management 3.4 Goal setting-need and importance 3.5 Creativity	03
Unit-IV **Emotions**	4a. Explain nature and types of human emotions 4b. Differentiate between cognitive and emotional intelligence	4.1 Basic emotions- 4.2 Emotional intelligence 4.3 Emotional stability/maturity.	01
Unit-V **Presentation Skills**	5a. Develop presentation skills with the help of body language 5b. Describe utilisation of voice quality in oral conversations	5.1 Body Language-Codes, dress and appearance, postures, gestures Facial expressions 5.2 Voice and language 5.3 Use of aids:-OHP, LCD projector, white board	02
Unit-VI **Group Discussion And Interview Techniques**	6a. Participate in group discussion 6b. Face interview without fear.	6.1 introduction to group discussion 6.2 ways to carry group discussion 6.3 Parameters-analytical, logical thinking, Decision making 6.4 Interview techniques Necessity, tips for handling common questions	02
Unit-VII **Team Work**	7a. Recognise the importance of team work 7b. Enhance leadership qualities	7.1 stages of team development 7.2 Understand and work with dynamic group 7.3 Ingredients of effective teams. 7.4 leadership in teams, handling frustration in group	02
Unit-VIII **Conflicts & Problem Solving**	8a. Describe sources of conflicts and resolve conflicts 8b. Develop lateral thinking abilities 8c. Identify innovative methods in solving Problems.	8.1 sources of conflict 8.2 Resolution of conflict 8.3 ways to enhance interpersonal relation 8.4 Steps in problem solving 8.5 Problem solving techniques-trial, error & brainstorming	02
		TOTAL	**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Self Introduction-giving personal details for introducing self	02
2	II	SLT-Access the book on biography of scientist/industrialist/invention from the library or internet	02
3	I	Deliver a seminar for 10 minutes using presentation aids.	02
4	IV	Prepare PowerPoint slides on given topic and make presentation	02
5	VII	Case study for problem solving in an organisation	04
6	V	Discuss a topic in a group & prepare minutes of discussion.	02
7	VI	Prepare questionnaire for your friend or any person in the organisation to check emotional intelligence.	02
8	VII	Goal setting for achieving the success-SMART goal.	02
9.	I	SWOT Analysis for yourself with respect to your Strength, Weakness, Opportunities & Threats	04
10	III	Attend a seminar or a guest lecture and note down the important points and prepare a report of the same.	02
11	VIII	Undertake any social activity in a team and prepare a report about it(i.e. tree plantation, blood donation, environment protection, rain water harvesting)	04
12	III	Management of self-stress management, time management, health management	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Preparing personal time table.
2. Performing YOGA as a routine part of daily life.
3. Practicing breathing exercises.
4. Improving concentration by chanting and meditation.
5. Focusing on behavior skills and mannerism
6. Searching information on internet and newspapers.
7. Concentrating on various aspects of personality development.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Use of videos on personality development.
2. Use of power point presentation on health, time & stress management
3. Case study of an organization
4. Use of videos to show interviews of successful personalities.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Make Every Minute Count	Marion E Haynes	Kogan Page India
2	Body language	Allen Pease	Sudha Publication Pvt. Ltd.
3	Presentation Skills	Michael Hatton	ISTE New Delhi
4	Organizational Behavior	Pearson Education Asia	Tata McGraw Hill
5	Working in Teams	Chakravarty, Ajanta	Orient Longman
6	Develop Your Assertiveness	Bishop, Sue	Kogan Page India
7	Adams Time Management	Marshall Cooks	Viva Books
8	Time Management	Chakravarty, Ajanta	Rupa and Company
9	Target setting & Goal Achievement	Richard hale, Peter whilom	Kogan page India
10	Creativity &problem solving	Lowe and Phil	Kogan page (I)Pvt. Ltd.
11	Basic Managerial Skills for all	E. H. Mc Grah, S. J.	Prentice Hall of India, Pvt. Ltd.

B) Software/Learning Websites

1. http://www.mindtools.com
2. http://www.successconsciousness.com
3. http://www.studyhabits.com
4. http://www.motivateus.com
5. http://www.quickmba.com
6. http://www.success77.com
7. http://www.stress.org
8. http://www.topachievement.com
9. http://www.ethics.com
10. http://www.creativityforlife.com
11. http://www.motivation.com
12. http://www.queendom.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	L	M			L		L	M	H		H
CO2	M	M			L	L	H		M		H
CO3					M		M	M	H		H
CO4	L	L			L	M	M		H		M
CO5					L		M	M	H	M	L
CO6		L			L	M			H		M
CO7	L				M	M	L	M	M	L	L
CO8	L	L			L	M	L	L	H		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Basic Mathematics (BMT) **COURSE CODE** : 6103

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	01	--	04	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

This course is classified under foundation course and intends to teach the students basic facts, concepts and principles of Mathematics, as a tool to analyse the engineering problems and lay down the understanding of basic technology courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire the knowledge of mathematical terms definitions, principles and procedure of algebra, trigonometry and co-ordinate geometry.
2. Develop the process of logical thinking.
3. Comprehend the principles of the other courses.
4. Solve problems by using analytical & systematic approach.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply logarithm concept for solving mathematical problems
2. Solve determinant and matrix
3. Solve simultaneous equation in three variables
4. Use partial fraction to solve engineering problems
5. Apply binomial theorem to solve engineering problems
6. Determine properties of triangle and solution of triangle
7. Use coordinate geometry for solving problems in straight lines and circles

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Logarithm**	1a. Define logarithm use it for conversion 1b. Apply laws of logarithm to solving problems 1c. Identify common logarithm and Naperian logarithm	1.1 Concept and definition of Logarithm, conversion of exponential and logarithmic forms 1.2 Laws of logarithms and change of base formula 1.3 Common logarithm and **Naperian** logarithm definition and **notation only.**	03
Unit-II **Determinant & Matrix Algebra**	2a. Calculate determinant of order two and three and apply Cramer's Rule. 2b. Calculate area Of Triangle & condition of co linearity 2c. Define various types of	2.1 Determinant of order two and three, Cramer's Rule for Three Variables. Area of Triangle and Condition of Co linearity. 2.2 Definition of a matrix, types of matrix, algebra of matrices, equality of matrices, scalar multiplication, product of two	02 10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	matrices; solve problems using Algebra of matrix. 2d. Calculate Inverse of matrix	matrices, Transpose of matrix. 2.3 Minor, cofactor, and ad joint of matrix, Inverse of matrix by ad Joint matrix method.	
Unit-III **Partial Fraction**	3a. Identify proper & improper 3b. Resolve partial fraction method of Case I, Case II, and Case III.	3.1 Rational function, proper and Improper rational Functions 3.2 Concept of partial fraction. Case-1 The denominator contains linear non repeated factors. Case-2 the denominator contains linear but repeated factors Case-3 the denominator contains quadratic irreducible factors	05
Unit-IV **Binomial Theorem**	4a. State Binomial Theorem for Positive integral Index. 4b. Use T_{R+1} for finding middle term general term 4c. Use approximation Theorem for solving problems	4.1 Binomial Theorem for positive integral index, formula for Tr+1, Middle term, particular term. 4.2 Binomial Theorem for rational and negative index (expansion up to four terms only), approximation theorem, simple problems	04
Unit-V **Measurement Of Angle**	5a. Conversion of sexagesimal systems & circular systems	5.1 Measurement of angles, sexagesimal systems & circular systems, co-terminal angles, positive and negative angles, conversion of angle to radian to degree and degree to radians.	02
Unit-VI **Trigonometric Ratios**	6a. Calculate trigonometric ratios of any angle, Solve problem using fundamental Identities. 6b. Solving problem using allied, Compound, Multiple and Sub multiple forms.	6.1 Trigonometric ratios of any angle, graph of trigonometric functions fundamental identities 6.2 Trigonometric ratios of allied, compound, multiple and sub multiple angles, sum &product forms.	08
Unit-VII **Inverse Trigonometric Functions**	7a. Convert & solving inverse trigonometry function 7b. Use of $\tan^{-1} x + \tan^{-1} y$ form to solve problem.	7.1 Concept and definition of trig. Function, Relation between inverse trig. functions	02
Unit-VIII **Properties Of Angle And Solution Of Triangle**	8a. Use properties of triangle : Sine rule, Cosine rule to solve mathematical problems 8b. Solve any triangle problems	8.1 Sine rule, cosine rule & law of tangent (simple problems) 8.2 solutions of triangle	04
Unit-IX **Equation Of Straight Line**	9a. Calculate Slope, X and Y, intercept Use various form of Straight line to solve problems.	9.1 Slope and intercepts of straight line, various form of straight line, angle between two lines, condition for two parallel or perpendicular lines, perpendicular distance formula, distance between two parallel lines.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-X **Equation Of Circle**	10a. Calculate Radius & Centre of general circle 10b. Apply various form of circle 10c. Calculate Equation of tangent & normal to the circle.	10.1 Equation Of std. circle, center radius form, general form of circle, Diameter form of circle, equation of tangent and normal to the circle.	04
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Logarithm	02	02	02	06
II	Determinant And Matrix Algebra	04	08	04	16
III	Partial Fraction	02	04	02	08
IV	Binomial Theorem	02	02	02	06
V	Measurement Of Angle	02	02	--	04
VI	Trigonometric Ratios	04	04	04	12
VII	Inverse Trigonometric Function	02	02	--	04
VIII	Properties of Triangle And Solution Of Triangle	02	02	04	08
IX	Equation Of Straight Line	02	04	04	10
X	Equation Of Circle	02	02	02	06
	TOTAL	**24**	**32**	**24**	**80**

6.0 ASSIGNMENTS/ TUTORIAL /TASKS

Sr. No.	Unit No.	Batch wise Tutorial Exercises **Tutorial:** Ten question of multiple choice with justification	Approx. Hrs. required
1	I	Logarithm	01
2	II	Determinant	01
3	II	Matrix Algebra	02
4	III	Partial Fraction	01
5	IV	Binomial Theorem	02
6	V	Measurement And Angle	01
7	VI	Trigonometric Ratios	01
8	VI	Trigonometric Ratios	01
9	VII	Inverse Trigonometric Ratios	02
10	VIII	Properties of Triangle And Solution Of Triangle	01
11	IX	Straight Line	02
12	X	Circle	01
		TOTAL	**16**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mathematics for polytechnic student (I)	S. P. Deshpande	Pune Vidyarthi Gruha
2	Trigonometry	S. L. Loney	S. Chand
3	Higher Engineering Mathematics	B. S. Grewal	Khanna
4	College Algebra	F.G. Valles	Charter Publication.
5	Higher Algebra	H. S. Halls & S.R. Night	
6	Matrices	F. Ayers	Schan Series. Metric Edition Book, Palace of India.

B) Software/Learning Websites

1. http://www.mathsisfun.com
2. http://mathinsight.org/logarithm_basics
3. http://www.mathportal.org/linear-algebra/determinants/determinant-of-a-matrix.php
4. http://www.math.hmc.edu/calculus/tutorials/matrixalgebra/
5. http://ibgwww.colorado.edu/~carey/p7291dir/handouts/matrix.algebra.pdf
6. http://www.purplemath.com/modules/binomial2.htm
7. http://www.themathpage.com/atrig/line.htm
8. http://i1.dainikbhaskar.com/web2images/education/maths_13659_13897.pdf
9. http://mathworld.wolfram.com/InverseTrigonometricFunctions.html
10. http://aieee.examcrazy.com/maths/formula-tips/Co-ordinate-Geometry-circle.asp

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer and Internet system.
3. LCD Projector

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H		M								L
CO2	H		M								L
CO3	H		L								L
CO4	H		L								L
CO5	H		M								L
CO6	H		M								L
CO7	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Engineering Mathematics (EMT) **COURSE CODE** : 6104

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	01	--	04	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The study of mathematics is necessary to develop in the students the skills essential new for the disciplines like Genetic Engineering, Biotechnology and Information Technology etc. This course is extension of Basic Mathematics and stepping to learn applied mathematics. Engineering mathematics lays down the foundation to understand and express principles and laws involved in other technology courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire knowledge of differential calculus, vector algebra, statistics and probability, complex numbers.
2. Develop the ability to apply mathematical methods to solve engineering problem.
3. Acquire sufficient mathematical techniques necessary for daily and practical problems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes :

1. Solve function and limit of function
2. Apply derivatives to solve engineering problems
3. Apply vector to solve engineering problems
4. Determine statistics probability to solve engineering problems
5. Solve engineering problems using complex number

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Function**	1a. Solve problem of functions, State even & odd function, identify various types of function.	1.1 Definition of function, types of functions, Basic functions such as algebraic, exponential, logarithmic, trigonometric, inverse trigonometric functions, explicit, implicit, composite, inverse, parametric, exponential even & odd functions, simple problems	03
Unit-II **Limits**	2a. Apply limit of various types of Functions.	2.1 Definition of limit, limit of Functions such as algebraic Functions, trigonometric functions, logarithm and exponential functions	05
Unit-III **Derivatives**	3a. Solve problems of derivative with the help of rules & formulae of derivative.	3.1 Concept and definition of derivative, Notation, standard Formulae and rules of derivative 3.2 Methods of differentiation, derivative of	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	3b. Differentiate various types of functions 3c. Calculate second order of derivative.	composite functions, implicit function. Parametric function. Inverse function. Logarithmic Differentiation. 3.3 Second order derivatives, simple problems.	
Unit-IV **Application Of Derivatives**	4a. Apply geometrical meaning of derivative; solve the problem based on related rates, radius of curvature & maxima minima.	4.1 Geometric meaning of derivative 4.2 Error theorem. 4.3 Related rates, radius of curvature 4.4 Maxima & Minima	06
Unit-V **Vectors**	5a. Apply algebra of vector 5b. Calculate scalar and vector products 5c. Apply vector algebra to find work done and moment of force, Area of parallelogram	5.1 Definition of vector, position vector, algebra of vector (equality, addition, subtraction, and scalar multiplication) 5.2 Dot (scalar) and vector (cross) product of two vectors. 5.3 Application of vectors, work done and moment of force about a point and line.	08
Unit-VI **Statistics & Probability**	6a. Calculate range, mean deviation, standard deviation for group and ungrouped data, coefficient of variance 6b. Apply the theory of probability to solve problem 6c. Apply addition and multiplication theorems	6.1 Measure of dispersion such as range, mean deviation, standard deviation, variation and coefficient of variation. 6.2 Definition of random experiment, sample space event, occurrence of events and types of events (impossible, mutually exclusive, exhaustive and equally likely) 6.3 Definition of probability, addition and multiplication theorems of probability.	08
Unit-VII **Complex Number**	7a. Solve problem based on complex number(real and imaginary part, polar form) 7b. Apply Algebra of complex number to solve problem 7c. Solve problem of Euler's function & circular function, Hyperbolic function.	7.1 Definition of complex number, Cartesian, polar and exponential forms of complex number. 7.2 Algebra of complex no. (equality, addition, subtraction multiplication and division) 7.3 De-Moiver's theorem (without proof) and simple problems. 7.4 Euler's form of circular functions, Hyperbolic functions and relation between them.	08
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Function	02	02	--	04
II	Limits	02	04	02	08
III	Derivative	06	08	06	20
IV	Application Of Derivative	02	04	06	12
V	Vector	04	06	02	12

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
VI	Statistics And Probability	04	04	04	12
VII	Complex Number	04	04	04	12
	TOTAL	**24**	**32**	**24**	**80**

6.0 ASSIGNMENTS/TUTORIAL/TASKS:

Sr. No.	Unit No.	**Batch wise Tutorial Exercises** (Outcomes in Psychomotor Domain) **Tutorial:** Ten question of multiple choice with justification	Approx. Hrs. required
1	I	Function	01
2	II	Limits I	01
3	II	Limits II	01
4	III	Derivative I	01
5	III	Derivative II	01
6	III	Derivative III	02
7	III	Second Order Derivative	01
8	IV	Application Of Derivative	02
9	V	Vector	02
10	VI	Statistics	01
11	VI	Probability	01
12	VII	Complex Number	02
		TOTAL	**16**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.
3. Learn graphical software: Excel, DPlot, and Graph.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mathematics for polytechnic student (II)	S. P. Deshpande	Pune Vidyarthi Gruha
2	Higher Engineering Mathematics	B. S. Grewal	Khanna
3	Advanced Engineering Mathematics	H.K. Das	Khanna Publication
4	Calculus of single variable	R.T. Smith	Tata McGraw Hill.
5	Engineering Mathematics	S.S. Shastrii	Prentice Hall Publication

B) Software/Learning Websites

1. http://schools.aglasem.com/1341
2. http://www.emathzone.com/tutorials/calculus/types-of-functions.html
3. http://www.mathsisfun.com/algebra/vectors.html
4. http://www.mathsisfun.com/data/
5. http://mathworld.wolfram.com/ComplexNumber.html

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer and Internet system.
3. LCD Projector.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H		M								L
CO2	H		M								L
CO3	H		M								L
CO4	H		M								L
CO5	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Physics (PHY) **COURSE CODE :**6105

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	Online Exam Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	02	Max.	80#	20#	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

 # Indicates online examination

1.0 RATIONALE:

Physics is associated with our lives at every stage. A good scientific attitude is essential for every human being to increase his/her quality of life. Today learning Physics has become more challenging because it is no more a watertight compartment. The approach is now inter-disciplinary and integrated with emphasis on the principle with their application.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand and apply the laws of Physics in various contexts.
2. Apply their knowledge of basic Physics to solve problems and present the solution in a clear and concise manner.
3. Acquire and develop experimental skills including the use of variety of laboratory instruments, taking of data for interpretation and its analysis.
4. Develop skill in the presentation of clear and concise written accounts of laboratory work.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Differentiate between various systems of measurement and identify proper unit of a physical quantity.
2. Identify the properties of Laser and Optical fibre as well as their engineering applications.
3. Acquire the knowledge about superconductors, indoor lighting.
4. Identify conductors & insulators of heat and analyse the relation between pressure, volume and temperature of gas.
5. Recognise elastic properties of materials and types of modulus of elasticity.
6. Identify the properties such as surface tension of liquids and viscosity of fluids.
7. Be aware of the propagation of sound and acoustics of building.
8. Distinguish between various effects produced by an electric charge.
9. Gain broad ideas about capacitors, semiconductors and p-n junction diode.
10. Discover the basics and applications of photoelectric cell and X rays.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Units & Measurements**	1a. Differentiate between fundamental &derived quantities/units.	1.1 Need of measurements, units of measurements, systems of units, SI units, fundamental & derived units, fundamental & derived quantities.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1b. Determine dimension of a physical quantity. 1c. Calculate different types of errors in measurements. 1d. Illustrate use of vernier caliper and screw gauge for linear measurements.	1.2 Dimension of physical quantity, dimensional analysis & its uses, order of magnitude & significant figures. 1.3 Accuracy & errors, instrumental, systematic and random error, estimation of error-average value, absolute error, relative error & percentage error, numerical. 1.4 Measuring instruments-vernier caliper and micrometer screw gauge.	
Unit-II **Light**	2a. Calculate refractive index of material of prism. 2b. Identify advantages of optical fibre over conducting wire. 2c. Differentiate between types of optical fibre. 2d. Recognise the principle of photometry. 2e. Acquire knowledge about indoor lighting.	2.1 Refraction of light, refractive index and its significance, Refraction through prism, Derivation of Prism formula. 2.2 Total internal reflection of light (TIR), Optical fibre, advantages and disadvantages, construction of optical fibre. 2.3 Transmission characteristics of Optical, fibre, types of optical fibre-step & graded index fibre, Application of optical fibre. 2.4 Luminous flux, luminous intensity, illumination, candela, lumen, illuminance, inverse square law of illuminance, principle of photometry. 2.5 Indoor lighting-direct, indirect, semi-indirect, utilization factor, efficiency of source, maintenance factor, space to height ratio, total luminous flux, numericals.	08
Unit-III **Laser**	3a. Describe the principle of laser. 3b. Acquire knowledge about He-Ne laser 3c. Identify applications of holography	3.1 Laser, Properties of laser, spontaneous absorption, spontaneous emission and stimulated emission, population inversion, pumping, life time, meta-stable-state. 3.2 Construction, advantages & disadvantages of Helium-Neon Laser, applications of Laser. 3.3 Holography recording and Reconstruction of hologram, Application of holography.	06
Unit-IV **Current Electricity**	4a. Demonstrate ohm's law, use of metre bridge to find resistance. 4b. Use potentiometer to find internal resistance. 4c. Identify positive/ Negative temperature coefficient of resistance of	4.1 Ohm's law, Specific resistance, conductance, conductivity, Wheatstone's network, balancing condition, metre bridge. 4.2 Theory of shunt, fall of potential along wire, potentiometer. 4.3 Effect of temperature on resistance of metals, semiconductors & insulators, temperature coefficient of resistance, positive& negative temperature coefficient of resistance.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	material. 4d. Calculate electrical energy consumed in kWh. 4e. Distinguish between properties of conductor & superconductor.	4.4 Heating effect of electric current, electric power, electric energy, kilowatt hour. 4.5 Superconductivity, graph of temperature versus resistance for mercury, superconductors, properties and application of superconductors, Numericals.	
Unit-V **Transfer of Heat & Gas laws**	5a. Illustrate conversion of temperature. 5b. Distinguish between good & bad conductors of heat on the basis of thermal conductivity. 5c. Calculate coefficients of expansion of solids. 5d. Identify the relation between pressure, volume & temperature of gas. 5e. Gain idea about specific heats of gases. 5f. Distinguish between isothermal, adiabatic, isobaric & isochoric process.	5.1 Temperature & heat, Celsius & Fahrenheit scale, conduction, convection, radiation. 5.2 Conduction of heat –variable state, steady state and temperature gradient, law of thermal conductivity, coefficient of thermal conductivity, applications of thermal conductivity. 5.3 Expansion of solids, Coefficient of linear, areal and cubical expansion and relation between them. 5.4 Statement of Boyle's law, Charle's law, Gay Lussac's law, concept of absolute zero, Kelvin scale of temperature. 5.5 General gas equation, universal gas constant, Work done in expanding a gas at constant pressure, specific heats of a gases and relation between them (equation only). 5.6 Isothermal, isobaric and isochoric and adiabatic process, difference between these processes, numericals.	08
Unit-VI **(ONLY For CE / ME / PS / AE)** **Elasticity**	6a. Differentiate between elasticity, plasticity & rigidity 6b. Calculate moduli of elasticity of materials. 6c. Illustrate applications of elasticity.	6.1 Deforming force, restoring force, elasticity, plasticity and rigidity. 6.2 Stress and strain with their types, elastic limit, Hooke's law, moduli of elasticity (Y, η, K) and their significance, Poisson's ratio. 6.3 Stress-strain diagram for wire under increasing load, factor of safety, applications of elasticity, Numericals.	06
Unit-VII **(ONLY For CE / ME / PS / AE)** **Surface Tension**	7a. Acquire knowledge about surface tension of liquids & its effects. 7b. Recognise effects of impurities & temperature on surface tension of liquid. 7c. Calculate surface tension of liquid.	7.1 Cohesive and adhesive force, range of molecular forces, sphere of influence, surface energy, Surface tension, molecular theory of surface tension. 7.2 Effect impurities and temperature on surface tension, relation between surface tension & surface energy 7.3 Angle of contact, capillary action relation between surface tension, capillary rise, radius of capillary, application of surface tension, numericals.	06
Unit-VIII	8a. Identify applications	8.1 Pressure, pressure due to liquid	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
(ONLY For CE / ME / PS / AE) **Viscosity**	of Pascal's law. 8b. Gain knowledge about viscosity of fluids. 8c. Find viscosity of fluids using Stokes law 8d. Distinguish between types of flow of fluid. 8e. Identify significance of Reynolds number.	column, hydrostatic paradox, Pascal's law and its applications. 8.2 Viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its unit. 8.3 Stoke's law, expression for relation between coefficient of viscosity and terminal velocity. 8.4 Types of flow, Streamline and turbulent flow, advantages of streamline flow. 8.5 Critical velocity, Reynolds's number and its significance, Bernoulli's principle & its applications, application of viscosity, Numericals.	
Unit-IX **(ONLY For CE / ME / PS / AE)** **Sound and acoustic**	9a. Recognise frequency of audible & other sound waves. 9b. Calculate sound intensity in decibel scale. 9c. Illustrate properties & applications of Ultrasonic waves. 9d. Calculate reverberation time using Sabine formula. 9e. Plan acoustical planning of a hall.	9.1 Introduction to sound, frequency of sound and limits of Audibility, intensity of sound. 9.2 Reflection of sound, absorption coefficient, transmission coefficient, reflection coefficient, Loudness and intensity level, threshold of hearing & pain, Decibel scale. 9.3 Ultrasonic waves-properties & applications. 9.4 Echo, Reverberation, standard reverberation time, Sabine's formula. 9.5 Condition for good Acoustics, factors affecting acoustical planning of auditorium. Numericals.	08
Unit-VI **(only for EE / IF / CM / EL)** **Electrostatics**	6a. Calculate force between two charges using Coulomb's law. 6b. Illustrate different properties of electric lines of force. 6c. Calculate electric potential due an electric charge. 6d. Identify importance of potential of earth.	6.1 Coulomb's inverse square law, permittivity of medium, unit charge, electric field, electric field intensity. 6.2 Electric lines of force and their properties, electric flux, Electric flux density and relation between them, Electric flux associated with charge. 6.3 Electric potential, potential difference, potential gradient, dielectric strength, breakdown potential, expression for PD between two points due to point charge, expression for absolute potential at point. 6.4 Potential due to charged sphere. (three cases), potential of earth, numerical.	08
Unit-VII **(only for EE / IF / CM / EL)** **Capacitance**	7a. Illustrate charging &discharging of capacitor. 7b. Calculate effective capacitance of combination of	7.1 Capacitor, Capacitance and its unit, dielectric, effect of dielectric, dielectric constant, dielectric breakdown, Principle of capacitor. 7.2 Charging and discharging of Capacitor, Capacitor in series and parallel.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	capacitors. 7c. Identify types of capacitors. 7d. Calculate energy stored by a capacitor.	7.3 Types of capacitor- fixed & variable. 7.4 Expression for capacitance of parallel plate capacitor, capacitance of spherical and cylindrical capacitor equation only, energy stored by charged capacitor (equation only), numericals.	
Unit-VIII **(only for EE / IF / CM / EL)** **Photo electricity and X-rays**	8a. Acquire knowledge about photoelectric effect. 8b. Identify characteristics of Photoelectric effect. 8c. Calculate KE of photoelectrons using Einstein's equation. 8d. Recognise production of X-rays. 8e. Illustrate properties & applications of x-rays.	8.1 Planck's quantum theory, Photo electric effect, experiment to study photoelectric effect. 8.2 Characteristics of photoelectric effect, threshold frequency, threshold-wavelength, photoelectric work function, stopping potential. 8.3 Einstein's photoelectric equation, photoelectric Cell and types, applications of photoelectric cell. 8.4 Origin of X-rays, production of X-rays using Coolidge's X-ray tube, minimum wavelength of X-ray. 8.5 Properties of X-rays, applications of X-rays, numerical.	06
Unit-IX **(only for EE / IF / CM / EL)** **Band Theory of Solids**	9a. Classify solids on the basis of band theory. 9b. Classify Semiconductors. 9c. Illustrate forward & reverse bias of P-N Junction diode.	9.1 Energy bands in solids-valence band, conduction band and forbidden energy gap, classification of solids on the basis of band theory : conductor, insulator, and semiconductor. 9.2 Properties of semiconductor, classification of semiconductors intrinsic & extrinsic, P type & N type semiconductors. 9.3 P-N junction diode, forward & reverse bias characteristics of P-N junction diode, advantages of semiconductor devices.	06
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
Units common for all programmes					
I	Units and measurements	04	02	04	10
II	Light	02	04	04	10
III	Laser	02	04	02	08
IV	Current electricity	02	04	04	10
V	Transfer of heat & gas laws	02	04	04	10
Units ONLY FOR CE/ME/PS/AE					
VI	Elasticity	02	04	02	08
VII	Surface tension	02	04	02	08
VII	Viscosity	02	02	04	08

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
IX	Sound and Acoustics	02	02	04	08
Units ONLY FOR EE/IF/CM/EL					
VI	Electrostatics	02	04	02	08
VII	Capacitance	02	04	02	08
VIII	Photo electricity & X-rays	02	02	04	08
IX	Band theory of solids	02	02	04	08
	TOTAL	**20**	**30**	**30**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

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* ***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.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
		Common practicals	
1	I	Measure the dimensions of different objects using Vernier caliper	02
2	I	Measure the dimensions of different objects using micrometer screw gauge	02
3	II	Determine the refractive index of material of prism using spectrometer	02
4	IV	Verify ohm's law and determine resistivity of material of given wire.	02
5	IV	Verify law of resistance in series & parallel using metre bridge.	02
6	V	Determine coefficient of linear expansion using Pullinger's apparatus.	02
7	V	Verify Boyle's law	04
8	IV	Verify principle of potentiometer.	02
		Practicals for CE/ME/PS/AE	
1	VI	Verify Hooke's law of elasticity and determine Young's modulus of material of wire using Searle's apparatus.	04
2	VII	Determine surface tension of water using capillary rise method.	02
3	VIII	Verify Stoke's law of viscosity and determine coefficient of viscosity of given fluid.	04
4	IX	Determine coefficient of absorption of sound of given acoustical material.	04
		Practicals for EE/IF/CM/EL	
1	VII	Verify law of capacitance in series/parallel.	02
2	VII	Charging & discharging of capacitor and determine its time constant.	04
3	VIII	To study I-V characteristic of photoelectric cell.	04

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
4	IX	To study I-V characteristics of PN junction diode in forward/reverse biased condition.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts of Vernier caliper, screw gauge, travelling microscope, spherometer & spectrometer for lab demonstration.
2. Study acoustical planning of institute's auditorium hall.
3. Study lighting system of institute's conference hall.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show videos based on topics in the curriculum (total internal reflection, population inversion, different laws of physics) for better understanding of the concepts.
2. Show videos of practical demonstration before performance of practical for better understanding of practical.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering Physics	R K Gaur & S L Gupta	Dhanpat Rai Pub.
2	Applied Physics	Prof. Arthur Beiser	Tata McGraw hill Pub.
3	Engineering Physics	D K Bhattacharya	Oxford University press
4	Physics	Halliday & Resnick	Wiley India

B) Software/Learning Websites

1. www.physicsclassroom.com
2. www.physics.org
3. www.physics.brown.edu
4. http://scienceworld.wolfram.com/physics/
5. http://hyperphysics.phy-astr.gsu.edu/hbase
6. www.msu.edu/~brechtjo/physics
7. http://www.rp-photonics.com/laser_applications.html
8. http://webphysics.davidson.edu/alumni/jimn/He-Ne/Pages/Theory.htm
9. http://physix_jun.tripod.com/fibres_4.htm
10. http://www.suite101.com/content/optics-total-internal-reflection-a51310
11. http://teachers.web.cern.Ch/teachers/archive/HST2001/accelerators/superconductivity/superconductivity.htm
12. http://en.wikipedia.org/wiki/Acoustics

C) Major Equipments/ Instruments with Broad Specifications

1. Vernier Caliper (LC = 0.02mm)
2. Micrometer screw gauge (LC = 0.01mm)
3. Aneroid barometer
4. Digital stop watch
5. Travelling Microscope
6. Regulated power supply
7. Apparatus to verify Boyles law
8. Stoke's App to measure viscosity
9. Metre bridge
10. Searle's apparatus for Young's modulus
11. Pullinger's apparatus

12. Gas burner with regulator, LPG gas cylinder and lighter
13. Spectrometer
14. Bunsen's photometer.
15. Ammeter, voltmeter, galvanometer, rheostat, resistance box
16. Potentiometer.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H		M	M	L			H	L		L
CO2	H		M	L	L			M	L		
CO3	H		M	L	L			M			
CO4	H	M	M	L	M	L		M			L
CO5	H	M	M	L	M			M			
CO6	H	M	L	L	M			M			
CO7	H		L	L	M	L		M	L		L
CO8	H		M	L	M			L	L		
CO9	H		M	L	M			M	L		
CO10	H		L	L	M	L		L	L		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Chemistry (CHY) **COURSE CODE** : 6106

TEACHING & EXAMINATION SCHEME

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	Online Exam. Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	02	Max.	80#	20#	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

 # indicates online examination

1.0 RATIONALE:

Chemistry is the basic science course which is essential to all engineering programmes. The basic aim of teaching science is to develop in the students the habit of scientific inquiry, ability to establish the cause and effect. The study of basic concepts of chemistry like atomic structure, water treatment, metals and alloys, corrosion, lubricants, non metallic materials, fuels, environmental effects etc. will help the students to understand engineering courses where the emphasis is laid on the application of these concepts. Teaching of chemistry should be aimed at developing the right type of aptitude in the students and the ability to predict the result under given conditions.

Thus good foundation in basic science will help the students in their self development to cope up with continuous flow of innovation.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop scientific attitude in students.
2. Apply knowledge of chemistry in engineering situations.
3. Develop in students the habit of scientific enquiry, ability to establish cause and effect.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Apply the principles of chemistry to engineering situations.
2. Apply knowledge to correlate the properties of materials, their engineering uses and protection.
3. Write electronic configuration of various elements.
4. Apply various applications of electrolysis in engineering situations.
5. Illustrate various methods of softening of hard water.
6. Use the appropriate metals and alloys for different engineering applications.
7. Differentiate various types of corrosion, and gain knowledge on control measures associated with corrosion
8. Select lubricants for machines.
9. Enlist the various characteristics of good fuel.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
Unit-I **Atomic Structure**	1a. Describe structure of an atom 1b. Explain Bohr's theory and distinguish between orbit and orbital	1.1 Structure of an atom, fundamental particles of an atom, concept of atomic number, mass number. 1.2 Bohr's theory, orbit, orbital, shapes of orbital, energy level, sub energy level	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
	1c. Describe rules for arrangement of electrons 1d. Give electronic configuration 1e. Describe the different types of compounds 1f. Explain the formation of various electrovalent and covalent compounds	1.3 Hund's rule, Aufbau principle, Rules for distribution of electrons in shell and sub shells. 1.4 Electronic configuration of atoms having atomic number 1-30 1.5 Electrovalent and covalent compounds, electrovalency and covalency 1.6 Formation of covalent compound e.g. H_2O, CH_4, O_2, N_2, C_2H_2 1.7 Formation of electrovalent compound e.g. NaCl, $CaCl_2$, $AlCl_3$	
Unit-II **Electro chemistry**	2a. Explain basic concepts of electrochemistry. 2b. Explain theory of ionization and factors affecting it 2c. Explain mechanism of electrolysis with examples. 2d. Describe faraday's first and second laws and solve numerical. 2e. Explain the applications of electrolysis 2f. Describe the construction and working of cells	2.1 Definition of electrochemistry, atom, ion, electrode, cell, electrolysis, electrolytes, non-electrolytes, anode, cathode. 2.2 Arrhenius theory of ionization, degree of ionization, factors affecting degree of ionization. 2.3 Electrolysis, mechanism, electrolysis of fused NaCl, aqueous NaCl using platinum electrode, $CuSO_4$ solution using Copper electrode. 2.4 Faraday's first and second law. 2.5 Numericals on Faraday's laws. 2.6 Process of electroplating and electro refining 2.7 Types of cell- e.g. Dry cell, Ni-Cd cell, introduction to solar cell	08
Unit-III **Water**	3a. Explain sources, impurities, properties of water. 3b. Differentiate between hard and soft water 3c. Describe the ill effect of hard water in domestic and industrial field 3d. Explain the different methods for removal of hardness of water. 3e. Describe the different treatments of drinking water 3f. Explain the concept of pH and pOH numerical related with it, applications of pH in engineering.	3.1 Sources of water- Rain, surface, underground water. Impurities in water- suspended, colloidal, dissolved, biological 3.2 Physical and chemical properties of water. 3.3 Hard and soft water. Types of hardness of water, Salts producing hardness of water, Units of hardness of water. 3.4 Domestic field- cooking, washing, bathing, drinking. Industrial field- paper, textile, dye, sugar industry. 3.5 Temporary hardness- boiling, Clark's method. 3.6 Permanent hardness- Permutit's method, ion exchange method. 3.7 Methods of purification of water: Screening, Sedimentation, coagulation, filtration, Sterilization of water. 3.8 Definition of pH and pOH, pH scale, and numerical. 3.9 Applications of pH in engineering. -city water supply, corrosion, effluent	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
		treatment, electroplating.	
Unit-IV **Metals**	4a. Explain the basic concepts of metallurgy. 4b. Describe different characteristics of metal. 4c. Explain the metallurgy of iron. 4d. Describe the physical properties and applications of metals.	4.1 Definition of ore, mineral, gangue 4.2 Hardness, toughness, brittleness, tensile strength, malleability, ductility, machinability, weldability 4.3 Flow sheet of metallurgy 4.4 Steps of metallurgy : a. Concentration: physical, chemical. b. Reduction: smelting, alumino thermic process. c. Refining: poling, liquation, distillation, electrorefining. 4.5 Physical properties and applications of Fe, Cu, Al, Cr, Ni, Sn, P	08
Unit-V **Alloys**	5a. Describe the meaning of alloy, its preparation, and its purposes of formation. 5b. Explain the classification of alloys and their applications	5.1 Definition of alloy, different methods of preparation of alloy, 5.2 Purposes of formation of an alloy. 5.3 Classification of alloys • Ferrous alloy-alloys steel and its applications. • Non ferrous alloy-Copper alloy-brass, bronze, gun metal, Monel metal Aluminum alloy-Duralumin • Solder alloy and its types.	06
Unit-VI **Corrosion**	6a. Describe magnitude of corrosion, meaning of corrosion, types of corrosion 6b. Explain the factors affecting the atmospheric and immersed corrosion 6c. Explain different methods of protection of metal from corrosion	6.1 Magnitude of corrosion, definition of corrosion, types of corrosion- a) Atmospheric corrosion-definition, types- b) corrosion due to oxygen, mechanism of corrosion due to oxygen, nature of film and its role in corrosion process c) Corrosion due to other gases 6.2 Immersed corrosion-definition, it's mechanism, galvanic and concentration cell corrosion 6.3 Factors affecting atmospheric and immersed corrosion 6.4 Methods of protection of metal from corrosion-hot dipping, metal spraying, sherardizing, electroplating of metal cladding, organic coating-paints and varnish	10
Unit-VII **Lubricants**	7a. Describe lubricants, its function, and classification of lubricants. 7b. Explain lubrication and it's types 7c. Describe physical and chemical properties of lubricants	7.1 Definition of lubricant, function of lubricants, classification of lubricants. 7.2 Definition of lubrication, types of lubrication 7.3 Physical properties-viscosity, viscosity index, oiliness, flash and fire point, volatility, cloud and pour point. 7.4 Chemical properties-acid value, saponification value, emulsification. 7.5 Properties and names of lubricants used	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
	7d. Explain selection of lubricants for various machines	for various machines like delicate instruments, heavy load and low speed machine, gears, cutting tools, I.C. Engine, steam engine	
Unit-VIII **Fuels**	8a. Describe fuels, characteristics of good fuel, types of fuel 8b. Describe solid fuel-e.g. coal in detail 8c. Describe liquid fuel e.g.-petroleum 8d. Describe gaseous fuel their advantages 8e. Distinguish between solid liquid and gaseous fuels	8.1 Definition of fuel, characteristics of good fuel, classification of fuel 8.2 Solid fuel-e.g. coal, it's types, properties of good coal, selection of coal, analysis of coal, determination of C and H in coal 8.3 Liquid fuel-e.g. petrol, classification of petrol, refining of petrol 8.4 Gaseous fuel e.g. LPG, natural gas, biogas 8.5 Advantages of gaseous fuel over solid and liquid fuels 8.6 Comparison between solid, liquid and gaseous fuels	08
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No	Unit title	Distribution of Theory marks			
		R level	**U level**	**A level**	**Total**
1	Atomic Structure	04	02	02	08
2	Electrochemistry	04	04	04	12
3	Water	04	04	04	12
4	Metals	04	02	04	10
5	Alloys	02	02	02	06
6	Corrosion	04	02	06	12
7	Lubricants	04	02	04	10
8	Fuels	04	02	04	10
	TOTAL	**30**	**20**	**30**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1 to 5	I	Inorganic qualitative analysis of any five solutions	10
6	II	Determination of electrochemical equivalent of copper.	02
7 to 8	III	Strength of given acidic solution using standard base solution.	04
9	III	Determination of pH of different unknown solutions.	02
10	III	Determination of chloride content in given water sample.	02
11 to 12	III	Determination of hardness of water	04
13	V	Determination of % of Fe in given ferrous alloy sample.	02
14	VI	To find relation between decrease in weight due to corrosion of metal and time.	02
15	VII	Determination of viscosity of given lubricating oil.	02
16	VIII	Determination of % of moisture in given coal sample by proximate analysis.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Draw structures and write electronic configurations of atoms having atomic number 1-30.
2. Testing of water samples.
3. Sampling and collection of coal.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. CAI package, video demonstration, charts, models, visits and expert seminar/lecture.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Books	Author	Publication
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons
2	A Text Book of Polytechnic Chemistry	V. P. Mehta	Jain Brothers
3	Engineering Chemistry	S. S. Dara	S. Chand Publication
4	Industrial Chemistry	B. K. Sharma	Goel Publication
5	Environmental Chemistry & Pollution control	S. S. Dara	S. Chand Publication
6	Engineering Chemistry	M. M. Uppal	Khanna Publisher New Delhi

B) Software/Learning Websites

1. http://chemistry.osu.edu/~woodward/ch121/ch2_atoms.htm
2. http://www.nyu.edu/pages/mathmol/textbook/atoms.html
3. www.chemguide.co.uk/atoms/properties/gcse.html
4. http://www.water-research.net/index.php/water-treatment/tools/hard-water-hardness
5. http://www.unitedutilities.com/documents/WaterhardnessFactSheet.pdf
6. http://www.explainthatstuff.com/alloys.html
7. http://www.gordonengland.co.uk/xcorrosion.htm
8. http://cuiet.info/notes/chemistry/Lubricants.pdf
9. http://www.ignou.ac.in/upload/unit-3.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Muffle furnace
2. Distillation Plant

3. Computer lab with 20 Computers for online theory exam.
4. Digital pH meter
5. Ostwald's viscometer
6. Electronic weighing balance (0 to 100gm capacity).
7. Digital Stop watch.
8. Lovibond comparator
9. Regulated DC power supply
10. Rheostat
11. Ammeter

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M	M		L			L			L
CO2	H		M	M	L						L
CO3	H			M							L
CO4	H			M							L
CO5	H	M	L		M			L			
CO6	H	M		M	M						L
CO7	H			M	M						L
CO8	H			M	M						L
CO9	H										L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / AE
COURSE : Engineering Mechanics (EMH) **COURSE CODE :** 6108

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

This course helps students in understanding correlation between different engineering and day to day's problems with the knowledge of different laws and principles of mechanics. It helps in solutions to problem related to forces acting on body. It also helps in understanding concept and application of Equilibrium, friction, centroid and Kinetics.

It helps in understanding concept of work, power and energy. Study of simple machines gives idea about input, output, efficiency and friction of machine. Understanding of this course facilitates easy learning of higher level course like strength of materials, Mechanics of structures, Theory of structures and Reinforced concrete structures.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the basic concepts of Forces, Equilibrium, Friction, Centre of gravity, Kinetics, Kinematics and simple Machines
2. Understand the basic concepts related to resolution and composition of forces, equilibrium condition, and frictional force, centre of gravity, momentum, impulse energy, and mechanism of machines.
3. Understand the basic principles of Lami's Theorem, Newton's law of motion, law of conservation of energy, law of machines, and laws of friction.

3.0 COURSE OUTCOMES:

Students shall be able to acquire specified learning outcomes in cognitive, psychomotor and affective domain to demonstrate the following course outcomes

1. Describe working of different machines and calculate Velocity Ratio & Efficiency of different Machines.
2. Draw free body diagram of forces acting on a body.
3. Apply laws and principles of mechanics to different practical situations.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamental Concepts**	1a. Differentiate Scalar and Vector quantities 1b. Define basic terms relevant to mechanics. 1c. Describe different coordinate systems.	1.1 Mechanics and its relevance to Engineering, Fundamental concepts-scalar quantities, vector quantities 1.2 Concept of rigid body, Definitions of deformable body, Particle, mass and weight Statics, Dynamics (Kinematics and Kinetics). 1.3 Reference frames of Axes a) Rectangular co-ordinate system b) Polar co-ordinate system. 1.4 Fundamental units, derived units and different systems of units.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		1.5 Newton's laws.	
Unit-II **Simple Lifting Machines**	2a. Compute M.A, V.R., Efficiency, Law of Machines for given Machines	2.1 Basic concepts-load, effort, input, output, mechanical advantage, velocity ratio, efficiency of machine, Law of machine, friction in the machine, ideal machine, reversibility of machine 2.2 Study of machines-simple wheel and axle, differential axle and Wheel, pulley blocks, simple screw jack, worm and worm wheel, winch crab (single & double purchase). 2.3 Numerical examples on above mentioned machines	08
Unit-III **Force**	3a. Identify and differentiate different force system 3b. Apply the laws to compute the resultant of given force system	3.1 Concept of force, Coplanar and Non coplanar force system Classification of co planer force system such as collinear, Concurrent, Non concurrent, Parallel, Like Parallel, Unlike Parallel, and General force System. 3.2 Law of transmissibility of a force, parallelogram law of forces, resolution and composition of forces, resultant, triangle law of forces, polygon law of forces. 3.3 Resultant of a coplanar concurrent force system (Analytical method) 3.4 Turning effect of force-Moment, Couple, nature of moment, characteristics of couple. 3.5 Varignon's theorem of moments and its application to coplanar parallel and non-concurrent force systems. Resultant of coplanar non concurrent force system (Analytical method)	16
Unit-IV **Equilibrium**	4a. Draw Free Body Diagram 4b. Apply Lami's Theorem 4c. Compute support reactions for given beam	4.1 Concept of Equilibrium, Analytical Conditions of equilibrium, equilibrant. 4.2 Free body diagrams (FBD) 4.3 Lami's theorem and its applications 4.4 Reactions at supports of beams-types of supports, types of loads types of beam 4.5 Determination of beam reactions-cantilever beams, simply supported beam and overhanging beam subjected to concentrated loads, uniformly distributed loads and applied moments or couples (Analytical method only)	13
Unit-V **Friction**	5a. Appreciate Friction and its engineering application 5b. Calculate friction forces and coefficient of friction	5.1 Introduction, frictional force 5.2 Laws of friction (static friction only), coefficient of friction, angle of friction, angle of repose. 5.3 Body resting on Horizontal plane, inclined plane and forces acting on the body in	07

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		any direction	
Unit-VI **Centroid and Centre of Gravity**	6a. Distinguish between Centroid and Centre of Gravity 6b. Compute Centroid and Centre of Gravity of different plane laminas and solids	6.1 Definition and Concept of centre of gravity and Centroid. 6.2 Centroid of line segment, centroid of regular areas such as rectangle, square, triangle, circle, semicircle, quarter circle. Problems on location of centroid of composite area consisting of above mentioned regular areas. 6.3 Centre of gravity of regular solids such as cube, rectangular prism, sphere, hemisphere, cylinder, solid cone. Problems on location of centre of gravity of composite solids consisting of above mentioned regular solids.	08
Unit-VII **Dynamics**	7a. State equations of motion. 7b. State Newton's Laws, Impulse Momentum equation and Work Energy Principle 7c. To compute work, Power and Energy	7.1 Introduction to dynamics, definition of Kinematics and, types of motion of particle, equations of motion, (No numerical problems on Kinematics) 7.2 Introduction to kinetics, Newton's laws, 7.3 definition of Impulse, momentum, Impulse momentum equation, law of conservation of momentum (No numerical Problems on above) 7.4 Work-power Energy, definitions, units, graphical representation of work, law of conservation of energy, work energy principle, Numerical examples.	08
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamental concepts	02	02	--	04
II	Simple Lifting Machines	02	--	06	08
III	Force	02	04	12	18
IV	Equilibrium	02	04	12	18
V	Friction	--	02	08	10
VI	Centroid and Centre of Gravity	--	04	08	12
VII	Dynamics	02	04	04	10
	TOTAL	**10**	**20**	**50**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
	A	Any **Four** of following Exercises	
1	I	Differential axle and wheel	02
2		Simple screw jack	02
3		Worm and worm wheel	02
4		Single gear crab	02
5		Double gear crab	02
6		Two sheaves & three sheaves pulley block	02
7		Differential pulley block	02
8		Geared pulley block	02
	B	Any **Two** of following Exercises	
9	III	Verification of law of polygon of forces	04
10		Verification of law of moments	04
11		Study of forces in the members of jib crane	04
	C	All of the following Exercises	
12	IV	Verification of Lami's theorem	04
13	IV	Beam Reactions	04
14	V	Determination of coefficient of friction	04
15	VI	Centroid of Regular and Irregular Lamina	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Observe and list different activities at home, on Roads and common places where simple machines are used.
2. Observe and list different activities at home, on Roads and common places where principles of Mechanics are involved.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show different simple lifting machines used in workshops and other work places.
2. Show Videos and slides involving application of different Principles of Mechanics.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Theory and problems of Engineering Mechanics-Schaum's outline series Statics and Dynamics SI Edition	E. Nelson, Charles Best & William McLean.	McGraw Hill
2	Engineering Mechanics statics and dynamics	Singer	Harper Collins Publisher, India.
3	Vector mechanics for Engineers (statics and Dynamics)	Ferdinand P. Beer, E Russell Johnson	McGraw Hill
4	Applied Mechanics for polytechnics	P. S. Sawhney & Manikpure	S. Chand & Co. Ltd.
5	A text book of Applied Mechanics	Ramamrutham	Dhanpat Rai Pub. Co.

Sr.No.	Title of Book	Author	Publication
			(P) Ltd., New Delhi
6	Text Book in Applied Mechanics	M. M. Malhotra, R. Subramanion, P. S. Gahlot	New Age International (P) Ltd. Publishers, New Delhi

B) Software/Learning Websites

www.nptel.com, www.youtube.com, www.howstuffworks.com, www.sciencedirect.com, www.wikipedia.org

C) Major Equipments/ Instruments with Broad Specifications

Force Table, Differential Axle & Wheel, Single and Double Purchase crab, Worm & Worm Wheel, Simple Screw Jack, Pulley Blocks, and Reaction of Beam Apparatus.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H						M			M
CO2	H	H						M			
CO3		H									M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / EE / PS / AE
COURSE : Workshop Practice (WSP) **COURSE CODE** : 6109

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	Test	TH+TEST	PR	OR	TW	Total
--	--	06	06	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Engineering diploma technician is expected to know conventional workshop practices like welding, Fitting, Drilling, Tapping, Plumbing and hot working processes. The students are required to identify, operate and control various power tools and machines. They should be able to select and use various tools and equipments for various operations and processes like welding, fitting, taping, Plumbing and forging.

The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each shop.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop basic engineering workshop skills.
2. Impart basic knowhow of various hand tools and their uses in different sections of workshop.
3. Enhance hands on experiences to learn manufacturing, production and advanced manufacturing processes.
4. Develop a skill in dignity of labour, precision at work place, team working and development of right attitude.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Know basic workshop processes.
2. Read and interpret job drawing.
3. Identify, select and use various marking, measuring, holding, striking and Cutting tools & equipments.
4. Operate, control different machines and equipments.
5. Inspect the job for specified dimensions
6. Produce jobs as per specified dimensions.
7. Adopt safety practices while working on the shop floor

4.0 COURSE DETAILS:

The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Introduction of workshop**	1a. Sketch general workshop layout. 1b. Follow preliminary safety rules in workshop.	1.1 Workshop layout. 1.2 Importance of various shops/ sections of workshop. 1.3 Types of jobs to be done in different sections of workshop. 1.4 General safety rules and work procedures in the workshop.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-II **Fitting Section**	2a. Select appropriate Fitting tools for required application. 2b. Prepare the simple Job as per drawing and specifications by using fitting tools.	2.1 Sketches, specifications and applications of different work holding fitting tools. 2.2 Fitter's bench vice, V-block, Clamps. Sketches, specifications, material, applications and methods of using fitting marking and measuring tools-marking table, surface plate, angle plate, universal scribing block, try-square, scriber, divider, centre punch, letter punch, callipers, digital vernier callipers, height gauge etc. 2.3 Types, sketches, specifications, material, applications and methods of using of fitting cutting tools hacksaw, chisels, twist drill, taps, files, dies. 2.4 Types, sketches, specifications, material, applications and methods of using of fitting finishing tools-files, reamers. 2.5 Sketches, specifications and applications of miscellaneous tools, hammers, spanners, screwdrivers sliding screw wrench. 2.6 Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.etc. 2.7 Preparation of simple and male-female joints. 2.8 Safety precautions at work place in fitting section.
Unit-III **Carpentry Section**	3a. Select appropriate Fitting tools for required application. 3b. Prepare the simple Job as per drawing and specifications by using carpentry tools.	3.1 Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule etc. 3.2 Types of woods and their applications. 3.3 Types of carpentry hardware's and their uses. 3.4 Demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining etc. 3.5 Preparation of wooden joints. 3.6 Safety precautions.
Unit-IV **Plumbing Section**	4a. Select appropriate pipe fitting tool for the required application. 4b. Prepare the simple job as per specification using pipe fitting tools.	4.1 Types, specification, material and applications of pipes. 4.2 Types, specification, material and applications of pipe fittings. 4.3 Types, specifications, material, applications and demonstration of pipe fitting tools. 4.4 Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling etc. 4.5 Types and application of various spanners such as flat, fix, ring, box, adjustable etc. 4.6 Preparation of pipe fitting jobs. 4.7 Safety precautions.
Unit-V **Welding Section**	5a. Select appropriate equipment and consumables for required application. 5b. Prepare the simple	5.1 Types, specification, material and applications of arc welding transformers. 5.2 Types, specification, material and applications of arc welding accessories and consumables. 5.3 Demonstration of metal joining operations-arc

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	jobs as per specification using proper metal joining and cutting method.	welding, soldering and brazing. Show effect of current and speed. Also demonstrate various welding positions. 5.4 Demonstrate gas cutting operation. 5.5 Preparation of metal joints. 5.6 Safety precautions.
Unit-VI **Smithy Section**	6a. Select appropriate Smithy tools for the required application. 6b. Prepare the simple jobs as per specification using Smithy tools.	6.1 Introduction to tools and equipments. 6.2 Smithy and Forging operations 6.3 One job of J Hook or I Hook 6.4 (Using round or square bar)
Unit-VII **Tin Smithy**	7a. Select appropriate tin smithy tool for the required application. 7b. Prepare the simple job as per specification using tin smithy tools.	7.1 Concept and conversions of SWG and other gauges in use. 7.2 Use of wire gauge. 7.3 Types of sheet metal joints and applications. 7.4 Types, sketch, specification, material, applications and methods of using tin smithy tools-hammers, stakes, scissors / snips etc. 7.5 Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining. 7.6 Preparation of tin smithy job. 7.7 Safety precautions.

5.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills leading to the achievement of the competency. **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Prepare carpentry and fitting shop layout.	02
2	II	Demonstrate use of different fitting tools-like work holding, marking, measuring, cutting, finishing and miscellaneous. Student will also prepare the report with sketch, specifications and applications of fitting tools demonstrated.	04
3	II	Two jobs : Prepare one simple and another male-female type fitting jobs as per given drawings and specifications.	10
4	III	Demonstrate use of different carpentry tools. Student will also prepare the report with sketch, specifications and applications of carpentry tools demonstrated.	04
5	III	Prepare one Job from the following allotted to a group of 4 to 6 student depending of volume work involving different joints, Turning and paining	12

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
		operation, surface finishing by emery paper, varnishing and polishing e. g. Electric switch board, pat, Chaurang, Table, Racks etc. OR One simple job involving any one joint like mortise and tendon dovetail bridle half lap etc. One Job per student	
6	IV	Demonstrate use of different pipe fitting tools. Student will also prepare the report with sketch, specifications and applications of pipe fitting tools demonstrated.	04
7	IV	**Two jobs :** Prepare pipe fitting jobs as per drawings and specifications.	12
8	V	Demonstrate use of different welding transformers and consumables. Also demonstrate arc welding, gas cutting, soldering and brazing operations. Student will also prepare the report with sketch, specifications and applications of welding tools demonstrated.	04
9	V	Prepare jobs using arc welding, gas cutting, spot welding, brazing and soldering process: - One simple job involving "Butt", "lap" and "T" joint, and utility article as per drawing and specifications.	12
10	VI	Demonstrate use of different smithy tools, operations. Student will also prepare the report with sketch, specifications and applications of smithy tools demonstrated.	04
11	VI	**One job :** Prepare one smithy job as per drawing having Job of J Hook or I Hook (Using round or square bar)	12
12	VII	Demonstrate use of different tin smithy tools. Student will also prepare the report with sketch, specifications and applications of tin smithy tools demonstrated.	04
13	VII	**One job :** Prepare one tin smithy job as per drawing having shearing, bending, joining and riveting.	12
		TOTAL	**96**

6.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

Sr. No	Student Activity
1	Prepare student reports as asked in the workshop practical assignment.
2	Visit the nearer timber merchant. Collect the information on types and appearance of wood being sold by them.
3	Visit the nearer plywood merchant. Collect the information on type and thickness being sold by them.
4	Visit nearer fabricator. Collect the information on welding electrodes, transformers and accessories being used by them.
5	Down load movies showing correct practices for fitting, carpentry, Smithy and welding.
6	Assignments on workshop technology tools equipments & processes used in above shops.

NOTES:

1. It is compulsory to follow safety norms while working in the workshop.
2. Preparation Workshop book is compulsory. Record of activities performed by
3. Student in each period is also compulsory and must be duly certified by concerned technical staff and teacher in routine workshop book.
4. Keep your all tools duly resharpened/ready.
5. It is compulsory to submit reports of student activities and workshop book.
6. Students activities are compulsory to perform.
7. Students are to be continuously assessed for competencies achieved.
8. Each student is required to submit the specified term work

7.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to workshop technology.
2. CBT Packages.

8.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1.	Mechanical workshop practice.	K.C. John	PHI
2	Workshop Technology-I.	Hazra and Chaudhary Media	promoters & Publisher private limited
3	Workshop Technology-I.	W.A. J. Chapman	Taylor & Francis.
4	Comprehensive Workshop Technology (Manufacturing Processes).	S.K. Garg	Laxmi publications.
5	Workshop practice manual.	K. Venkata Reddy	B.S. Publications.
6	Workshop familiarization.	E. Wilkinson	Pitman engineering craft series.
7	Workshop Technology	B. S. Raghuwanshi	Dhanpat Rai and Sons, New Delhi
8	Workshop Technology	H. S. Bawa	Tata McGraw Hill Publishers, New Delhi
9	I.T.B. Handbook.	-	Engineering industry Training Board.
10	Production Technology Hand Book HMT	-	Tata-McGraw Hill Publisher, New Delhi.

B) Software/Learning Websites

1. http//www.nptel.ac.in
2. http//www.howstuffworks.com
3. http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
4. http://www.weldingtechnology.org
5. http://www.newagepublishers.com/samplechapter/001469.pdf
6. http://www.youtube.com/watch?v=TeBX6cKKHWY
7. http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related
8. http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu
9. http://www.piehtoolco.com
10. http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/

C) Major Equipments/ Instruments with Broad Specifications

Sr.No.	Name Of Equipments/ Instruments	Qty
	Carpentry Section	
1	Circular saw	1
2	Jig-saw	1
3	Wood Planer	1
4	Drilling Machine Bench Type	1
5	Universal wood working Machine	1
6	Bench Grinder	1
7	Hand Tools Kit	20 Sets
8	Carpentry Bench Vice	20
9	Wood Turning Lathe	5
10	Measuring Tools & Gauges	20 Sets
11	Electrician Tool Kit	2
12	Carpentry Work Bench	20
13	Band Saw	1
14	Band saw and Circular Saw Sharpener	1
15	Chain And Chisel Mortising Machine	1
16	Vertical Sander	1
17	Heavy Duty Circular Saw	1
18	Heavy Duty Variable Speed Reciprocating Saw Kit	1
19	Single Speed Impact Drill.	1
20	ANGLE GRINDER.	1
21	Cordless drill (Keyed Chuck)	1
22	Heavy Duty palm grip sander	1
23	Heavy Duty Router	1
	Fitting Shop	
1	Marking Table with scribers	2
2	Surface plate	2
3	Measuring Instruments, Marking Instruments, Fitting Hand Tools	2 Each
4	Tap & die set.	5 Sets
5	Bench Drilling Machine	1
6	Bench Grinder	1
7	Fitting Shop Vice Size-100/150 mm.	20
8	Electrically operated Hand Drilling Machine (pistol Type)	2
9	Power Hack Saw Machine	1
10	Pedestal Grinder	1
11	Hand Grinder	1
12	Fitter's Work Bench	10
13	Hand Press Double (Pillar Type)	1
14	Arbor Press	1
	Smithy Shop	
1	Hearth with blower	5
2	Anvil	5
3	Leg Vice Size-150mm.	5
4	Swage Black	2
5	Tools and Gauges	20
6	Power Hammer	1
7	Bench Grinder	1
8	Work Bench With vice	2
9	Induction Hardening equipment	1
	Welding Shop	
1	Oil Cooled Arc Welding Transformer Three Phase With Standard Accessories	2
2	Single Phase Air-cooled arc Welding Transformer with Accessories	2

Sr.No.	Name Of Equipments/ Instruments	Qty
3	Light Duty Spot Welding Machine	1
4	Oxy-Acetylene Gas Welding Set	1
5	Soldering Irons	2
6	Double Ended Pedestal Type Grinder	1
7	Welding accessories	1
8	Electrician Tool Kit	2 Set
9	MIG / Welding Equipment	1
10	T. I. G. Welding set.	1
11	Work Bench With Vice Size-1800 x 1200 x 750 mm	2
12	Welding Table Size-1200 x 1200 x 750 mm With sliding tray	2
13	DC Arc Welding Transformer Rectifier type 3 Phase	1
14	Brazing Equipment and Accessories	1
15	Heavy Duty Angle Grinder.	1
16	Heavy Duty 10 mm. VSR Cordless Drill / Driver Kit.	1
	Sheet Metal & Plumbing Shop	
1	Shearing Machine	1
2	Sheet Bending Machine	1
3	Pipe Bending Devices	1
4	Hand Tools and other Equipment	1
5	Pipe Threading Dies	5
6	Portable Drilling Machine	1
7	Plumber Pipe Vice Size-50 mm., 12 mm. to 24 mm.	1 & 20
8	Plumber's Tool Kit	1
9	Stoving Oven	1
10	Plumber's Work Bench Size-1800 x 1200 x 750 mm	2
11	Swaging Machine	1
12	Universal sheet Folding Machine	1
13	Double Column Power Press	1
14	Hydraulic Press	1
15	Circle Cutting Machines	1

Note:-Latest Technology & specifications are to consider at the time procurement.

9.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H							M	L	M
CO2		M							M		
CO3	H										
CO4			H	M							M
CO5		M	H	L				H			
CO6			H		M		H	H			
CO7			H			L	H				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / PS / EE
COURSE : Computer Aided Graphics (CAG) **COURSE CODE** : 6201

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

This course provides the basic knowledge of the Computer Aided Drafting for Civil / Plastic / Electrical Engineering.

This course gives basic foundation knowledge for advance computer based software. Today the manufacturing industries needs the computer oriented man power for their global needs and to cope up the fast changing technology. Moreover, the conventional method of drafting of the objects has been replaced by computer-based drafting. Therefore this course is introduced in the present curriculum.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the importance of Computer Aided Drafting (CAD).
2. Use basic CAD command to develop 2D drawings.
3. Use CAD commands for edit/modification of existing drawings as per needs and suggestions.
4. Print the drawing.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. State the applications, advantages and features of CAD.
2. Execute CAD commands.
3. Prepare a simple drawing file using basic draw commands.
4. Apply basic CAD command to develop 2D drawings related to discipline.
5. Apply CAD commands for edit/modification of existing drawings.

4.0 COURSE DETAILS:

There are no separate classes for theory as given below. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Introduction to Computer Aided Drawing**	1a. State the applications and advantages of CAD 1b. State the features of CAD as drafting package 1c. State the hardware requirements to run CAD	1.1 Advantages of CAD 1.2 Applications of CAD, Components of CAD system
Unit-II **Basic menus in CAG**	2a. Identify component of the drawing screen. 2b. Apply the methods of selecting/entering commands to start new drawing	2.1 Opening of Drawing, commanding CAG, Command windows, text window, AutoCAD Command, 2.2 Entering commands at command prompt, Pull down Menus, Screen menus, Entering command from dialog

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	2c. Execute CAD commands by selecting from menus, tool bars and entering Commands on command line. 2d. Set the limits of the drawing to get the needed working area. 2e. Apply the 'setting commands' Grid, Snap, & Ortho Commands.	box. 2.3 Using transparent command, Repeating command and, System variables, 2.4 Co-ordinates system: WCS, UCS, UCSICON. UNITS, Setting of drawing screen using limits and zoom all command, Display of co-ordinates on screen, 2.5 Entering the Co-ordinates: Cartesian coordinate, polar coordinate, scale factor, limits setting, Grid setting, snap setting, Creating, saving and exiting / end drawing files.
Unit-III **Drawing Display Commands.**	3a. Apply display commands and commands to view drawing. 3b. Apply 'view commands'	3.1 Zoom in and zoom out command & dynamic zoom, Size of windows, View command, PAN command, Redraw – Regen command, Blipmode & Redraw command, Viewers' command, Hide command, View ports command, Plan command, fill command, Drag Mode command
Unit-IV **Drawing Commands**	4a. Prepare a simple drawing file using basic commands 4b. Apply 'Draw commands'.	4.1 Point, Line, Circle, Arc, Ellipse, polygon, Pline, Donut, Trace. 4.2 Osnap Modes, Aperture command, Text and dtext command, style command, Shape command.
Unit-V **Edit Commands**	5a. Explain the applications of Edit commands 5b. Modify existing drawing. 5c. Apply 'modify commands.	5.1 Select, Erase, oops, move, copy, Array, Explode, List, Rotate, Break, trim, extend, Fillet, Chamfer, Divide, Offset, Change, Chprop, Pedit, Area, Measure, Mirror, Dlst, Stretch, U, Undo.
Unit-VI **Dimensioning Commands.**	6a. Dimension the given figures.	6.1 Linear dimensioning concept. 6.2 Dim: Continue, Baseline, Angular, Diameter 6.3 Dimension editing commands - New text, Tedit, Trotate, Hometext, Update, Dimension Utility Commands.
(Only For PS) Unit-VII **3-D Commands**	7a. Apply 3D commands to given drawing.	7.1 Extrude, Change properties, Region Hide, Union, Pan, Hidden, 3-D mesh, Subtract, Revolve, Shade, 3D view (SW, SE, NE, NW, TOP, Bottom, left, right, front, back) View ports (1, 2, 3, 4 view ports), 3D Orbit.

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Laboratory Work:

A) For Civil Engineering Programme only

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I, II, III	Study and use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	IV	Draw 2mm, 4 mm and 6mm text used for civil engineering drawing	04
3	IV, V	Draw five symbols each of following a) Civil Engineering Materials b) Doors and Windows c) Water supply and Sanitary Fittings d) Electrification	08
4	I to VI	Draw Plan, Elevation and Side view for steps or any civil engineering object	04
5	I to VI	Draw Line plan for a small residential / public building	08
6	I to VI	Draw Section of load bearing wall up to parapet for a single storeyed building.	08
7	I to VI	Draw Plan and section of an isolated RCC column footing.	04
8	I to VI	Draw Plans for any four types of stairs used in residential building	04
9	I to VI	Draw Detailed Plan and Elevation of single storeyed flat roofed small residential building	16
		TOTAL	**64**

B) For Electrical Engineering Programme only

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I, II, III	Study and use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	IV	Draw 2mm, 4 mm and 6mm text used for Electrical engineering drawing	04
3	IV, V	Draw electrical symbols for various electrical devices	08
4	I to VI	Draw circuit diagram for godown and staircase wiring	04
5	I to VI	Draw control and power circuit diagram for DOL starter	08
6	I to VI	Draw front panel of an electronic digital multimeter	08
7	I to VI	Draw transmission tower of single circuit or double circuit	04
8	I to VI	Draw electrical installation plan for small residential unit	04
9	I to VI	Draw single line diagram and wiring diagram of three phase induction motor connected to supply with star delta starter.	16
		TOTAL	**64**

For Plastic Engineering Programme only

Sr. No.	Unit No.	Name of Laboratory work	Hours
1	I to VI	Use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	VII	Use of 3D commands such as Extrude, Change properties, Region Hide, Union, Pan, Hidden, 3-D mesh, Subtract, Revolve, Shade, 3D views etc.	12
3	I to VII	Draw standard plates for injection mould.	04
4	I to VII	Draw sprue bush, guide pin, ejector pin, stopper pin and ejector rod for injection mould.	04
5	I to VII	Draw different types of gate in injection mould with section.	04
6	I to VII	Draw locating ring and guide pillar with dimensions and section.	08
7	I to VII	Draw different plastic products with dimensions by using 3D commands.	08
6	I to VII	Draw balanced runner layout for 8, 16, 32 and 64 cavities with dimensions.	08
7	I to VII	Draw single cavity two plate injection mould with section and dimensions.	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

i. FOR CIVIL ENGINEERING STUDENTS

1. Visit to architect/civil engineering firm for understating the CAD and its applications and study of typical drawings prepared by AutoCAD
2. Collect different types of civil drawings in hard copy from architects, builders and practicing engineers prepared using CAD software

ii. FOR ELECTRICAL ENGINEERING STUDENTS

1. Contact a design engineer, understand the use of computer aided drawings in profession
2. Visit to an industrial workshop collect various electrical drawings.

iii. FOR PLASTIC ENGINEERING STUDENTS

1. Visit to TECHNOCAD/ACCESSCAD/MG DESIGNERS AND ENGINEERS or any other CAD institutes or CAD/CAM centre.
2. Collect and practice mould / die drawings from industries.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Lecture Method, Use of teaching aids, Industrial Visits, Demonstrations and Expert Lectures.

9.0 LEARNING RESOURCES

A) Books

Sr.No.	Title of Book	Author	Publication
1	Auto Cad 2005	George, Omura B. Robert Callori	BPB Publisher
2	Auto Cad 2005 Instant Reference	George Omura B. Robert Callori	BPB Publications
3	Auto Cad 2007 Bible	Famkline	Wiley
4	Auto Cad 2007 L T	Fred·Bery	Wiley
5	Working With AutoCAD	Ajit Singh	Tata McGraw Hills

B) Software/Learning Websites

AutoCAD

1. http://www.ferris.edu/htmls/academics/course.offerings/hillm/MYWEB7/index.html
2. http://mould-technology.blogspot.in/search/label/Mold%20Construction
3. http://webhotel2.tut.fi/projects/caeds/tekstit/mould/mould_structure.pdf
4. http://mould-technology.blogspot.in/2008/02/basic-functions-of-mold-base-parts.html

C) Major Equipments/ Instruments with Broad Specifications

1. Computers
2. LCD Projectors
3. Printers

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M									
CO2	H	M	H	H	M						M
CO3	H	H	H	H	M	L	M	M	M		M
CO4	H	M	H	H	M						M
CO5	H	M	H	H	M						M

H: High Relationship, M: Moderate Relationship, L: Low Relationship

PROGRAMME : Diploma Programme in ME / PS / AE
COURSE : Engineering Drawing (EDG) **COURSE CODE** : 6212

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
02	--	04	06	04	Max.	80	20	100	--	--	25	125
					Min.	32	--	40	--	--	10	--

1.0 RATIONALE:

Engineering drawing is the graphical language of engineers. It describes the scientific facts, concepts, principles and techniques of drawing in any engineering field to express the ideas, conveying the instructions, which are used to carry out jobs in engineering field. This course aim for building a foundation for the further course in drawing and other allied courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the basic concepts of engineering drawing.
2. Visualize the objects.
3. Draw different views in different positions of objects.
4. Draw the different views of machine elements.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Interpret missing view from given orthographic view
2. Draw auxiliary views of machine component.
3. Draw projections of line and plane inclined to both reference planes.
4. Differentiate true shape and apparent shape of solids.
5. Interpret the positions of section plane and draw projections of solids.
6. Develop lateral surfaces of different solids.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-1 **Missing Views (only for ME/AE)**	1a. Interpret given orthographic views 1b. Draw missing views of different objects	1.1 Draw missing view from the given Orthographic views-simple components (First Angle Projection Method only)	04
Unit-I **Orthographic Projections (only for PS)**	1a. Interpret & draw orthographic views from given pictorial view.	1.1 Concept of Orthographic projections. 1.2 Conversion of pictorial view into Orthographic views only first angle projection method.	04
Unit-2 **Auxiliary Views**	2a. Interpret given orthographic views 2b. Draw auxiliary views	2.1 Draw complete view from the given partial orthographic views 2.2 Draw auxiliary view for the given machine part.	04
Unit-3 **Projection of Lines and Planes**	3a. Draw projections of line 3b. Draw projections of planes.	3.1 Draw projections of lines inclined to both reference planes 3.2 Draw projections of planes inclined to both reference planes	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-4 **Projections of Solids.**	4a. Interpret orientation of solids with respect to principal planes. 4b. Draw its projection.	4.1 Projections of Prism, Pyramid, Cone, Cylinder, Tetrahedron, Cube with their axes inclined to one reference plane and parallel to other.	05
Unit-5 **Sections of Solids.**	5a. Interpret orientation of section plane with respect to principal planes. 5b. Interpret orientation of solids with respect to principal planes. 5c. Draw projection of solid.	5.1 Solids:-Prism, Pyramid, Cone, Cylinder, Tetrahedron, Cube resting on their base on HP/VP. 5.2 Section plane inclined to one reference plane and perpendicular to other.	05
Unit-6 **Developments of Surfaces.**	6a. Interpret orientation of solids with respect to principal planes. 6b. Develop the lateral surfaces of various solids and understand its engineering applications	6.1 Developments of Lateral surfaces of cube, prisms, cylinder, pyramids, cone and their applications such as tray, funnel, Chimney, pipe bends etc.	06
TOTAL			**32**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I (only for ME/AE)	Missing views	02	04	10	16
I (only for PS)	Orthographic Projections	02	04	10	16
II	Auxiliary views	02	04	06	12
III	Projections of Lines and Planes	02	06	08	16
IV	Projection of solid	02	04	06	12
V	Section of Solids	02	04	06	12
VI	Development of surface	02	04	06	12
	TOTAL	**12**	**26**	**42**	**80**

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

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1 (only for ME/AE)	I (only for ME/AE)	Draw one sheet on missing views. (Two problems)	08
1 (only for PS)	I (only for PS)	Draw one sheet on orthographic projection. (Two problems)	08
2	II	Draw one sheet on auxiliary views. (Two problems)	08
3	III	Draw one sheet on projections of lines. (Four problems) Draw one sheet on projections of planes. (Four problems)	12
4	IV	Draw two sheets on projections of solids. (Four problems)	12
5	V	Draw two sheets on sections of solids. (Four problems)	12
6	VI	Draw two sheets on development of surfaces. (Four problems)	12
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like
The student to

1. Identify applications of prism, pyramid, cone and cylinder.
2. Observe applications of development of lateral surfaces.
3. Observe applications of projections of lines, planes.
4. Find applications of auxiliary views.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI / confront computer software related to Engineering Drawing.
2. Arrange expert lectures of industry/academic person in the area of course.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Titles of Book	Author	Publication
1	Engineering Drawing	N. D. Bhatt	Charotar Publishing House
2	Engineering Drawing	R.K.DHAWAN	S. Chand and Company
3	engineering Drawing and Graphics + AutoCAD	K. Venugopal	New Age Publication
4	Engineering Graphics	K. R. Mohan	Dhanpat Rai and Publication Co.
5	Machine Drawing	R.K. Dhawan	S. Chand Co.

B) Indian Standards: SP46-1988

C) Software/Learning Websites

1. http://www.design-technology.info/IndProd/drawings
2. http://www.cognifront engineering.edu
3. Software Sketch up,

D) Major Equipments/ Instruments with Broad Specifications

1. Half Imperial size drawing sheet for practical/TW.
2. A3 size sketch book for class/assignment work.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H										
CO2		H									
CO3			M	H							
CO4				M							
CO5			M								
CO6					H						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in ME / PS / AE
COURSE : Strength of Materials (SOM) **COURSE CODE :** 6213

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	25	125
					Min.	32	--	40	--	--	10	--

1.0 RATIONALE:

Machine parts are made up of various materials and subjected to different types of loads. Their sustainability depends on the properties of the materials used. Different materials have different properties, which are important criteria for the design of the component. It is therefore essential, for technician to understand basic principles of design. This course deals with study of behaviors of machine parts under the applications of different types of forces. It also provides the laboratory work through which a technician confirms behavior of material under different types of load and appreciates the importance of the testing.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand different types of forces acting on machine parts.
2. Understand behaviour of materials under various types of forces.
3. Apply the basic principles to solve the problems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Calculate various material properties under direct loading Condition.
2. Calculate stresses on given plane for the element with given state of stress.
3. Draw shear force and bending moment diagram for different beams.
4. Calculate stresses due direct and bending in different components and draw stress distribution diagram.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Stress and Strain**	1a. Define different properties of Material 1b. Analyse simple, composite / compound sections and Calculate direct stress, different strains 1c. Compute punching shear stresses	1.1 Concepts of elastic, plastic and rigid bodies, concepts of deformation, stresses and strains different material Properties like Ductility, Brittleness, Hardness, Toughness, Malleability, Fatigue etc. 1.2 Axial tensile and compressive loads, Hooke's Law, axial stresses, axial strain, lateral strain, Poisson's ratio, volumetric strain, problems on bars of uniform cross section and different cross sections (stepped bars). 1.3 Behaviour of mild steel under tensile loading, stress-strain curve, limit of proportionality, yield stress, Ultimate stress, Breaking stress, factor of safety, safe stress, working stress. 1.4 Composite sections under axial load, modular ratio, simple problems on analysis of	15

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		composite sections 1.5 Concept of bi-axial stresses, tri-axial stresses, equations of total strain in three directions, Equation for Volumetric Strain. 1.6 Definition of temperature stress, nature of stresses. Simple problems on temperature stresses in homogeneous sections only 1.7 Concept of shear load, shear stress and shear strain, modulus of rigidity, simple shear, complementary shear stresses, Punching Shear. 1.8 Elastic constants, relation between modulus of Elasticity, modulus of rigidity and bulk modulus. (No derivations of these relations)	
Unit-II **Shear Force and Bending Moment**	2a. Draw Shear Force and Bending Moment Diagram for Statically Determinate Beams	2.1 Concept and definitions of shear force and bending moment, sign conventions, relation between bending moment, shear force and rate of loading. 2.2 Shear force and bending moment diagrams for simply supported, cantilever and overhanging beams subjected to concentrated loads, uniformly distributed load and couples, point of zero shear, Point of contra-flexure	12
Unit-III **Moment of Inertia**	3a. Compute Moment of Inertia of Symmetric and asymmetric structural sections	3.1 Concept of moment of inertia for plane areas, radius of gyration, expression for moment of inertia about centroidal axes for regular plane areas such as rectangular, triangular, circular and semicircular sections. Section modulus 3.2 Parallel axes theorem, perpendicular axes theorem, and polar moment of inertia. Moment of inertia of composite sections.	07
Unit-IV **Principal Planes and Principal Stresses**	4a. Calculate Normal and shear stress on a inclined plane in a element subjected to plane stress condition 4b. Calculate Principal Stresses, Principal Planes, maximum shear stress and their Planes.	4.1 Concepts of simple shear, Complementary shear, Element subjected to general state of stress (Plane stress condition i.e. Normal stresses in x, y direction and shear stress all in same plane). 4.2 Equations for Normal stress, shear stress on any plane, Principal planes and Principal stresses, maximum shearing stresses and their planes. (No Derivations of these equations) Resultant stress, angle of obliquity, Numerical problems on above.	09
Unit-V **Bending Stresses**	5a. Apply Bending Theory. 5b. Calculate Bending Stresses 5c. Draw stress 5d. distribution diagram	5.1 Concept of pure bending, theory simple bending, Assumption in the theory of pure bending, stress distribution diagram, Equation of moment of resistance, flexure equation (Derivation not required). 5.2 Application of theory of bending, moment of resistance for symmetrical and	07

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		unsymmetrical sections of beam. Simple numerical problems on standard sections. (No problems on built up sections)	
Unit-VI **Direct and Bending Stresses**	6a. Calculate Direct and Bending Stresses of various machine and structural components 6b. Draw stress distribution diagram for the given section	6.1 Concept of direct and eccentric loads 6.2 Tension and compression members subjected to load with eccentricity about one principal axis only, stress distribution, nature of stresses. 6.3 Condition for no tension, limits of eccentricity, maximum and minimum resultant stresses, core of section for rectangular and Circular sections, middle third rule. Resultant stress distribution diagram at given section. (No problems on Chimneys and Dam sections)	08
Unit-VII **Torsion**	7a. Calculate shear stresses due to torsion 7b. Draw shear stress distribution diagram for the shaft 7c. Calculate power transmitted by the shaft	7.1 Theory of pure torsion, twisting moment of resistance, equation of torsion, Assumptions in theory of pure torsion. 7.2 Shear stress distribution across a section of solid or hollow circular shafts, strength of solid circular shafts, polar modulus. 7.3 Power transmitted by solid circular shaft. (Numerical Problems on Solid circular shafts only)	06
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Stress and Strain	02	06	12	20
II	Shear Force and Bending Moment	02	04	10	16
III	Moment of Inertia	02	02	04	08
IV	Principal planes and principal stresses	02	02	06	10
V	Bending Stresses		02	06	08
VI	Direct and Bending Stresses	02	02	06	10
VII	Torsion		02	06	08
	TOTAL	**10**	**20**	**50**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
		Any Eight of the Following Exercises	
1	I	Identify and Observe Functions of different parts of Universal Testing Machine.	02
2	I	Tension test on mild steel, plotting stress strain curve, significant points.	04
3	I, IV	Compression test on metals.	02
4	I	Shear test on mild steel, aluminium, and brass rod. (Any Two Metals)	04
5	I	Izod and Charpy impact test on mild steel, aluminium, copper and brass (Any Two Metals).	04
6	II, III, V	Bending test on timber / metal specimens.	04
7	VII	Torsion test.	04
8	I	Rockwell hardness test.	02
9	I	Brinell hardness test	02
10	II	Drawing shear force and bending moment diagrams, 6 problems.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Observe and collect samples of different mechanical engineering materials used in Industry.
2. Carry out tests on different mechanical engineering materials in laboratory.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show Videos and slides involving conduct of Test on different Materials.
2. Arrange industry Visit.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Strength of materials	Singer and Pytel	Harper and Row, Publishers, New York
2	Mechanics of Materials	Beer and Johnson	McGraw Hills
3	Strength of Materials	Schaum's outline Series William Nash	McGraw Hill
4	Strength of Materials	Timo Shenko and Young	CBS Publisher and distributors
5	Strength of Materials	Ramamrutham	Dhanpat Rai and sons
6	Strength of materials	Khan R. S.	S. Chand
7	Strength of Materials	B. K. Sarkar	Tata McGraw Hill
8	Strength of materials	Sunil S. Deo	Nirali Publications

B) Software/Learning Websites

1. www.nptel.com, www.youtube.com, www.howstuffworks.com,
2. www.sciencedirect.com, www.wikipedia.org

C) Major Equipments/ Instruments with Broad Specifications

1. Digital Universal Testing Machine (1000kN), Compression Testing Machine (200 tonne), Torsion Testing Machine, Impact testing Machine, Hardness testing Machine.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H										
CO2	H	H									
CO3	H	H									
CO4		H	M								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in ME / PS / AE
COURSE : Electrical Technology (ELT) **COURSE CODE :** 6220

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	25	125
					Min.	32	--	40	--	--	10	--

1.0 RATIONALE:

A diploma technician has to handle and maintain electrical equipments machinery/instruments which involve use of devices, its parts, working principles of electrical engineering. For effective operation and maintenance of these systems they must have sound knowledge of concepts, principles, operation, industrial applications of electrical machines, electrical circuits, switches and relays.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire the knowledge of the basic electric rules, laws related to electric, magnetic circuits and electromagnetic induction.
2. Understand fundamentals of AC single phase supply
3. Understand the basic rules and laws to solve DC circuit
4. Know the various effects of an electric current
5. Get acquainted with star and delta connection.
6. Familiarize with machines and transformers and relays
7. Know the various types of switches

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Apply the basic rules and laws to solve DC circuit.
2. Differentiate between Electric and magnetic circuit.
3. Classify single phase and three phase AC supply system.
4. Identify the pats of DC motor and state its applications.
5. State applications of single phase and three phase induction motors.
6. Read and Interpret connections of switches and relays.
7. Use the transformer in application circuits.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals**	1a. Define basic electrical parameters 1b. State and apply Ohm's law to various circuits. 1c. Explain the laws of resistance. 1d. Differentiate between voltage drop and terminal Voltage 1e. Solve numerical based on Kirchhoff's current and	1.1 Concept of electric current, voltage, resistance, inductance, capacitance 1.2 Ohm's Law, concept of voltage drop and terminal Voltage 1.3 Kirchhoff's current and voltage laws. (Simple Numerical) 1.4 Effects of electric current- Heating, Magnetic and Chemical.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	voltage laws 1f. State the effects of electric current.		
Unit-II **Magnetism and Electromagnetic Induction**	2a. State various parameters for magnetism. 2b. Explain concept and laws of magnetic circuit. 2c. Differentiate between electric and magnetic circuit. 2d. Explain concept and laws of Electromagnetic Induction. 2e. Solve numerical based on induced EMF by different methods.	2.1 Definitions: magnetic flux, magnetic flux density, magnetic field strength, Magnetic Circuit: MMF, Reluctance, Permeance, Reluctivity 2.2 Comparison of electric and magnetic circuit 2.3 Fleming's Right hand rule, Lenz's law 2.4 Dynamically induced EMF and statically induced EMF, Self induced EMF and Mutually induced EMF (Simple Numerical)	08
Unit-III **Single Phase and Three phase system**	3a. Define various Parameters of AC fundamentals. 3b. State current, voltage and power relationship in pure resistive, inductive and capacitive circuit. 3c. Explain concept of reactance, impedance and power factor for R-L-C series circuit. 3d. Draw the power triangle 3e. State advantages of poly phase system over single phase system. 3f. Solve numerical based on Star and Delta Connection.	3.1 Comparison of DC and AC supply. 3.2 Equation for instantaneous value of alternating voltage and current 3.3 Definitions : Waveform, cycle, Time period, frequency, electrical and mechanical angle, Maximum value, average value and RMS value of sine wave, Form factor, Peak factor 3.4 Current, voltage and power relationship in pure Resistive, inductive and capacitive Circuit. 3.5 Concept of reactance, impedance, power factor for R-L-C series Circuit. 3.6 Concept of Active (kW), Reactive (kVAR) and Apparent power (kVA) 3.7 Advantages of polyphase system over single phase system 3.8 Star Connection, relation between line values and phase values of current, voltages (No derivation) (Simple Numerical) 3.9 Delta Connection, relation between line values and phase values of current, voltages (No derivation) (Simple Numerical)	08
Unit-IV **Transformer**	4a. State Working Principle of single phase transformer 4b. Classify single phase transformer 4c. Describe construction of	4.1 Working Principle of single phase transformer 4.2 Construction details : Parts and their function 4.3 Classification-Core type and	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	Single phase transformer. 4d. Derive emf equation of transformer. 4e. State concept of kVA rating of a transformer and transformation ratio. 4f. Solve numerical on Transformation ratio, regulation and efficiency. 4g. Interpret performance of transformer from Load Test. 4h. Draw winding connections of three phase transformer. 4i. State working concept of Autotransformer and its applications.	shell type 4.4 Derivation of EMF equation of a transformer 4.5 kVA rating of a transformer, Voltage ratio, current ratio, transformation ratio (Simple Numerical) 4.6 Losses in transformer, Efficiency and Regulation of transformer by load test (Simple Numerical) 4.7 Three Phase transformer, winding Connections 4.8 Autotransformer-concept and Applications	
Unit-V **DC Motor**	5a. Explain construction and working principle of DC motor 5b. State types of DC Motor with their Applications. 5c. Draw connection diagram and Speed-Torque characteristic of DC shunt Motors. 5d. Explain speed control methods. 5e. Explain 3 point starter	5.1 Construction and working Principle 5.2 Classification on the basis of connection 5.3 Speed-Torque characteristic of DC shunt motor, and speed control Applications 5.4 Necessity of starter, 3 point starter	04
Unit-VI **Three Phase Induction Motor**	6a. Explain construction and working principle of induction motor. 6b. State types of induction motor with their applications. 6c. Draw connection diagram and Torque slip characteristic of induction motors. 6d. Explain Necessity of starter for induction motor. 6e. State selection criteria of induction motor. 6f. State types enclosures of Induction motor.	6.1 Principle of operation 6.2 Construction, Types of rotor : squirrel cage and slip ring 6.3 Synchronous speed, slip speed 6.4 Torque-slip characteristics of induction motor 6.5 Necessity of starter, Different types of starter (only names) 6.6 Reversal of rotation of three phase motor 6.7 Applications in industry 6.8 Selection criteria of motor, 6.9 Types of enclosures.	08
Unit-VII **Single Phase Motors**	7a. State types of single phase Induction motor. 7b. Draw schematic diagram, Torque speed characteristic of single phase induction motors. 7c. List down applications of single phase motors.	7.1 Types-Resistance split phase, Capacitor split phase (Schematic diagram, T-N characteristic, applications) 7.2 Universal Motor-Principle of operation, T-N characteristic, Applications	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-VIII **Switches and relays**	8a. Explain construction and Woking of relays and switches 8b. Explain limit switches and actuators 8c. State applications of switches, relays and contactors,	8.1 Basic Construction, working, connections, types and applications of: • Electromechanical relay, • Single-pole, double-throw (SPDT) switch • Double-pole, double-throw (DPDT) switch 8.2 Actuators, Limit Switches, Power Contactors.	04
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamentals	04	04	--	08
II	Magnetism and Electromagnetic Induction	04	04	04	12
III	Single Phase and Three phase system	04	04	06	14
IV	Transformer	02	04	06	12
V	DC Motor	02	02	04	08
VI	Three Phase Induction Motor	04	04	06	14
VII	Single Phase Motors	02	--	04	06
VIII	Switches and relays	02	04	--	06
	TOTAL	**24**	**26**	**30**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Verification of Ohm's Law	02
2	I	Verification Of KCL and KVL	04
3	III	Determine power, Power factor and Impedance of R-L-C series circuit.	02
4	I	Use of Multimeter for measurement of AC and DC voltage, resistance, continuity	02
5	V	Starting and speed control of DC shunt motor below and above normal speed	06
6	VI	To plot speed torque characteristics of three phase induction motor	02

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
7	IV	Load test on single phase transformer for determination of Efficiency and regulation	04
8	--	Demonstration and Study of Servomotor	02
9	--	Demonstration and Study of Stepper motor	02
10	--	Demonstration and study of Electric heating, Induction heating, dielectric heating	06
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Assignments for solving numerical
2. Collect leaflet/data of switches, relays.
3. Visit to transformer/motor manufacturing unit

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1. Arrange Industrial visit /Expert lecture

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A text book of electrical Technology Volume-I	B.L. Theraja A.K. Theraja	S. Chand and Co.
2	Basic Electrical Engineering.	V.N. Mittal	Tata McGraw Hill
3	Electrical Technology	Edward Hughes	E.L.B.S.
4	Fundamentals of Electrical Engineering	M.N. Mittal	Everest Publishing House

B) Software/Learning Websites

1. www.howstuffworks.com
2. www.kpsec.freeuk.com

C) Major Equipments/ Instruments with Broad Specifications

1. Ammeters
2. Voltmeters
3. Wattmeters
4. Tachometer
5. Rheostats
6. Lamp Bank
7. Single phase Transformer
8. Auto transformer
9. Three phase induction motor
10. Stepper motor
11. Servomotor

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M									
CO2		H									
CO3		H									
CO4		H	M								
CO5		H									
CO6		H	M								
CO7			H		M						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in ME / PS / AE
COURSE : Principles of Electronics (POE) **COURSE CODE** : 6221

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	25	125
					Min.	32	--	40	--	--	10	--

1.0 RATIONALE:

A technician come across machines / equipments / testing instruments /equipments and systems involving use of devices, parts working on principles of electronics engineering. For effective operation and maintenance of these systems, a technician should have a sound knowledge of facts, concepts, principle, procedure and operation of electronic devices / Instruments, electronic circuits, devices, transducers, measuring instruments / meters.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand principle and terminology of electronics.
2. Understand the use of semiconductor devices in electronic circuits
3. Interpret the characteristics of electronic devices.
4. Understand the working of basic electronic, digital circuits, digital instruments, transducers.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select and identify appropriate semiconductor devices required for various electronic applications.
2. Trace input and output waveform of different electronic circuits
3. Explain working and applications of different digital circuits
4. Understand the basic facts and concepts and working of measurement and electronic instrumentation system.
5. Identify and use various transducers, sensors and actuators for measurement of electrical, non-electrical quantity.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Semiconductor Devices**	1a. Draw symbols of PN junction diode, UJT, SCR, TRIAC. 1b. Draw and explain characteristics of PN junction diode and zener diode. 1c. Draw and explain working of NPN transistor. 1d. Compare CE, CB, CC configuration of transistor	1.1 PN junction Diode-symbol, Construction, VI Characteristics, Working, application 1.2 Zener Diode-symbol, Construction, VI characteristics, Working, application 1.3 Transistor-Definition, Types-NPN, PNP, symbol, working. 1.4 Transistor configuration: CE, CB, CC(only circuit diagrams) 1.5 Input and output characteristics of CE configuration Comparison between CE, CB, CC 1.6 UJT, SCR, TRIAC, DIAC	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		Symbol, working, characteristics.	
Unit-II **Rectifiers and Filter**	2a. Categorize diode rectifiers and filters. 2b. Draw and explain operation of Half Wave Rectifier, along with input/output waveform. 2c. Draw and explain operation of Full Wave Bridge Rectifier with filter. 2d. Define Peak Inverse Voltage, Ripple Factor and TUF. 2e. Draw and explain working of zener diode as voltage regulator.	2.1 Classification of rectifiers. 2.2 Rectifiers: Definition, Need for Rectification, Circuit diagram and operation of Half Wave Rectifier, Full Wave Rectifier (center-tapped), Full Wave Bridge Rectifier.(no derivations), Definition of Ripple Factor, Efficiency, PIV, TUF, Comparison of Rectifiers 2.3 Filters: Definition, Necessity of Filters, Types of Filters-C, LC, CLC-Circuit Diagram, working with Input-Output Waveform, Comparison of Filters 2.4 Zener voltage regulator	08
Unit-III **Amplifiers and Oscillator**	3a. Describe the principle of Single and multistage amplifiers and state its need. 3b. Draw the circuit diagram and explain the working of two stages RC coupled amplifier. 3c. Differentiate between positive and negative feedback. 3d. Draw the circuit diagram and explain the working of RC phase shift oscillator	3.1 Single Stage CE amplifier, Circuit Diagram, function of components, working and frequency response of single stage amplifier 3.2 Multistage amplifiers: Need for multistage amplifier. Types of Coupling: RC coupled, Direct Coupled. Circuit Diagram, Frequency response and Function of each component 3.3 General theory of feedback: Types of feedback-negative and positive feedback. Barkhausen's criteria. 3.4 Operating principles of RC and LC oscillators 3.5 RC oscillators-RC phase shift, 3.6 LC oscillators-Colpitts, piezoelectric effect, Crystal oscillator circuit diagram, equation for frequency of oscillation	08
Unit-IV **Linear Integrated Circuits**	4a. Draw labeled block diagram of op-amp. 4b. Differentiate between Inverting amplifier and Inverting amplifier 4c. Derive equation for gain for inverting configuration of op-amp. 4d. Draw and Explain Op-amp as adder. 4e. Draw block diagram of IC 555	4.1 OP-amp-Block diagram, symbol, pin configuration of 741 4.2 Configuration of OP-amp-open and closed loop 4.3 Inverting amplifier 4.4 Non inverting amplifier 4.5 Applications-adder, subtractor, circuit diagram and derivation 4.6 Timer 555-Block diagram, pin configuration. 4.7 Circuit diagram and working of Astable multivibrator, monostable multivibrator using IC555	08
Unit-V	5a. Draw block diagram of	5.1 Digital Multi meter-Block	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Digital Instrument	digital multimeter and explain its operation. 5b. Draw and explain working of CRO. 5c. Draw and explain block diagram of Regulated power supply.	5.2 Diagram and operation only, application 5.3 Block Diagram and working of CRO. Working principle of CRT, applications of CRO 5.4 Function generator and working principle, block diagram, operation 5.5 Regulated power supply: block diagram and working	
Unit-VI **Digital Circuits**	6a. Convert decimal to binary or binary to decimal. 6b. Draw symbol and Write truth table of basic gates. 6c. Explain 4:1 Multiplexer with its block diagram. 6d. Draw and explain Encoder. 6e. Explain Ripple counter.	6.1 Number systems types: binary to decimal and decimal to binary 6.2 Logic gates, AND, OR, NOT, NAND, NOR symbols, truth table 6.3 Flip flop-RS. JK, truth table and working, Encoder(8:3), Decoder(3:8), 6.4 Multiplexer(4:1)logical block diagram and working, Demultiplexer(1:4) logical block diagram and working, 6.5 Basic principle of shift register (SISO)and counter (Ripple) 6.6 Display-LED and Seven segment display.	06
Unit-VII **Industrial Application and Transducers**	7a. Draw circuit and explain operation of UJT as a relaxation oscillator. 7b. Draw circuit diagram and explain operation of light dimmer. 7c. Draw circuit diagram and explain operation of battery charger circuit. 7d. Explain different types of transducers and control circuit.	7.1 Single phase fully controlled rectifier with resistive and inductive load. 7.2 UJT as relaxation oscillator 7.3 Light dimmer 7.4 Battery charger 7.5 Transducers, sensors and actuators-Definition, types and difference between them, proximity sensor, Temperature (RTD), pressure(Strain gauge), displacement (LVDT)transducers 7.6 Level and temperature control circuits	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A Level**	**Total Marks**
I	Semiconductor devices	02	08	--	10
II	Diode rectifiers and filters	04	08	--	12
III	Amplifiers and Oscillator	04	08	--	12
IV	Linear Integrated Circuits	04	04	04	12
V	Digital Instruments	02	08		10
VI	Digital Circuits	04	04	04	12
VII	Industrial application and transducers	--	08	04	12
	TOTAL	**20**	**48**	**12**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

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* ***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. (Perform Any TEN* **ASSIGNMENTS/PRACTICALS/TASKS:** listed below)

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. hrs. reqd.
1	I	Plot Forward characteristics of Semiconductor PN junction diode	02
2	I	Plot reverse characteristics of Semiconductor PN junction diode	02
3	II	Observe and plot input and output wave form for half wave rectifier	02
4	II	Observe and plot input and output wave form for full wave rectifier(any one)	02
5	II	Observe and plot input and output wave form for full wave rectifier with filter (any one)	02
6	II	Observe the performance of zener shunt regulator	02
7	III	Observe output waveforms for oscillator (any one)	02
8	IV	Demonstrate the use of op-amp as Adder	02
9	V	To Observe front panel controls of Digital multimeter and perform measurement of • DC voltage, DC Current • AC voltage, AC current • Resistance • Continuity testing	04
10	V	Measure frequency, voltage, phase difference (by time measurement) using CRO	02
11	V	Observe front panel control of function generator	02
12	VI	Verify the truth table for logic gates (AND, NOT, OR, NAND, NOR)	02
13	VI	Verify truth table of 4:1 Multiplexer	04
14	VII	Displacement Measurement by using LVDT	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Download data sheets of Semiconductor diode, zener diode, BJT, IC 741, Timer IC 555
2. Collect data about prices of electronic components such as semiconductor diode, zener diode etc.
3. Conduct the market survey for different digital and electronic devices and transducers used in industry.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic components, devices and circuits.

9.0 LEARNING RESOURCES:

A) Reference Books

Sr.No.	Title of Book	Author	Publication
1	A Text Book of Applied Electronics	R.S. Sedha	S. Chand Publisher,
2	Principles of Electronics	V.K. Mehta	S. Chand, ISBN:8121924502, 9788121924504
3	Electronic Devices And Circuits	G.K. Mittal	Khanna
4	Modern Digital Electronics	R. P. Jain	Tata McGraw-Hill Education Pvt. Ltd. (TMH) Fourth Edition
5	Electrical and Electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai and co.
6	Operational Amplifiers	R. Gaikwad	Prentice-hall of India, New Delhi ISBN No. 0750656948

B) Software/Learning Websites

1. http://www.electronicstheory.com
2. http://www.nptl.com
3. http://www.electronictutorial.com
4. http://www.allaboutcircuit.com

C) Major Equipments/ Instruments with Broad Specifications

1. Cathode ray oscilloscope
2. Function Generator
3. Regulated power supply
4. CRO Probe
5. V-I Characteristics of PN diode-Experimental kit
6. V-I Characteristics of zener diode-Experimental kit
7. Half wave rectifier-Experimental kit
8. Full wave rectifier-Experimental kit
9. Bridge Full wave rectifier with and without filter-Experimental kit
10. RC phase shift oscillator-Experimental kit
11. Colpitts oscillator-Experimental kit
12. OP-amp as adder-Experimental kit
13. Verification of logic gates-Experimental kit
14. Multiplexer(4:1)-Experimental kit
15. UJT relaxation oscillator-Experimental kit
16. Digital multimeter

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2				M							
CO3	M										
CO4					H						
CO5		H									

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Fluid Flow and Heat Transfer (FHT) **COURSE CODE** : 6222

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

This course intends to impart basic knowledge of different types of fluids and heat transfer elements involved in plastics processing. This course includes basic fundamentals of fluid properties and its behavior, which helps for interpretation of fluid flow. This course also focuses concepts of heat transfer, which can be correlated with the units used in plastics processing.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand properties and flow of fluid.
2. Understand use of various measuring instrument.
3. Understand working of hydraulic pumps.
4. Know various sources of energy.
5. Understand principles of heat transfer and its applications.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Measure pressure by pressure measuring instruments.
2. Calculate friction factor for a pipe.
3. Analyze Bernoulli's theorem.
4. Explain construction and working of hydraulic pumps and heat exchangers.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Units and Measuring Instruments**	1a. State units of various entities. 1b. State working principle of various measuring devices. 1c. State use of different measuring instruments.	1.1 Units of pressure, volume, temperature, work, power and energy (In SI-Units). 1.2 Pressure measurement-Piezometer, U-tube manometer, Inverted U-tube manometer, Micro manometers, and Bourdon's pressure gauge. 1.3 Temperature measurement-Liquid-in-glass thermometers, Thermocouples, Bi-metallic Thermometers, Resistance Thermometers, Radiation Pyrometers.	14
Unit-II **Fluids and Hydrokinetics**	2a. Describe various types of fluids and its flow. 2b. Apply various theorems and equation to flow conditions of fluid. 2c. Determine	2.1 Nature of Fluids, Types of fluids and examples, Causes of flow. 2.2 Concept of steady, uniform and non-uniform streamline, turbulent, rotational flows. 2.3 Energy possessed by flowing fluid like pressure, kinetic and potential energy. 2.4 Reynolds number, its significance.	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	different coefficients involved in fluid flow.	2.5 Total Energy equation, Bernoulli's theorem and its applications to venturimeter, Pitot tube, rotameter. 2.6 Flow measuring parameters and its coefficient. 2.7 Losses in flow through pipes major loss and minor loss. **(Simple numerical on above topics)**	
Unit-III **Pumps**	3a. Illustrate principle of operation of various pumps. 3b. Explain function of components of various pumps 3c. Select suitable type of pump.	3.1 Construction, principle of working, main components and applications of centrifugal, reciprocating, gear, vane, plunger, vacuum pumps. 3.2 Power required, cavitation, NPSH and priming of pump. **(No Derivations and Numerical on Pumps)**	10
Unit-IV **Sources of Energy**	4a. 4a. Summarize the sources of energy.	4.1 Brief description of various sources of energy. 4.2 Renewable and Non renewable sources of energy-Fossil, Hydraulic, Wind, Nuclear, Tidal, Solar, Geothermal, Bio-mass and Bio-gas.	08
Unit-V **Heat Transfer Principle**	5a. Elaborate modes of heat transfer. 5b. Illustrate working of various types of heat exchangers. 5c. Determine various parameters and coefficients involved in heat transfer.	5.1 Modes of heat transfer: fundamentals of conduction, convection and radiation. 5.2 Conduction heat transfer: Fourier's law of heat conduction. Thermal conductivity, conduction through cylinder. 5.3 Thermal resistance Composite walls, composite cylinders. Heat transfer coefficient, Free and forced convection, combined conduction and convection. 5.4 Thermal radiation: Absorptivity, transmissivity, reflectivity, emissivity, black and gray bodies, Stefan-Boltzmann law-heat transfer by radiation. 5.5 Heat exchanger-types of heat exchangers, study of double pipe heat exchanger, shell and tube, plate type, finned tube exchanger, Evaporators, Chillers, Cooling Towers. 5.6 Temperature patterns in multipass heat exchangers, heat transfer coefficient in shell and tube, correction of LMTD for cross-sectional flow. **(No numerical on this topic)**	18
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Units and Measuring Instruments	04	04	08	16
II	Fluids and Hydrokinetics	04	08	12	24
III	Pumps	04	04	04	12
IV	Sources of Energy	04	04	00	08
V	Heat Transfer Principle	04	08	08	20
	TOTAL	**20**	**28**	**32**	**80**

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Measurement of pressure by Bourdon's pressure gauge and differential pressure by 'U' Tube differential manometer.	04
2	I	Temperature measurement using (a) Liquid in glass, (b) Bi-metallic.	04
3	II	Verification of Bernoulli's theorem.	04
4	II	Determination of coefficient of discharge of Venturimeter.	04
5	II	Determination of friction factor of pipe (Flow through pipe).	04
6	III	Calculate the power required and overall efficiency of centrifugal pump.	02
7	III	Calculate the power required and overall efficiency of reciprocating pump.	02
8	V	Demonstration of shell and tube heat exchanger.	04
9	V	Demonstration of double pipe heat exchanger.	04
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare chart for energy generation by various sources.
2. Draw charts for working principles of measuring instruments.
3. Observe and identify heat exchangers used in plastics processing machines.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show demo of CAI computer software related to instruments.
2. Arrange a visit to plastics processing plant.
3. Arrange expert lecture on modern measuring instruments.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Fluid Mechanics	R. K. Rajput	S. Chand and Company
2	Hydraulic Machines	R. S. Khurmi	S. Chand and Company
3	Fluid Mechanics and Hydraulic Machines	S. M. Seth, P. N. Modi	Standard Book House
4	Thermal Engineering	R. K. Kapoor	Tata McGraw hill
5	Thermal engineering	S. A. Rao	Priya Publications
6	Thermal Engineering	V. M. Domkundwar	Dhanpat Rai And Sons
7	Elements of Heat Engines	Patel Karamchandani	Acharya Book Depot
8	Non-conventional Energy Sources	Dr. S. P. Sukhatme	
9	Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Tata McGraw Hill

B) Software/Learning Websites

1. CDs developed by Maharashtra Energy Development Agency (MEDA), Pune. (www.mahaurja.com)
2. http://www.bee-india.nic.in (Website of Bureau of Energy and Efficiency).
3. http://www.mahaurja.com (Website of Mahaurja).
4. http://www.energymanagertraining.com (Energy management).

C) Major Equipments/ Instruments with Broad Specifications

1. Pressure measuring instruments.
2. Temperature measuring instruments.
3. Flow measuring instruments.
4. Hydraulic bench.
5. Centrifugal and reciprocating pumps.
6. Shell and tube heat exchanger.
7. Double pipe heat exchanger.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1			H						L		
CO2				H					L		M
CO3					M	M	M		L		M
CO4					M	M	M	H	L		M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Polymer Chemistry (PCH) **COURSE CODE** : 6223

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	50	175
					Min.	32	--	40	--	10	20	--

1.0 RATIONALE:

The course deals with basic knowledge of polymers chemistry which includes classification of polymers, polymerization reactions, techniques of polymerization, molecular weight of polymer and its determination, polymer degradation.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Classify polymerization reactions.
2. Describe different polymerization techniques.
3. Illustrate glass transition temperature and its significance.
4. Understand significance of polymer molecular weight.
5. Describe different methods of molecular weight determination.
6. Understand the mechanism of polymer degradation.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Classify polymers.
2. Identify homo polymers and copolymers.
3. Correlate structure and properties of polymer.
4. Select suitable polymerization reaction.
5. Compute molecular weight of polymers by using different methods.
6. Identify different types of polymer degradation.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Polymer and Its Classification**	1a. Define polymer. 1b. Differentiate between thermoplastics and thermosets. 1c. Classify polymers. 1d. Draw the structures of polymers.	1.1 Introduction to Monomer, Oligomer, Polymer. 1.2 Classification of polymers, on the basis of Source, thermal behavior, structure, Tacticity and C-C Linkages. 1.3 Homo-polymers, co-polymers-random, alternating, block and graft. 1.4 Polymerization, Degree of polymerization, Monomer functionality and its importance.	08
Unit-II **Polymerization Reactions**	2a. Explain addition polymerization. 2b. Differentiate between poly condensation and polyaddition. 2c. Select appropriate	2.1 Addition Polymerization: Free radical Polymerization, Ionic Polymerization-Anionic and Cationic Polymerization, Co-ordination polymerization. 2.2 Step Polymerization: Polycondensation, Polyaddition	10 10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	polymerisation reaction.	polymerization and Ring opening Polymerization.	
Unit-III **Polymerization Techniques**	3a. Explain different polymerization techniques. 3b. Compare different polymerization techniques.	3.1 Bulk Polymerization, Solution Polymerization, Suspension Polymerization, Emulsion Polymerization. 3.2 Merits and demerits of different techniques.	10
Unit-IV **Glass Transition Temperature**	4a. Explain Glass transition temperature. 4b. Relate Glass transition temperature with Melting temperature. 4c. State factors affecting Glass transition temperature.	4.1 Transitions in Polymers, Glass Transition Temperature, factors affecting Glass transition temperature, Glass transition temperature of Co-polymers, Relation between Glass transition temperature and Melting temperature. 4.2 Practical Significance of glass transition temperature, Methods of determination of glass transition temperature.	06
Unit-V **Polymer Molecular Weight**	5a. State types of molecular weight of polymer. 5b. Describe Polydispersed system. 5c. Compute polymer Molecular Weight. 5d. Compare the techniques to determine molecular weight.	5.1 Average Molecular Weights in polymers: Number average and weight average molecular weight, viscosity average molecular weight, practical significance of molecular weight, Polydispersity and molecular weight distribution in polymers. 5.2 Analytical techniques used to determine molecular weight: End-group analysis, Light scattering, Viscometry, Cryoscopy, Ebulliometry, Membrane Osmometry, Ultra centrifugation.	06 08
Unit-VI **Degradation of Polymers**	6a. Illustrate different types of polymer degradation.	6.1 Introduction to Polymer degradation, Types: Mechanical, Oxidative, Thermal, UV Degradation, Prevention of degradation.	06
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Polymer and Its Classification	02	04	--	06
II	Polymerization Reactions	06	08	08	22
III	Polymerization Techniques	04	06	04	14
IV	Glass Transition Temperature	04	04	02	10
V	Polymer Molecular weight	04	06	08	18
VI	Degradation Of Polymers	02	04	04	10
	TOTAL	**22**	**32**	**26**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
1	I	Determination of melting point of given polymer sample.	04
2	II	Determination of hydroxyl value of a plastic	04
3	III	Preparation of Phenol Formaldehyde resin.	08
4	III	Preparation of Urea Formaldehyde resin.	08
5	III	Synthesis of Nylon 6:6.	08
6	IV	Preparation of Polystyrene by bulk polymerization method.	08
7	IV	Preparation of Melamine Formaldehyde.	08
8	IV	Preparation of alkyd.	08
9	IV	Preparation of PMMA by solution polymerization.	04
10	V	Determination of molecular weight of polymer by viscometry method.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Visit to Industries to collect various plastic materials.
2. Prepare charts of structures of polymers.
3. Prepare charts of classification of polymers.
4. Prepare charts of polymers and its glass transition temperatures.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI packages related to polymer and its structure.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Polymer Science	Gowarikar V. R	New Age International (P) Ltd.
2	Principles of Polymerization	George Odian	Wiley
3	Text Book Of Polymers	Billmeyer	Wiley
4	A Textbook of Polymer (Chem. & Tech. of Polymer) vol. I &II	M.S. Bhatnagar	S. Chand
5	Outlines Of Polymer Technology	R. P. Sinha	S. Chand

B) Software/Learning Websites

1. http://www.metrotec.es/metrotec/WWW_DOC/PETech-09.pdf
2. http://zeus.plmsc.psu.edu/~manias/MatSE259/lecture6.pdf
3. http://plc.cwru.edu/tutorial/enhanced/files/polymers/orient/orient.htm

C) Major Equipments/ Instruments with Broad Specifications

1. Melting point apparatus
2. Condenser
3. Monomers and Polymers
4. Three neck round bottom flask
5. Thermometer
6. Resin kettle
7. Digital weighing balance
8. Ostwald Viscometer
9. Heating Mantle

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H									
CO2	M	H									
CO3		H	H	M				H			M
CO4			H	M							M
CO5		H	M	H				H			M
CO6		H	H	M				H			

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Fundamentals of Chemical Engineering (FCE) **COURSE CODE** : 6224

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

This course imparts basic knowledge about chemical engineering, scope of chemical engineering. The course gives brief idea about unit operations, unit processes and process instrumentation used in chemical process industry.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Compute unit conversions.
2. Explain the unit operations used in chemical industries.
3. Describe unit processes used in chemical plants.
4. Draw the process flow sheet, block diagram of chemical plant.
5. Explain the instrumentation and safety precautions in chemical plants.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Carry out unit conversions.
2. Prepare normal, molar and molal solutions of any compound.
3. Carry out unit operations.
4. Analyze unit process.
5. Represent chemical process by using block diagram and process flow sheet.
6. Operate measuring and personal protective devices.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Units and Conversions**	1a. Classify chemical industries. 1b. Carry out unit conversions. 1c. Prepare normal, molar and molal solutions. 1d. Express materials and their compositions	1.1 Historical Background, scope of chemical engineering, types of industries. 1.2 Basic chemical calculations: Units, dimensions, conversion and conversion factors. 1.3 Basic Concept: Mole, molecular weight, equivalent weight, normality, molarity, molality, weight %, mole %. 1.4 Vapour pressure, partial pressure, Dalton's law, Amagat's law (Only statement) and problems based on these.	22
Unit-II **Unit Operations**	2a. Explain unit operations. 2b. Draw symbols for unit operations.	2.1 Definitions, symbols and examples of unit operations like size reduction, sedimentation, filtration, distillation, evaporation, gas absorption,	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2c. Identify unit operation for specific process.	extractions, fluid handling, fluid-solid contacting, Fluid solid separation, Fluid storage, mixing, solid handling, solid-solid separation, crystallization, drying, leaching. 2.2 Size separation and heat transfer.	
Unit-III **Unit Processes**	3a. Explain unit process. 3b. Write reaction for unit process. 3c. Select unit process for chemical operation.	3.1 Introduction to unit processes with simple examples like sulphonation, polymerization, oxidation, reduction, hydrogenation, hydration, amminolysis, saponification, dehydration, alkalization, esterification, nitration, chlorination, amination, calcination and cracking /pyrolysis	10
Unit-IV **Chemical Process**	4a. Compute conversion, yield and efficiency of chemical reaction. 4b. Represent chemical process by using block diagram and process flow sheet.	4.1. Conversion, yield, reaction efficiency, flow diagrams, flow sheets and block diagrams with examples like sulphuric acid, nitric acid.	08
Unit-V **Process Instrumentation and Safety**	5a. Illustrate working of measuring devices. 5b. State use of measuring and personal protective devices.	5.1 Temperature scale, measurement of temperatures using bimetallic thermometer, mercury expansion thermometer, and gas/vapour filled thermometer. 5.2 Pressure scales and units, measurement of pressure using manometers, bourdon tube. 5.3 Level measurement using direct methods like bob and tape, float and tape, sight glass. 5.4 Flow measurement using rotameter. 5.5 Measurement of viscosity by using Redwood viscometer Density measurement by using specific gravity bottle. 5.6 Personal protective devices.	12
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A and above Levels**	**Total Marks**
I	Units and Conversions	04	04	20	28
II	Unit Operations	04	08	04	16
III	Unit Processes	06	04	04	14
IV	Chemical Process	04	04	--	08
V	Process Instrumentation and Safety	04	04	06	14
	TOTAL	**22**	**24**	**34**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Preparation of 1 normal and 1 molar solution of H_2SO_4.	02
2	I	Preparation of 1 normal and 1 molar solution of HCl.	02
3	I	Preparation of 1 normal and 1 molar solution of NaOH.	02
4	I	Preparation of 1 normal and 1 molar solution of KOH.	02
5	II	Screen Analysis to determine weight percentage of solid mixture.	04
6	V	Calibration of Glass thermometer.	04
7	V	Measurement of differential pressure by using U tube manometer.	04
8	V	Measure volumetric flow rate using rotameter.	04
9	V	Determination of viscosity of given liquid using Redwood viscometer.	04
10	V	Determination of density of given liquid by using specific gravity bottle.	04
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information about nearby chemical industry.
2. Visit to chemical industry.
3. Prepare the demonstrative models of unit operations.
4. Draw the process flow sheet of any one chemical industry.
5. Prepare the charts of unit operation symbols.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to nearby chemical industry.
2. Demonstration of use of personal protective devices.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Introduction to Chemical Engineering	Walter L. Badger	Tata McGraw Hill International
2	Introduction to Chemical Engineering	Ghosal S. K.	Tata McGraw Hill Publications
3	Industrial Instrumentation and Control	S. K. Singh	Tata McGraw Hill Publications
4	Text Book of Fundamentals of Chemical Engineering	K. A. Gavhane	Nirali
5	Raw materials for Industrial Polymers	Ulrich Henri	Hanser

B) Software/Learning Websites

1. online.stanford.edu/course/introduction-chemical-engineering-self-study-resource.
2. bookboon.com/en/chemistry-chemical-engineering-ebooks

C) Major Equipments/ Instruments with Broad Specifications

1. Weighing balance (1-350 gm)
2. Beakers (250 ml, 500 ml)
3. Thermometers.
4. Volumetric flask (500 ml).
5. Specific gravity bottle (25/50 ml)
6. U-Tube manometer.
7. Redwood viscometer.
8. Goggles, helmet, ear mufs, gloves, gum boots.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H	M					L	L		L
CO2	M	H	H	M			L	M	L		L
CO3	H	H	M	M	L	L		L	L		L
CO4		M	H	M				L			L
CO5		M	H	M				M	L	L	L
CO6			H	H			L	L			L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastic Materials (PLM) **COURSE CODE** : 6225

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	50	175
					Min.	32	--	40	--	10	20	--

1.0 RATIONALE:

In order to select the material for particular application(s) depending on the end use and other requirements, one should know the structure and properties of plastics materials. This course gives knowledge about the various thermoplastics and thermosetting plastics used in plastics product manufacturing industries, their grades, properties and end applications.

2.0 COURSE OBJECTIVES:

The student will be able to

1. State classification of plastics.
2. Explain synthesis of different Plastics materials.
3. Describe the different test used to identify different types of plastics.
4. List properties and applications of Plastics.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Classify plastics on basis of applications.
2. Prepare different types of plastics.
3. Identify different types of plastics on basis of chemical tests.
4. Select plastic for specific application.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **History and Development of Plastics**	1a. Classify plastics on the basis of application. 1b. State sources of Plastic material.	1.1. History and development of polymer material. 1.2. Basic Raw materials for plastics. 1.3. Sources of plastics material. 1.4. Thermoplastics and Thermosets 1.5. Commodity, Engineering and Specialty Plastics. 1.6. Commercial plastic material and their abbreviations.	08
Unit-II **Polyolefins**	2a. Explain preparation of polyolefins. 2b. List properties and applications of polyethylenes.	Brief idea of preparation, properties and uses of commodity plastics (Flow Sheet not Expected) 2.1. Polyethylene(HDPE/LDPE/LLDPE/HMWHDPE/UHMWPE/Chlorinated PE/ Cross linked PE) 2.2. Polypropylene	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-III **Styrenic and Acrylics**	3a. Explain preparation of styrenic and acrylic plastics. 3b. List properties and applications of styrenic and acrylic plastics.	Brief idea of preparation, properties and uses of commodity plastics (Flow Sheet not Expected) 3.1. Styrenics-Polystyrene, High Impact Polystyrene. 3.2. Acrylics-Styrene acrylonitrile, Polymethyl methacrylate, Polyacrylonitrile, Polyacrylates, Polymethacrylates, Polyacrylamide, Poly (Acrylic Acid), Poly (Methacrylic Acid).	12
Unit-IV **Vinyls and Cellulosics**	4a. Explain preparation of vinyl and cellulosic plastics. 4b. List properties and applications of vinyl and cellulosic plastics.	Brief idea of preparation, properties and uses of commodity plastics (Flow Sheet not Expected) 4.1. Vinyl Plastics-Polyvinyl chloride, Polyvinyl acetate, Polyvinyl alcohol. 4.2. Cellulosics-Rayon, Cellulose Nitrate, Cellulose Acetate.	08
Unit-V **Engineering Plastics**	5a. Explain preparation of engineering plastics. 5b. Compare properties of various engineering plastics. 5c. Select material for engineering application.	5.1 Brief idea of preparation, properties and uses of Engineering and high performance plastics (Flow Sheet not Expected): • Nylons 6, Nylon 66 • ABS • Polycarbonates • Polyacetals • Polysulfones • Polyethylene terephthalate • Polybutylene terephthalete • Polytetrafluoroethylene	14
Unit-VI **Thermosetting Plastics**	6a. Describe preparation of thermosetting plastic material 6b. Compare Properties and applications of thermosetting plastics.	6.1 Brief idea of preparation, properties and uses of thermosetting plastics (Flow Sheet not Expected): • Phenol Formaldehyde • Urea Formaldehyde • Malamine Formaldehyde • Polyurethane • Silicone • Unsaturated polyester • Epoxy • Vinyl ester	14
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	History and Development of Plastics	02	04	--	06
II	Polyolefins	02	06	04	12
III	Styrenics and Acrylics	04	06	04	14
IV	Vinyls and Cellulosics	04	06	04	14

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
V	Engineering plastics	04	06	08	18
VI	Thermosetting plastics	04	04	08	16
	TOTAL	**20**	**32**	**28**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	II	Identification of Polyolefins (PE, PP).	04
2	II	Determination of Acid value of given plastics material.	04
3	III	Identification of Styrenes and Acrylics (PS, PMMA).	04
4	III	Determination of Saponification value of given plastics material.	04
5	III	Determination of Iodine value of given plastics material.	04
6	IV	Identification of vinyl polymers.	04
7	V	Identification of engineering plastics (PTFE, PET, ABS).	04
8	VI	Identification of thermosetting plastics (PF, UF, MF).	04
9	II to VI	Report on applications of polymers in Building and Construction.	08
10	II to VI	Report on applications of polymers in Automotive.	08
11	II to VI	Report on applications of polymers in Agriculture and Horticulture.	08
12	II to VI	Report on applications of polymers in Electrical and Electronics.	08
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts trade names for some industrial polymers.
2. Search information about polymer manufacturing industries.
3. Prepare chart for commonly used abbreviations for Industrial Polymers
4. Comparison of data based on grade, make and end use of material.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange expert lecture of industry person in the area of Application of Plastics.
2. Arrange visit to exhibitions / industry.
3. Show PPT, Videos, and Models regarding plastics material.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Plastic Materials	J. A. Brydson	Butterworth
2	Polymer Science	V. R. Gowarikar	New Age International (P) Ltd.
3	Plastics Material Handbook	A. S. Athalye	Multitech
4	A Textbook of Polymer (Chemistry and Technology of Polymer) Vol. I and Vol. II	M. S. Bhatnagar	S. Chand
5	Identification and Testing of Plastics	A. S. Athalye	Multitech
6	Plastic Technology Handbook	Chanda and Roy	Marcel Dekker
7	Raw materials for Industrial Polymer	Ulrich Henry	Hanser
8	Plastic Technology	Patton W. J.	D. B. Jaraporelala & Sons.

B) Software/Learning Websites

1. http://ed.iitm.ac.in/~shankar_sj/Courses/ED5312/Materials_for_Automobiles17.pdf
2. www.matweb.com
3. www.intertek.com/polymers_plastics
4. www.plasticsintel.com/sortable_material.php
5. www.plastemart.com

C) Major Equipments/ Instruments with Broad Specifications

1. Titration Assembly
2. Burner (Bunsen burner)
3. Test tube and Beaker
4. Pair of tong
5. Melting point apparatus
6. Sodium Fusion Tube

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	M	H									
CO2			H	H				M			
CO3		H	H					M			M
CO4		H	H								M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Organic Chemistry (OCH) **COURSE CODE** : 6226

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

This course helps to acquire the basic knowledge of Organic Chemistry. The course involves preparation and chemical reactions of most commonly used organic compounds and compounds with different functional groups as well.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Explain the major difference between organic and inorganic chemistry
2. Draw structural formulae for organic compounds.
3. Recognize different functional groups: halides, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, amides, and esters.
4. Write condensed structural formulas for organic compounds
5. Name organic compounds according to the IUPAC system for given structural formulas and vice versa.
6. List the characteristic reactions of the organic compounds.
7. Interpret the properties of organic compounds.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify, classify, and draw structures of organic molecules.
2. Apply the basic rules of organic nomenclature to convert between structures and names.
3. Recall reagents and predict products for a defined set of organic reactions.
4. Draw organic structures consistent with the results of specific chemical tests.
5. Predict the physical properties of organic chemicals based on their structures (e.g. relative boiling point, melting point, and solubility.)
6. Demonstrate proficiency in organic chemical laboratory techniques. (Chemical tests, extraction, filtration, instrumental analysis, molecular model building)

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Organic Compounds and Reactions**	1a. Explain the major difference between organic and inorganic chemistry. 1b. Draw structural formulas for organic compounds. 1c. Recognize different functional groups: halides, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, amides, and esters. 1d. Write condensed structural	1.1 Importance of organic chemistry, Characteristics of organic compounds, Classification of organic compounds, Empirical and Molecular formula of organic compounds, applications of organic chemistry. 1.2 Organic Reactions-Inductive Effect, Mesomeric Effect, Electromeric Effect,	09

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	formulas for organic compounds. 1e. Explain the classification of organic reagents. 1f. Describe the types of organic reactions.	Classification of Reagents, Types of Organic Reactions-Substitution, Addition, Elimination, Rearrangement Reactions.	
Unit-II **Alkanes, Alkenes and Alkynes**	2a. Explain the difference between a saturated and an unsaturated hydrocarbon 2b. Name alkanes, alkenes and alkynes according to the IUPAC. 2c. Define cis-trans isomerism of alkanes, alkenes and alkynes. 2d. List the characteristic reactions of the alkanes, alkenes and alkynes. 2e. Describe the properties of alkanes, alkenes and alkynes.	2.1 Alkanes-Introduction, Nomenclature, General Methods of Preparation, Chemical properties-Halogenation, Nitration, Pyrolysis, Combustion and uses. 2.2 Alkenes-Introduction, Nomenclature, Isomerism, General Methods of Preparation, Chemical properties-Hydrogenation, Halogenation, Hydrohalogenation, Markownikoffs Rule, Peroxide Effect, Reactions with H_2SO_4, Ozone, alkaline KMnO4 and uses. 2.3 Alkyenes**-**Introduction, Nomenclature, General Methods of Preparation, Chemical properties-Hydrogenation, Halogenation, Reactions with H_2SO_4, Ozone, Water, Hydrogen Halide, Cyclisation and uses.	20
UNIT-III **Aromatic Compounds**	3a. Draw the structure of benzene and discuss its resonance properties. 3b. Use the IUPAC system to give correct names for benzene and its derivatives. 3c. Give examples of characteristic reactions of benzene. 3d. Describe the characteristics of aromatic compounds.	3.1 Introduction, Classification, Characteristics, Structure of Benzene, Reactions of Benzene-addition (H, O_3, Cl_2) and substitution (Halogenation, Nitration, Sulphonation, Friedal-Crafts Alkylation)	08
UNIT-IV **Alkyl Halides, Alcohols and Phenols**	4a. Name alkyl halides, alcohol and phenols according to the IUPAC system for given the structural formulas and vice versa 4b. State physical properties of alkyl halides, alcohol and phenols. 4c. Illustrate methods of preparation of some alkyl halides, alcohol and phenols.	4.1 Alkyl Halides-Introduction, classification, general methods of preparation, Reactions of Alkyl Halides-Substitution, Elimination, Wurtz reaction, formation of Grignard's reagent. 4.2 Alcohols-Introduction, classification, general methods of preparation,	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	4d. List some characteristic reactions of alkyl halides, alcohol and phenols.	oxidation of alcohols. 4.3 Phenols-Introduction, general methods of preparation, reactions of phenols.	
UNIT-V **Aldehydes and Ketones**	5a. Explain the difference between an aldehyde and a ketone. 5b. Name aldehydes and ketones according to the IUPAC system. 5c. Describe methods of preparation of aldehydes and ketones. 5d. Write classification of aldehydes and ketones. 5e. Discuss the physical properties of aldehydes and ketones. 5f. List characteristic reactions of aldehydes and ketones.	5.1 Carbonyl Compounds and their classification, nomenclature, general methods of preparation, reactions-oxidation, aldol condensation, cannizzaro reaction.	09
UNIT-VI **Acids, Esters, Ethers and Amines**	6a. Name carboxylic acids, esters, ethers and amines according to the IUPAC system. 6b. Discuss the physical properties of carboxylic acids, esters, ethers and amines. 6c. Illustrate methods of preparation of some carboxylic acids, esters, ethers and amines. 6d. List some characteristic reactions of carboxylic acids, esters, ethers and amines.	6.1 Introduction, nomenclature, classification, general methods of preparation, applications of Carboxylic Acid, Ester, Ether and Amine.	08
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Organic Compounds and Reactions	04	04	04	12
II	Alkanes, Alkenes and Alkynes	08	08	08	24
III	Aromatic Compounds	04	04	02	10
IV	Alkyl Halides, Alcohols and Phenol	04	04	04	12
V	Aldehydes and Ketones	04	04	04	12
VI	Acids, Esters, Ethers and Amines	04	04	02	10
	TOTAL	**28**	**28**	**24**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive,**

psychomotor and affective domain) so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1		Preparation of Chemicals and Demonstration of Quality Analysis by faculty	04
2	II to VI	Identification of Organic Compound through Qualitative Analysis. Any 14 of following Organic Compounds 1) Acetic Acid, 2) Benzoic Acid, 3) Salicylic Acid, 4) Oxalic Acid, 5) B-Naphthol, 6) Acetone, 7) Glucose, 8) Naphthalene, 9) Aniline, 10) Urea, 11) Thiourea, 12) Chlorobenzene, 13) Ethanol, 14) Methanol, 15) Nitrobenzene, 16) m-dinitrobenzene, 17) Cinnamic Acid, 18) Phthalic Acid, 19) Benzaldehyde, 20) Ethyl Acetate, 21) Benzyl Alcohol, 22) Acetanilide, 23) o- Nitroaniline, 24) p-Nitroaniline, 25) m- - Nitroaniline, 26) o- Nitrophenol, 27) m- Nitrophenol, 28) p- Nitrophenol, 29) Resorcinol.	02 x 14 = 28
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Construct molecular models of organic compounds.
2. Prepare charts of organic compounds with structures.
3. Identify the organic compounds through organic qualitative analysis.
4. Compute empirical formulae of different organic compounds.
5. Preparing solutions for organic reactions.
6. Follow safety precautions during the organic qualitative analysis.
7. Collect information about the applications of organic chemistry in plastics and polymer field.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to organic chemistry.
2. Arrange a visit to nearby chemical laboratories for applications of organic chemistry.
3. Arrange expert lecture of industry person in the area of organic qualitative analysis.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Modern Organic Chemistry	Bahl	S. Chand
2	Hand Book Of Organic Chemistry	Morison and Boyd	Western Publication
3	Textbook of organic chemistry	R. K. Bansal	New Age Publication

B) Software/Learning Websites

1. www.organic-chemistry.org
2. www.ochem.com
3. www.masterorganicchemistry.com/resource-guide/
4. www.chem.uiuc.edu/weborganic/organictutorials.htm
5. www.chem.ucla.edu/harding/orglinks.html

C) Major Equipments/ Instruments with Broad Specifications

1. Chemicals, solvents
2. Purification set
3. Test tubes, 18 x 150 mm
4. Stirring rod, glass
5. Bunsen burner
6. Beaker, (50 ml, 250 ml)
7. Tongs or forceps
8. Ring stand and ring with wire gauze
9. Safety equipments (gloves, goggles etc)
10. Wooden stick
11. Sodium fusion tubes
12. Thermometer
13. Capillary tubes
14. Evaporating dish
15. Test tube stand
16. Thieles tube

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M	L					L			L
CO2	H	M						L			M
CO3	H	M	M	L							L
CO4	M		H	L							L
CO5	M	H	M					M			L
CO6	M	L	H	H	L		L				L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Advanced Polymers and Product Design(APP) **COURSE CODE** : 6227

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Many advanced polymers have been developed to meet the requirement of end users. The course intends to acquaint the students with speciality, high performance and biodegradable polymers in use. The course also imparts essential knowledge of product design.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the need of special quality plastics.
2. Suggest the suitable material on the basis of cost and properties.
3. Explain basic features of product design.
4. Justify the utility of biodegradable polymers.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select the material for special purpose application.
2. Suggest the polymer for high performance applications.
3. Differentiate plastics on the basis of end performance and thermal characteristics.
4. Modify the product design or suggest alternative product design.
5. Estimate the cost of product.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Speciality Polymers**	1a. Categorize polymers for special purpose applications. 1b. Select polymers for speciality applications.	Polymers, Properties & Applications of: 1.1 High Temperature and Fire Resistant Polymers 1.2 Electro active Polymers 1.3 Liquid Crystal Polymers 1.4 Ionic Polymers 1.5 Inorganic polymers 1.6 Water soluble polymers	10
Unit-II **High Performance Polymers**	2a. Draw structures of high performance polymers. 2b. Compare the properties of various high performance polymers.	Structure, Properties & Applications of : 2.1 Poly(Vinyl Acetal), Poly(Vinyl Ether), Poly(Vinyl Pyrrolidone) 2.2 Polyvinylidene chloride 2.3 Polyvinyl fluoride and Polyvinylidene fluoride 2.4 Polyimides 2.5 Polysulfides 2.6 Polyether	08
Unit-III	3a. State utility of biodegradable	3.1 Introduction and terminology. 3.2 Properties and applications of	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Biodegradable Polymers	polymers. 3b. Compare various biodegradable polymers.	biodegradable polymers: 3.3 Natural polymers such as Rosin, Shellac (starch, cellulose based Plastics) natural Rubber 3.4 Factors affecting biodegradability	
Unit-IV **Material Selection**	4a. State properties of plastic materials. 4b. Select the suitable material for manufacturing a product.	4.1 Specific properties of material in commodity and engineering applications. 4.2 Comparative evaluation of thermoplastics and thermosetting plastics with respect to permanence performance characteristics, heat related characteristics and cost effective characteristics. 4.3 Material considerations-environment, electrical and chemical characteristics, mechanical factors, economics.	08
Unit-V **Process Selection**	5a. Elaborate various processes. 5b. Select the suitable process for manufacturing a particular product.	5.1 Criteria for process selection. 5.2 Different plastic processing methods (injection moulding, compression moulding, thermoforming, extrusion, blow moulding, rotomoulding, casting). 5.3 Advantages and limitations, Comparison of process with respect to complexity of part (thickness, bosses, undercuts, inserts, holes) and economic factors (quantity, production rate, equipment cost, tooling cost).	06
UNIT-VI **Product Design Features**	6a. Describe basic design considerations. 6b. Suggest design modifications. 6c. Estimate cost of product.	6.1 Introduction to product design, Considerations in product design-appearance, design limitations, material shrinkage, tolerances. 6.2 Product design features for: • Inside sharp corners • Uniform wall thickness • Tapers or draft angles • Weld line • Internal plastic threads • Moulded-in inserts • Gate size and location • Undercuts • Thermoplastic hinges 6.3 Cost estimation for plastics parts.	10
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Speciality Polymers	04	04	06	14
II	High Performance Polymers	04	04	06	14
III	Biodegradable Polymers	02	04	04	10
IV	Material Selection	04	04	06	14

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
V	Process Selection	02	04	04	10
VI	Product Design Features	08	04	06	18
	TOTAL	**24**	**24**	**32**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I, II, III	Report on applications of polymers in Domestic Appliances and Business Machines.	04
2	I, II, III	Report on applications of polymers in Aerospace.	04
3	I, II, III	Report on polymers in Medical and Biomedical.	04
4	I, II, III	Report on polymers in Packaging applications.	04
5	I, II, III	Report on polymers in Marine and Offshore applications.	04
6	I, II, III	Report on applications of polymers in Sports.	02
7	IV	Selection of suitable material for a given plastic product.	04
8	V	Selection of suitable process for a given plastic product.	04
9	VI	Modify the given product design of a product or Cost Estimation of a plastic product.	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect market rates for various plastic raw materials / products.
2. Observe a vehicle and list various plastics parts and their materials.
3. Prepare charts for properties and applications of special polymers.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video / arrange visit for processing of PTFE.
2. Demonstrate computer software related to product design.
3. Organize expert lecture in the area of product development.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Plastics Materials	Brydson	Butterworth-Heinemann
2	Engineering Thermoplastics	James Margolis	CRC Press
3	Plastics Technology Handbook	Manas Chanda and Roy	Marcel Dekker
4	Bio Polymer Vol-I and II	Uttraki	Sci-Tech
5	Principles of Polymerization	George Odian	Wiley
6	Plastic Product Design and Process Engineering	Harold Belofsky	Hanser
7	Product Design with Plastics	J. B. Dym	Industrial Press Inc.
8	Industrial Plastics: Theory and Applications	Terry L. Richardson	Robert Lynch
9	Plastics Product Design	Beck	Industrial Press Inc.
10	Plastics Product Design HB	Miller	Marcel Dekker
11	Designing with Plastics and Composites	Rosato	Hanser
12	Fundamentals of Plastics Mould Design	S. K. Nayak P. C. Padhi	McGraw Hill

B) Software/Learning Websites

1. www.plastemart.com
2. www.omnexus.com
3. http://cdn.intechopen.com/pdfs-wm/34065.pdf
4. http://ed.iitm.ac.in/~shankar_sj/Courses/ED5312/Materials_for_Automobiles17.pdf
5. www.europeanplasticfilms.eu/docs/AustralianReportonBiodegradablePlastics.pdf
6. http://www.sdplastics.com/ensinger/aerodef.pdf
7. www.icmpp.ro/sustainableplastics/files/Biodegradable_plastics_and_polymers.pdf
8. web.stanford.edu/cheme160/lectures
9. http://www.madehow.com/Volume-2/Contact-Lens.html
10. http://www.designboom.com/history/monobloc.html
11. http://plastics.dupont.com/plastics/pdflit/americas/general/H76838.pdf
12. www.satishinjecto.com
13. www.vipbags.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	M		L						
CO2		H	M		L						
CO3			H			L				M	
CO4	M							M		L	L
CO5										H	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Mathematics (AMT) **COURSE CODE** : 6301

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	00	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The study of mathematics is necessary to develop in the students the skills essential for new technological development. This course introduces some applications of engineering, through which the students can understand mathematics with engineering principles.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire knowledge of mathematical terms, concepts, principles and different methods.
2. Develop ability to apply mathematical method to solve engineering problems.
3. Acquire sufficient mathematical technique necessary for practical problems.
4. Apply the relation between mathematics and applications in engineering.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to solve engineering and applied mathematical problems using

1. Methods of integration
2. Definite integral and its application
3. Differential equation and its application
4. Numerical methods for solving algebraic and simultaneous equations
5. Laplace's transform.
6. Probability distribution.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Integration**	1a. Solve integration problem using rules and formulae 1b. Apply method of integration for solving problem	1.1 Definition of integration, integral as anti-derivative, integration of standard functions. 1.2 Rules of integration (Integral of sum or difference of functions, scalar multiplication) 1.3 Methods of integration. a. Integration by method of substitution & by using trigonometric transformation b. Integration of rational functions & by method of partial fraction c. Integration by parts	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Definite Integration And Its Application**	2a. Apply definite integration to solve engineering problems, area Volume, and R.M.S. value.	2.1 Definite Integration a. Definition of definite integral b. Properties of definite integral with simple problems c. Application of definite integration Area under curve, area bounded by two curves. Volume generated by revolution of curve, RMS value & mean value.	08
Unit-III **Differential Equations**	3a. To form and solve Differential Equation 3b. Apply various method to solve differential equations 3c. Solve engineering problems using differential equation.	3.1 Definition of differential equation, order and degree of differential equation. Formation of differential equation for function containing single or double constants. 3.2 Solution of differential equations of first order and first degree such as a. Variable separable form b. Reducible to variable separable c. Homogeneous differential equation d. Linear differential equation e. Bernoulli's differential equation. 3.3 Applications of differential equations.	08
Unit-IV **Numerical Methods**	4a. Solve algebraic equations by using Bisection method and Newton Raphson Method 4b. Solve simultaneous Equations by using Gauss-Seidel method and Jacobi's method 4c. Apply Lagrange's interpolation formula and Newton forward interpolation formula	4.1 Solution of algebraic equations using iterative method a. Bisection method b. Newton-Raphson method. 4.2 Solution of simultaneous equations containing three unknowns-iterative methods a. Gauss-Seidel method b. Jacobi's method 4.3 Interpolation a. Lagrange's interpolation formula b. Newton's forward difference 4.4 Interpolation formula	08
Unit-V **Laplace transform**	5a. Acquire knowledge of Laplace transform and Inverse Laplace transform. 5b. Apply Laplace Transform to solve Differential Equations.	5.1 Definition of Laplace transform and standard formulae of Laplace transform 5.2 Properties of Laplace transform (linearity, first & second shifting, multiplication by t^n, division by t) 5.3 Inverse Laplace transform, using partial fraction 5.4 Laplace transform of derivatives 5.5 Application of Laplace transform for solving differential equation.	06
Unit-VI **Probability Distribution**	6a. Apply Binomial Distribution 6b. Apply Poisson's Distribution 6c. Apply Normal Distribution	6.1 Binomial distribution 6.2 Poisson's distribution 6.3 Normal distribution (simple examples)	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Integration	04	08	08	20
II	Definite integration and its application	04	04	04	12
III	Differential equations	04	08	04	16
IV	Numerical methods	04	04	08	16
V	Laplace transform	02	04	02	08
VI	Probability distribution	02	04	02	08
	TOTAL	**20**	**32**	**28**	**80**

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Unit wise home assignment, containing ten problems.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.
3. Learn graphical software: Excel, DPlot, Graph etc.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
01	Mathematics for polytechnic student (III)	S. P. Deshpande	Pune Vidyarthi Gruha
02	Applied Mathematics	Kumbhojkar	Phadake Prakashan
03	Numerical Methods	S. S. Sastry	Prentice Hall Of India
04	Text book of Applied Mathematics, Volume I&II	P. N. Wartikar, J. N. Wartikar	Pune Vidyarthi Gruha Pune

B) Software/Learning Websites

1. http://www.mathsisfun.com/calculus/integration-definite.html
2. http://www.intmath.com/applications-integration/applications-integrals-intro.php
3. http://www.maths.surrey.ac.uk/explore/vithyaspages/differential.html
4. http://tutorial.math.lamar.edu/Classes/DE/LaplaceIntro.aspx
5. http://library2.lincoln.ac.nz/documents/Normal-Binomial-Poisson.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer, Internet system.
3. LCD Projector.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H		M								L
CO2	H		M								L
CO3	H		M								L
CO4	H		M								L
CO5	H		M								L
CO6	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Environmental Studies (EVS) **COURSE CODE** : 6302

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	02	02	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis.

It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, forests.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand and realize nature of the environment, its components, and inter-relationship between man and environment.
2. Understand the relevance and importance of the natural resources in the sustainability of life on earth and living standard.
3. Comprehend the importance of ecosystem and biodiversity.
4. Identify different types of environmental pollution and control measures.
5. Correlate the exploitation and utilization of conventional and non-conventional resources.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Explain uses of resources, their overexploitation and importance for environment
2. Describe major ecosystem
3. Suggest measurers for conservation of biodiversity
4. Identify measures for prevention of environmental pollution
5. Describe methods of water management
6. Identify effects of Climate Change, Global warming, Acid rain and Ozone layer
7. Explain Concept of Carbon Credits
8. State important provisions of acts related to environment

4.0 COURSE DETAILS:

There are no separate classes for theory. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Importance of Environmental Studies**	1a. Define the terms related to Environmental Studies 1b. State importance of awareness about environment	1.1 Definition, Scope and Importance of the environmental studies 1.2 Need for creating public awareness about environmental issues
Unit-II **Natural Resources**	2a. Define natural resources 2b. Identify uses of natural resources, their overexploitation and importance for environment	2.1 Uses of natural resources, overexploitation of resources and importance for environment 2.2 Renewable and Non-renewable resources 2.3 Forest Resources 2.4 Water Resources 2.5 Mineral Resource 2.6 Food Resources
UNIT-III **Ecosystems**	3a. Define Ecosystem 3b. List functions of ecosystem 3c. Describe major ecosystem in world	3.1 Concept of Ecosystem 3.2 Structure and functions of ecosystem 3.3 Major ecosystems in the world
UNIT-IV **Biodiversity and its Conservation**	4a. Define biodiversity 4b. State levels of biodiversity 4c. Suggest measurers for conservation of biodiversity	4.1 Definition of Biodiversity 4.2 Levels of biodiversity 4.3 Threats to biodiversity 4.4 Conservation of biodiversity
UNIT-V **Environmental Pollution**	5a. Classify different types of pollution 5b. Enlist sources of pollution 5c. State effect of pollution 5d. Identify measures for prevention of pollution	5.1 Definition, Classification, sources, effects, and prevention of • Air pollution • Water Pollution • Soil Pollution • Noise Pollution 5.2 E-waste management
UNIT-VI **Social Issues and Environment**	6a. Describe methods of water management 6b. Identify effects of Climate Change, Global warming, Acid rain and Ozone Layer 6c. Explain Concept of Carbon Credits	6.1 Concept of sustainable development 6.2 Water conservation, Watershed management. Rain water harvesting: Definition, Methods and Benefits. 6.3 Climate Change, Global warming, Acid rain, Ozone Layer Depletion, 6.4 Concept of Carbon Credits and its advantages
UNIT-VII **Environmental Protection**	7a. State important provisions of acts related to environment	7.1 Importance of the following acts and their provisions: • Environmental Protection Act • Air (Prevention and Control of Pollution) Act • Water (Prevention and Control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Population Growth: Aspects, importance and effect on environment • Human Health and Human Rights • ISO 14000

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

SR. No.	Unit No.	Practical Exercises	Approx. Hrs. required
1	I	Report on Importance and public awareness of Environmental Studies.	04
2	II	Report on Use of natural resources and overexploitation of Resources	04
3	II	Visit /Video Demonstration to Renewable / Non-renewable (wind mill, hydropower station, thermal power station)/ resources of energy.	04
4	II	Visit to polyhouse and writing report on its Effects on agriculture food production.	04
5	III	Assignment/Report on structure and functions of ecosystem.	04
6	IV	Visit to a local area to environmental assets such as river / forest / grassland / hill / mountain and writing report on it.	04
7	V	Group discussion on Environmental Pollution (Air pollution/Water pollution/Soil pollution/Noise pollution/E-waste)	04
8	V	Visit to study recycling of plastic and writing a report on it.	04
9	VI	Visit to Water conservation site / Watershed management site / Rain water harvesting site and writing a report on it.	04
10	VI	Visit to study organic farming/Vermiculture/biogas plant and writing a report on it.	04
11	VI	Video Demonstration /Expert Lecture Report on Climate Change and Global warming	04
12	VII	Write important provisions of Acts related to Environment/ Air (Prevention and Control of Pollution) Act/Water (Prevention and Control of Pollution) Act/ Wildlife Protection Act/ Forest Conservation Act	04
		TOTAL	**32**

***Note: Any Four Visits/ Video Demonstration and Four Reports/Assignments from above list to be conducted.**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1) Collect articles regarding Global Warming, Climate Change
2) Collect information regarding current techniques, materials etc. in environmental system.
3) Tree plantation and maintenance of trees in the Campus.
4) Cleanliness initiative (Swachhata Abhiayan)

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Course Video
2. Expert Lectures

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Environmental Studies	Erach Bharucha	Universities Press (India) Private Ltd., Hyderabad
2	Environmental Studies	Dr. Suresh K Dhameja	S K Kataria & Sons New Delhi
3	Basics of Environmental Studies	U K Khare	Tata McGraw Hill

B) Software/Learning Websites

Not Applicable

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H	M			M	H					M
CO2	H	M			M	H					M
CO3	H	M	M		M	H			M		M
CO4	H	M		M	M	H		M		M	M
CO5	H	M			M	H					M
CO6	H	M			M	H	M				M
CO7	H	M			M	H					M
CO8	H	M			M	H					M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in ME / PS / EE / IF / CM / EL / AE / DD
COURSE : Industrial Organization and Management(IOM) **COURSE CODE** : 6303

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

Diploma engineer has to work in organization. One must know how organization works, structure of organization, departments & their roles in organization. One should be familiar with concept of organization & its importance in management.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the concepts of organization.
2. Resolve the major challenges in the design of an effective organizational structure.
3. Develop critical thinking, research, oral and written communication skills.
4. Promote an understanding to create organizational values and satisfy their stakeholders.
5. Know the preventive measures for accidents and safety.
6. Apply the various tools for scientific management.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify the organization and its types with ownerships.
2. State the principles of management with different levels.
3. Describe the types of accidents and its measures.
4. Work as a production supervisor and store officer.
5. Co-ordinate the functions of HRM and Marketing departments.
6. Use the practices of CPM/PERT and Supply Chain Management.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Organization and Ownerships**	1a. Describe organization and its types 1b. State various types of ownership firms	**a. Organization** 1.1 Concept of organization 1.2 Types of organization structures as line, line and staff, functional organizational structures, their merits and demerits. **b. Ownerships** 1.3 Proprietorship 1.4 Partnership, Types of partners, Partnership deed. 1.5 Joint stock companies, Private Limited, Public Limited, Joint Ventures. 1.6 Govt. departments, Govt. undertaking, Public corporation 1.7 Cooperative Organizations 1.8 Merits & demerits of all above mentioned types of ownership.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Scientific Management**	2a. Explain functions of scientific management 2b. State the principles of management. 2c. Describe different levels of management.	**Scientific Management** 2.1 Concept and importance of scientific management. 2.2 Principles of Management, Taylor, Fayol's Theories of management. 2.3 Functions of Management, Levels of Management and skills at different levels	06
Unit-III **Industrial Developments in India and Industrial Acts**	3a. Explain the major areas of Indian industries 3b. Describe types of accidents & safety measures 3c. State provisions of industrial acts.	**a. Industrial Developments in India** 3.1 Major areas of industry in India (Automobile, Cement, Steel and Agro industries) 3.2 Introduction of WTO and GATT **b. Industrial Acts** 3.3 Safety Management • Causes of accidents • Types of Industrial Accidents • Preventive measures • Safety procedures 3.4 Industrial Legislation-Necessity of Acts, Provisions of following acts: • Indian Factory Act • Workman Compensation Act • ⋅ Minimum Wages Act	08
Unit-IV **Production and Material Management**	4a. Explain the types of production systems 4b. Describe the material management techniques 4c. State use of ERP and MRP	**a. Production Management** 4.1 Concept of production management 4.2 Types of production systems-job, batch and mass 4.3 Merits and demerits of all above production systems **b. Material Management** 4.4 Inventory Concept, its classification, functions of inventory 4.5 ABC Analysis-Necessity & Steps 4.6 Economic Order Quantity Concept, graphical representation, determination of EOQ 4.7 Standard steps in Purchasing 4.8 Modern Techniques of Material Management-JIT, KANBAN, VSM, LEAN. 4.9 Material Resource Planning (MRP)-Functions of MRP, Input to MRP, Benefits of MRP 4.10 Enterprise Resource Planning (ERP)-Concept, advantages & disadvantages of ERP	10
Unit-V **Marketing and Human Resource Management**	5a. Explain the functions of marketing management 5b. Describe selection procedure by HRM dept.	**a. Marketing Management** 5.1 Concept of marketing management and importance 5.2 Functions of marketing promotion of sales, market segmentation, marketing mix, 4P's, and Physical distribution.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	5c. Importance of Employee training	**b. Human Resource Management** 5.3 Recruitment selection procedure, Functions of HRM Dept. 5.4 Training of human resources-objectives, importance and methods of training	
Unit-VI **CPM/PERT and Supply Chain Management**	6a. Explain the importance of CPM/PERT 6b. Describe the need of SCM in industry	**a. CPM/PERT** 6.1 CPM & PERT-definitions of node, activity, dummy activity, resources, duration, network, earliest start time, earliest finish time, latest start time, latest finish time, float. 6.2 Drawing of network and determination of critical path. 6.3 Analysis of network. **b. Supply Chain Management** 6.4 Definition and Concept of SCM 6.5 SCM practices-Relational, Vendor Managed Inventory (VMI), Agile Manufacturing and Postponement. 6.6 Green SCM 6.7 Concept of cross docking 6.8 Case study of Wall Mart and Dell Computer	08
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	a. Organization	--	04	--	04
	b. Ownerships	02	04	--	06
II	Scientific Management	02	04	02	08
III	a. Industrial Developments in India	02	04	--	06
	b. Industrial Acts	04	04	--	08
IV	a. Production Management	02	04	02	08
	b. Material Management	02	04	02	08
V	a. Marketing Management	--	08	--	08
	b. Human Resource Management	02	06	--	08
VI	a. CPM/PERT	02	02	04	08
	b. Supply Chain Management	02	02	04	08
	TOTAL	**20**	**46**	**14**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the organization structures of manufacturing, cement, pharmacy, electrical, govt. Sectors.
2. Find out the information of above mentioned industries by internet.
3. Collect the rules of industrial acts by ILO websites.
4. Gather information about chain structures of material management by logistics' industries.
5. Collect the information about WTO and GATT by online resources.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (IF ANY):

1. Show organization structures of different industries, govt. sectors, private firms etc.
2. Arrange a visit to industries, govt. offices located at nearby areas.
3. Arrange expert seminar/lectures by a resource person from industry in the area of manufacturing, HRM, Logistics etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering & Management	Dr. O. P. Khanna	Dhanpat Rai & Sons New Delhi
2	Industrial Engineering & Management	Banga & Sharma	Khanna Publication
3	Business Administration & Management	Dr. S. C. Saksena	Sahitya Bhavan Agra
4	The process of Management	W. H. Newman E. Kirby Warren Andrew R. McGill	Prentice-Hall
5	Entrepreneurship Development & Management	Dr. R. K. Singal	S. K. Kataria & Sons, New Delhi
6	Production Planning & Control	Dr. R. K. Singal	S. K. Kataria & Sons, New Delhi

B) Software/Learning Websites

1. http://www.wto.org/
2. http://www.gatt.org/
3. http://www.worldtradelaw.net/
4. http://www.supplychainbrain.com/
5. http://www.legallyindia.com/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1				M							
CO2					L		M				
CO3		M					L				
CO4	L					H					
CO5				L							L
CO6							M				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Supervisory Skills (SSL) **COURSE CODE** : 6305

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

A diploma engineer working in the industry has to co-ordinate and supervises a group of workers. An engineer should have a leadership attitude. This course will help to develop requisite traits in the diploma engineer.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand importance of scientific management.
2. Understand the controlling performance of process & people.
3. Know organizing, staffing and training of worker.
4. Understand the importance of leadership.
5. Know industrial psychology and human relation.
6. Know safety awareness and health administration in the industry.
7. Understand role of supervisor in industry.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Explain the importance of scientific management.
2. Describe controlling performance of process & team of worker.
3. Explain the methods to train the worker.
4. State the qualities of leader.
5. Describe progressive disciplinary action to worker.
6. Enlist causes of accident and prevention of accident.
7. Explain the role of supervisor towards management and worker.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Scientific Management and Management of Job**	1a. Define the term management. 1b. Differentiate between management, administration and organisation. 1c. Explain the necessity and steps of scientific management. 1d. Describe handling complexity and its steps.	1.1 Management-definition, its job, Difference between management, administration and organization. Levels and its functions of management. 1.2 Definition, Necessity and, procedure of scientific management 1.3 Handling complexity and its steps. 1.4 Optimization and its steps.	06
Unit-II **Supervisory**	2a. Explain objective of planning by supervisory 2b. Describe the different	2.1 Planning by supervisor, necessity, steps and objectives 2.2 Budgeting at supervisory level,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Management	types of budget. 2c. Explain the controlling of performance of team of worker in term of quantity & cost.	objective and its advantages. Types of budget. 2.3 Deciding mental & physical activities of workers. 2.4 Controlling the performance of process & team of worker in term of quantity / quality/ time/ cost.	
Unit-III **Organising, Staffing and Training.**	3a. Define organising. 3b. State physical resources needed for production. 3c. Explain staffing with human resources. 3d. Define Merit rating. 3e. Explain methods of merit rating. 3f. Describe needs & objectives of training. 3g. List types of training. 3h. Explain types of training.	3.1 Organizing effectively the department, provision of physical resources, matching human need with job need, allotment of to individual and establishing relationship among person working in a group. 3.2 Staffing with the human Resources. 3.3 Appraisal of Employee performance or merit rating and its types. 3.4 Training-definition, needs and objectives its types-induction and orientation, by skill & old worker, on job training, apprentice training, by special schools.	06
Unit-IV **Activating the Work Force**	4a. Define-Motivation. 4b. Explain the motivating factors. 4c. State qualities of leader. 4d. Explain democratic leadership. 4e. Explain need of effective communication.	4.1 Motivation-definition, types, and motivating factors. 4.2 Leadership-definition, qualities of leader, Role of leadership, methods-authoritarian, democratic, and lassez-faire or free rein. 4.3 Effective employee communication.	08
Unit-V **Managing Problem Performance**	5a. State symptoms of troubled employee. 5b. Explain causes of industrial dispute. 5c. Describe collective bargaining. 5d. State the causes of substandard performance. 5e. Explain progressive disciplinary action.	5.1 Counseling troubled employees-symptoms, need and guidelines for counseling. 5.2 Industrial dispute-causes, strikes, settlement of industrial dispute, collective bargaining, conciliation & mediation and arbitration. 5.3 Disciplining-definition, Substandard performance, progressive disciplinary action.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-VI **Employee Health and Safety Under OSHA**	6a. Define accident. 6b. List causes of accident. 6c. Explain the effect of accident to industry, worker and society. 6d. Describe role of OSHA	6.1 Accident-definition, Causes of accident, Prevention of accident, effect of accident to industry, worker and society, Preparation of accident report and investigation. 6.2 Occupational diseases, hazards, safety awareness. 6.3 Role of OSHA. (Occupational safety & health administration), industrial health.	06
Unit-VII **Supervisor's Role in Labour Relation.**	7a. Explain role of supervisor towards management and work. 7b. Describe function of labour union.	7.1 Role of supervisor in management/ worker/fellow Supervisor/work. 7.2 Labour or trade union-function, right and liabilities.	04
Unit-VIII **Moving up in your Organisation**	8a. Explain activities to be done at end of shift by supervisor. 8b. Describe sort of attitude and action by supervisor while moving up in organization.	8.1 Taking charge of career to know organization, Department & Worker etc. Planning the day work, activities to be done before shift start, beginning, during, and end of shift. 8.2 Moving up-sort of attitude and action by supervisor	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Scientific Management and Management of Job	04	04	04	12
II	Supervisory Management	04	04	04	12
III	Organizing, staffing and Training.	04	06	--	10
IV	Activating the work force.	06	04	--	10
V	Managing problem performance.	04	04	04	12
VI	Employee Health and safety under OSHA	04	02	04	10
VII	Supervisor's role in Labour Relation.	--	06	-	06
VIII	Moving up in your organisation.	04	04	--	08
	TOTAL	**30**	**34**	**16**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare safety charts and slogan.
2. Exhibition of safety charts and slogan.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video clips on management and motivation.
2. Arrange expert lecture of industry person in the area of safety awareness in industry.
3. Show video clip on safety in industry.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering and management	O. P. Khanna	Dhanpat Rai & Sons
2	Industrial organization & Engineering Economics	Banga & Sharma	Khanna Publication
3	Industrial management	Shrinivasan	Dhanpat Rai & Sons

B) Software/Learning Websites

1. http://www.management.com
2. www.safety.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	M			H					M		M
CO2			H	M			L	M	M		
CO3		M	H	M			M		M		M
CO4	H		M			H			M		M
CO5		M			M		M		M		
CO6		M			M		M		M		M
CO7				M	M	M	M	M	M		

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Marketing Management (MKM) **COURSE CODE** : 6306

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The Marketing of product is the most important aspect of each industry. It needs to be systematically surveyed and planned as in the increasing competitive situation. An organization should have a profit for its existence. An engineer as entrepreneur, marketing set up of a company should have knowledge of marketing management. The job opportunities for an engineer in the marketing are increasing due to essentiality of person to deal the technical matter and give related feedback for improvement of product marketing function.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand various elements of market survey and design its methodology.
2. Understand the duties of marketing personal.
3. Learn the concept of pricing, branding, product mix etc.
4. Understand various marketing strategies.
5. Study various sales Forecasting methods and product diversification.
6. Acquire knowledge of various tools/techniques of Market research and product promotion.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Assess market opportunities by analyzing customers, competitors, collaborators, considering strengths and weaknesses of a company.
2. Develop effective marketing strategies to achieve organizational objectives.
3. Design a strategy implementation program to maximize its chance of success.
4. Assess scope for international marketing.
5. Use various tools/techniques of Market research and product promotion.
6. Apply various innovative ideas of advertisement for enhancing the sales.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Marketing Management Concept**	1a. Explain the needs, wants and demands of customers. 1b. Describe the concept of marketing management 1c. Explain the functions of marketing management.	1.1 Needs, wants and Demands, Types of market demands, Products (Goods, services and Ideas), cost and satisfaction. 1.2 Markets, Marketers and prospects, primary purpose of marketing management.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1d. Differentiate between selling and marketing. 1e. Explain the techniques of maximizing, consumption, customer choice and satisfaction. 1f. Distinguish between macro and micro environment. 1g. Explain techniques of maximizing consumer satisfaction, choice, product life etc.	1.3 Simple marketing system, value exchange and transaction, functions of marketing. 1.4 The product, production and selling concept. 1.5 The marketing concept, difference between marketing and selling, the social marketing concept. 1.6 Maximize consumption, satisfaction, choice, product life, quality, customer value and consumer satisfaction, Customer-delight, life time customer. 1.7 Marketing environment-value, macro and micro environment.	
Unit-II **Marketing Management Process**	2a. Explain various types of market segmentation. 2b. Explain product life cycle. 2c. Describe 4P's of marketing. 2d. Explain the significance of different techniques in product promotion. 2e. Differentiate between Direct and Indirect marketing.	2.1 Market segmentation: Basis for segmentation-Geographic / Demographic / psychographic segmentations, benefits of Market segmentation. 2.2 Product: Concept of Product, New product development process. 2.3 Product Life cycle, Stages in PLC and Marketing Strategies. 2.4 Marketing mix: 4 P's, significance of 4P's. 2.5 Methods of marketing-Direct and Mass marketing. 2.6 Product promotion-Role of advertisement, personnel selling and internet in marketing promotion, mail marketing.	08
Unit-III **Price Decisions**	3a. Explain the significance of pricing in marketing management. 3b. Describe the different pricing methodologies.	3.1 Importance of pricing, price setting in practice 3.2 Cost oriented pricing-mark-up pricing, target pricing. 3.3 Demand oriented pricing, price discrimination. 3.4 Competition oriented pricing-going rate pricing, sealed bid pricing.	06
Unit-IV **Marketing Research**	4a. Explain the concept, scope, objectives, importance and limitation of market research. 4b. Explain various methods of data collection. 4c. Describe the market research tools and techniques. 4d. Differentiate between primary data and secondary data.	4.1 Market research-Introduction, Nature, Scope, objective, importance, limitations and issue formulation. 4.2 Source and collection of marketing data-primary data, secondary data. 4.3 Methods of collection of primary data-observation, mail, personal interview, television etc. 4.4 Market Research Techniques-National Readership survey, consumer panel, test marketing.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-V **Advertising and sales management**	5a. Explain the concepts of marketing communication. 5b. Explain the different types of sales promotions. 5c. Describe the concepts of sales management. 5d. Describe the various types of advertising media.	5.1 Concept and the process of marketing communication. 5.2 Concept of Sales promotion and its types. 5.3 Advertising media-objectives and functions, Types of media, advertising budget, functions of advertising agency. 5.4 Sales management: Concept, objectives, sales forecasting. 5.5 Personnel selling-concept, salesmanship, qualities of salesman.	08
Unit-VI **Strategic marketing**	6a. Describe the concepts of strategic marketing management. 6b. Explain the concept of Strategic marketing	6.1 Objectives and concept of strategic marketing management, 6.2 Strategic marketing Analysis-SWOT Analysis, BCG Matrix.	04
Unit-VII **International and Export marketing**	7a. Explain the concept, scope, opportunities and challenges of international marketing. 7b. Describe the Multi-National Enterprises with examples. 7c. Explain the role of Indian Trade Promotion Organization. 7d. State and explain the benefits to exporters.	7.1 Concept, scope, challenges and opportunities in international marketing. 7.2 Foreign market entry strategies. 7.3 Concept of Multi-National Enterprises (MNE) with examples. 7.4 Institutional support from government to promote export. 7.5 Role of I.T.P.O. (Indian Trade Promotion Organization) 7.6 Benefits offered to exporters by Central government.	04
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Marketing Management concept	06	08	--	14
II	Marketing Management Process	04	08	04	16
III	Price Decisions	04	04	--	08
IV	Marketing Research	04	04	04	12
V	Advertising and sales management	04	08	04	16
VI	Strategic marketing	02	04	--	06
VII	International marketing-Export	02	02	04	08
	TOTAL	**26**	**38**	**16**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Group discussion on Brand Strategies of any one company.
2. Assignment / Report writing on:
   (a) Distribution strategy of any one company.
   (b) Promotional tools (communication mix) adopted by any one company.
   (c) Comparative advertising strategies of any two companies.
   (d) Sales promotions offered by FMCG companies/brands (Minimum two companies/brands).

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Introduction to Marketing science	Lal G. K.	Pearson edition international
2	Marketing	Dale Timge	Prentice hall
3	Marketing Engineering.	Lillen Gary	Pearson edition international
4	Marketing Management	Phillip Kolter	Pearson edition international
5	Modern Marketing Management	Francis G. K.	S. Chand & Company
6	Advertising Marketing Sales Management	Thakur D.	D&D Publication
7	Marketing Management	Mr. S. A. Sherlekar	Everest Publications.
8	How to Export	NABHI	NABHI Publication

B) Software/Learning Websites

1. http://www.business-standard.com/
2. http://studymarketing.org/
3. http://salesandmarketing.com/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1				L			M	H	M	L	
CO2					H			H	H	H	
CO3			M	M	M		M	M	L		
CO4					M		H	L	M		
CO5					L		L	M	M	M	H
CO6			L	M	M	M	L	H	H	H	L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / AE
COURSE : Material Management (MMT) **COURSE CODE** : 6307

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

A diploma engineer has to work in different areas like Research and Design, Tool Room, Production, Production planning, Industrial Engineering, Stores, Quality Control, Marketing, Purchase.

For expressing the ideas communicating & the instructions to shop level, the knowledge of material management is essential. This course aims to avoid bottleneck due to shortage of materials and excessive inventory by quantity and number of parts, which will lead to increase in cost and ultimate loss to the industry.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the importance of raw material planning according to production requirement.
2. Identify the procedures for selecting and giving orders to the suppliers.
3. Understand the importance and procedure of inventory management.
4. Apply the various tools used for inventory management.
5. Know the procedure for purchasing material.
6. Apply the latest tools and techniques for store management.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify the types of materials and their requirements.
2. Explain the Co-ordination of material planning amongst the department.
3. Identify the different material handling equipments.
4. Enlist the duties of store officer
5. Explain the functions of production and store department.
6. Calculate the Economic Order Quantity as per requirement.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Functions of Material Management**	1a. Describe objectives of material management 1b. State functions of material management	1.1 Introduction to materials management 1.2 Objectives of material management 1.3 Functions of material management 1.4 Operating Cycle 1.5 Value analysis-Make or buy decisions.	06
Unit-II **Purchase Management**	2a. Explain functions of purchase management 2b. State the process of purchasing.	2.1 Objective, scope & Functions of purchasing department 2.2 Responsibility of purchasing section 2.3 Purchasing procedure or purchasing cycle.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2c. Describe selection procedure of material.	2.4 Material Requisition: Material Indent form, Travelling Requisition card, Bill of material 2.5 Determining Price: Price terms, Payment terms, cost comparative statement 2.6 Calling for bids or tender or quotation: Tender, Types of tenders, Invitation to BID or An Enquiry, Evaluation of bid. 2.7 Placing purchase order formats of indent/inquiry 2.8 Selection of sources of supply 2.9 Vendor development-Vendor evaluation and rating-Imports and Buyer 2.10 Supplier relationship, Negotiations-Insurance and claims managements	
Unit-III **Stores Management**	3a. Explain the function of stores department 3b. State types of stores 3c. Describe material issue system.	3.1 Functions of stores. 3.2 Location identification 3.3 Layout of store dept. 3.4 Stock taking and materials handling 3.5 Codification of materials 3.6 Duties of storekeepers 3.7 Types of stores, storage equipments/accessories 3.8 Receipt system inward good, stock items, direct purchase items. 3.9 Material issue system 3.10 Accounts of store or store records 3.11 Valuation of Material issue from store 3.12 FIFO, LIFO. 3.13 MIS for stores management	10
Unit-IV **Inventory Management**	4a. State the various inventory costs. 4b. Explain the inventory control system. 4c. State use of OR techniques in inventory management.	4.1 Concept and definition of inventory management 4.2 Classification of Inventory 4.3 Need & function of inventory 4.4 Economic order quantity: Order quantity, Lead time, Safety stock, Re-order point. numerical analysis. 4.5 Inventory Cost: Procurement cost, Inventory carrying cost 4.6 ABC analysis. 4.7 Inventory control system: Two Bin systems, periodic inventory order system, combinations of two bin & periodic system. 4.8 Use of computer in inventory control system. 4.9 Application of Operations Research Techniques in Materials Management for inventory.	10
Unit-V	5a. State the procedure for	5.1 Define inspection & their types, Goods receipt note	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Receiving and inspection	inspection at receipt quality store 5b. Describe quality checking and quantity checking 5c. Importance of material handling for intricate materials	5.2 Inspection at vendor's work 5.3 Quality checking and Quantity checking levels 5.4 Rejected goods replacement procedure. 5.5 Repair processes for rejected material 5.6 Material handling for intricate materials	
Unit-VI **Latest Trends in material management**	6a. Explain the importance of JIT 6b. Describe the need of SCM in industry 6c. State the need of E-material management	6.1 Concept of JIT (Just In Time) 6.2 Zero Inventory system 6.3 Introduction to supply chain 6.4 Developing supply chain to gain competitive advantage 6.5 Methods of transportation by air, rail, road, piping. 6.6 Value Stream Mapping (VSM) 6.7 KANBAN card system 6.8 E-Procurement	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Functions of material management	04	08	--	12
II	Purchase management	04	08	04	16
III	Stores management	04	08	04	16
IV	Inventory management	04	08	04	16
V	Receiving and inspection	02	06	--	08
VI	Latest trends in material management	02	10	--	12
	TOTAL	**20**	**48**	**12**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the logistics information of manufacturing, cement, pharmacy, civil, electrical industries
2. Collect and study the literature on GSCM from any industry
3. Collect and analyse the information about guidelines of material handling procedures.
4. Collect and study information of appropriate material handling devices.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show supply chain structures of different industries.
2. Arrange a visit to logistics stores or in industries from nearby areas.
3. Arrange expert seminar/lectures by a resource person from industry in the area of manufacturing, Logistics etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering & Management	O. P. Khanna	S. Chand & Co.
2	Industrial Organisation & Management Science	Banga & Sharma	Khanna Publication
3	Materials Management	Amner Deans S.	Khanna Publication
4	Materials Management	Gopalkrishnan	Khanna Publication
5	Supply chain management. Strategy, planning & operation	Sunil Chopra	Pearson Publication

B) Software/Learning Websites

1. http://www.supplychainbrain.com/
2. http://www.legallyindia.com/
3. http://www.cipmm-icagm.ca/en/
4. http://www.iimm.org/
5. http://matmgmt.ucr.edu/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H				M					M
CO2				M				M	H		
CO3				M		M			H		M
CO4		H		M					H		
CO5	L				M				M		M
CO6	L		H	M			M			M	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Entrepreneurship Development (EDP) **COURSE CODE :** 6309

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. On the global scenario we have abundant physical and human resources which emphasizes the importance and need of entrepreneurship. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as-BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. This course will help in developing the awareness and interest in entrepreneurship and create employment for others.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Identify entrepreneurial opportunity.
2. Develop entrepreneurial personality, skills, values and attitude.
3. Analyze business ideas-project selection.
4. Develop awareness about enterprise management.
5. Take help of support systems like banks, Government, DIC etc.
6. Prepare preliminary project report.

3.0 COURSE OUTCOMES:-

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Develop Entrepreneurial skill by brainstorming games, SWOT analysis, Risk taking games
2. Collect information by Visiting to DIC and Nationalised Banks
3. Interview of successful entrepreneur
4. Learn the success stories from successful entrepreneur.
5. Select product after market survey for product comparison, specifications and feasibility study
6. Prepare preliminary project report

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Entrepreneurship, Creativity and Opportunities**	1a. Conduct self analysis 1b. Overview of Entrepreneurship 1c. Generating business idea 1d. Search business	1.1 Concept, Classification & Characteristics of an Entrepreneur 1.2 Creativity and Risk taking. 1.3 Concept of Creativity, brainstorming Risk Situation, Types of risk & risk takers.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	opportunities	1.4 Trade Related opportunities 1.5 Business Idea-Methods and techniques to generate business idea. 1.6 Transforming Ideas in to opportunities 1.7 SWOT Analysis 1.8 Scanning Business Environment	
Unit-II **Business Terminology, Information and Support Systems**	2a. Understand Classification of business sectors 2b. Acquiring help from support systems 2c. Planning of business activities	2.1 Types of business and industries, forms of ownership, Franchisee, Export, Network/Multilevel Marketing 2.2 Sources of Information. Information related to project, support system, procedures and formalities 2.3 Support Systems 1. Small Scale Business Planning, Requirements. 2. Statutory Requirements and Agencies. 3. Taxes and Acts	02
Unit-III **Market Assessment**	3a. Conducting Market survey 3b. Selection of product	3.1 Marketing-Concept and Importance 3.2 Market Identification, Survey Key components 3.3 Market Assessment	02
Unit-IV **Business Finance**	4a. Understanding terminology of finance 4b. Search and analyse sources of finance 4c. Financial ratio and profitability study	4.1 Cost of Project 4.2 Sources of Finance 4.3 Assessment of working capital 4.4 Product costing 4.5 Profitability 4.6 Break Even Analysis 4.7 Financial Ratios and Significance 4.8 Various govt. /bank schemes of finance (long term and short term)	04
Unit-V **Business Plan and Project Appraisal**	5a. Prepare a project report 5b. Conduct feasibility study	5.1 Preliminary project report preparation. 5.2 Project Appraisal & Selection Techniques • Meaning and definition • Technical, Economic feasibility • Cost benefit Analysis • Checklist	04
		TOTAL	**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Entrepreneurship Awareness-Who am I?/ EOI/ Microlab Exercise	04
2	I	Creativity Exercises/games	02
3	I	Risk taking Exercises/games	02
4	II	Brainstorming/group discussion/problem solving exercises	04
5	III	Business Games and Related Exercises	04
6	II	Interview of an entrepreneur	02
7	IV	Event/task/activity management-group of 4-6 students will work together	04
		AND/OR	
1 to 7	I-IV	3 day Achievement Motivation Training workshop /Entrepreneurship Awareness Program	22
8	V	Visit to DIC/Bank/MSSIDC/MIDC/MPCB/Industry	04
9	V	Prepare a preliminary project report and study its feasibility	06
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Assess yourself-are you an entrepreneur? (Self Analysis)
2. Report on
   - interview of successful entrepreneurs (minimum two)
   - interaction with the support systems
   - visit to small scale industry
3. Product survey-select one product and collect all its related information i.e. specification, price, manufacturer from at least three suppliers/ manufacturers
4. Prepare list of identified opportunities

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Conduct 3 days awareness camp for entrepreneurship by professional bodies
2. Arrange a visit to SSI/DIC
3. Arrange Interview / Expert lecture of an entrepreneur

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Entrepreneurship Development	E. Gorden K. Natrajan	Himalaya Publishing, Mumbai
2	Entrepreneurship Development	Colombo plan staff college	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
3	A Manual on How to Prepare a Project Report	J. B. Patel D. G. Allampally	EDI STUDY MATERIAL Ahmedabad
4	A Manual on Business Opportunity Identification & Selection	J. B. Patel S. S. Modi	
5	National Directory of Entrepreneur Motivator & Resource Persons.	S. B. Sareen H. Anil Kumar	
6	A Handbook of New Entrepreneurs	P. C. Jain	
7	The Seven Business Crisis & How	V. G. Patel	

Sr.No.	Title of Book	Author	Publication
	to Beat Them.		
8	Entrepreneurship Development of Small Business Enterprises	Poornima M. Charantimath	Pearson Education, New Delhi
9	Entrepreneurship Development	Vasant Desai	Himalaya Publishing, Mumbai
10	Entrepreneurship Theory and Practice	J. S. Saini B. S. Rathore	Wheeler Publisher, New Delhi
11	Entrepreneurship Development	--	TTTI, Bhopal / Chandigarh
12	Entrepreneurship Management	Aruna Kaulgad	Vikas Publication

B) Software/Learning Websites

Websites-

1. http://www.ediindia.ac.in
2. http://www.dcmsme.gov.in/
3. http://www.udyogaadhaar.gov.in
4. www.smallindustryindia.com
5. www.sidbi.com
6. www.tifac.org.in

C) Video Cassettes /CDs

Sr.No.	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmedabad (Near Village Bhat, Via Ahmedabad Airport & Indira Bridge), P.O. Bhat 382428, Gujarat, India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in olpe@ediindia.org Website : http://www.ediindia.org
2	Assessing Entrepreneurial Competencies	
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur skill	
6	Chhoo Lenge Aasman	
7	Creativity	

D) Major Equipments/ Instruments with Broad Specifications

Not applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1			L				L	M			M
CO2					M		M	H	M	M	H
CO3					L		M	L	H	L	M
CO4					L	M	M	M	M	H	M
CO5					H	M	M	H	H	M	M
CO6	L	M	M	M	M	M	H	H	M	H	H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / PS / EE / EL / AE
COURSE : Renewable Energy Sources (RES) **COURSE CODE** : 6310

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Modern society relies on stable, readily available energy supplies. Renewable energy is an increasingly important component of the new energy mix. The course covers energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems. Thermodynamics concepts (including the first and second law) form the basis for modelling the renewable energy systems. The course also touches the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change.

2.0 COURSE OBJECTIVES:

The student will be able to

1. List various sources of energy and their applications in India, and around the world.
2. Describe the challenges and problems associated with the use of various energy sources, with regard to future supply and the environment.
3. Determine potential solutions to the supply and environmental issues associated with energy sources.
4. Understand Emerging Energy Technologies.
5. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

3.0 COURSE OUTCOMES:

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

1. Enlist various energy sources and state their present scenario in India
2. State the solar energy applications and functions of system components.
3. Apply the basics of wind and ocean energy for electricity generation.
4. Describe the conversion process of biomass energy.
5. State and apply the various Emerging Energy Technologies

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Energy Science and Sources**	1a. Define energy conservation law 1b. Identify various sources of energy and compare them. 1c. Understand the present energy situations and schemes for renewable energy promotion.	1.1 Concept of energy, Law of conservation of energy 1.2 Introduction to conventional energy sources and renewable energy sources 1.3 Comparison between energy sources 1.4 Present scenario in energy crises in India and world 1.5 Government schemes to promote use of renewable energy sources	02
Unit-II **Solar**	2a. Define the basic conversation principle of solar energy.	2.1 Introduction to solar energy 2.2 Physical principles of conversion of solar radiation into heat	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Energy	2b. Describe the solar system used in water heating. 2c. State the applications of solar energy	2.3 Flat plate collectors and concentric collectors 2.4 Solar energy storage system 2.5 Applications of solar energy in Water heating, Space heating and cooling, Greenhouses and electricity generation	
Unit-III **Wind and Oceans Energy**	3a. Understand the concept of electrical wind generation. 3b. State basic components of WECS. 3c. Distinguish Wind and Oceans Energy 3d. Explain ocean thermal electric power generation 3e. Describe the principle of tidal power generation.	3.1 Basic principles of wind energy conversion 3.2 Site selection considerations 3.3 Basic components of a wind energy conversion system (WECS). 3.4 Advantages and disadvantages of WECS. 3.5 Applications of Wind energy. 3.6 Introduction of Oceans energy 3.7 Methods of ocean thermal electric power generation 3.8 Open cycle and closed cycle Ocean thermal energy conversion (OTEC) system 3.9 Basic principle of tidal power	05
Unit-IV **Bio mass Energy**	4a. State resources of Biomass energy. 4b. Describe the biomass conversion process. 4c. Know Bio Diesel and Bio Mass plant 4d. State information of Government schemes to promote use of biomass energy.	4.1 Introduction to biomass energy 4.2 Biomass energy resources 4.3 Biomass conversion process : Direct combustion, thermo chemical conversion, bio chemical conversion 4.4 Introduction to bio gas plant 4.5 Introduction to Bio Diesel, Bio Mass plant 4.6 Government schemes to promote use of biomass energy	03
Unit-V **Emerging Energy Technologies**	5a. Define the Hydrogen Energy. 5b. Describe properties of hydrogen and its sources. 5c. Know the hydrogen handling.	5.1 Hydrogen Energy 5.2 Properties of hydrogen 5.3 Hydrogen as source of renewable energy 5.4 Sources of hydrogen 5.5 Production of hydrogen 5.6 Storage and transportation 5.7 Introduction to Carbon Capture and Storage (CCS)	02
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***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 **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.*

A. SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Group discussion on benefits of renewable energy sources.	02
2	II	Visit solar water heating system demonstrate and write report on demonstration of solar water heater	04
3	II	Report on demonstration of solar light with the connection diagram.	04
4	II	Visit to the solar power plant write report and draw layout of solar power plant.	06
5	III	Visit to the wind power plant write report and draw a layout of Wind power plant	06
6	IV	Report on demonstration of bio mass gasifier	04
7	IV	Case study of Bio gas plant and tidal power plant	04
8	V	Group discussion on Emerging Energy Technologies and their future	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect renewable energy information from web source.
2. Collect and analyse information from web site of BEE (Bureau of Energy Efficiency) and MEDA (Maharashtra Energy Development Agency) on energy.
3. Prepare a report on Government schemes to promote use of renewable energy sources.
4. Identify and collect list of different manufactures of solar water heater.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration of solar water heater system.
2. Visit to solar plant to understand the working of solar generation.
3. Arrange expert lectures on new trends in renewable energy.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Renewable energy sources and conversion technology	Bansal Keemann, Meliss	Tata McGraw Hill
2	Renewable energy resources and emerging technologies	Kothari D. P.	Prentice Hall of India Pvt. Ltd.
3	Non-Conventional energy Sources	Rai G. D.	Prentice Hall of India Pvt. Ltd.
4	Nonconventional Energy	Ashok V. Desai	New Age International Publishers Ltd.

B) Major Equipments/ Instruments with Broad Specifications

1. Solar water heating system
2. Solar lighting system

C) Learning Websites

1. Website of bureau of energy and efficiency: www.bee-india.nic.in
2. www.betterenergy.org
3. www.mahaurja.com Maharashtra Energy Development Agency (MEDA):
4. www.worldenergy.org
5. www.renewableenergyworld.com

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		M			L	H					
CO2			H								M
CO3		M				H					
CO4			H								
CO5					M	H					

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS) / Automobile Engineering (AE)
COURSE : Solid Modelling (SDM) **COURSE CODE** : 6313

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Solid Modelling is a technique of developing 3 dimensional digital model using computer graphics. Today 3D models are used in wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, mould design and manufacturing, assembly design etc. Many commercial solid modelling types of software like Unigraphics-NX, CATIA, PRO-E, Solid Edge etc are available in the market. Diploma engineer should have the knowledge of solid modelling software to visualize the machine components and assembly like dies, moulds, cars, machine tools etc.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Specify requirement for solid modeling.
2. Understand principle of development of solid models.
3. Prepare assembly using details.
4. Generate orthographic drawing from solid models.
5. Know applications of solid modeling.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Develop solid models, assemblies and generate 2 D drawings using solid modeling software.
2. Draw 2 D sketch, develop solid models and assemblies and then generate orthographic projections.
3. Apply geometric and dimensional constraints to drawing.
4. Apply sketch, extrude, revolve, hole, threading, array commands to drawing.
5. Draw orthographic views, sectional views, isometric views, details, assembly drawings, intersection of solids.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Solid Modelling Tools**	1a. Enlist applications of Solid Modelling 1b. Identify and select hardware and software for solid modelling	1.1 Concept of digital models, solid modeling 1.2 Applications, benefits, requirements 1.3 Different solid modeling packages, 1.4 Need of solid modeling packages for design, manufacturing and analysis 1.5 Cost saving due to solid modelling	03
Unit-II **Working in 2D**	2a. Draw 2D sketches 2b. Apply constraints	2.1 Working in sketcher mode 2.2 Drawing 2D entities with Line, Circle, and Arc. 2.3 Modifying sketches with editing	03

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Environment		options. 2.4 Applying constraints, Geometric and Dimensional constraints.	
Unit-III **Creation of Solid Models**	3a. Develop solid models 3b. Apply Boolean operations	3.1 Creating 3D solid models, creation of planes, reference planes. 3.2 Extruded objects, revolved objects and swiped objects, blending of objects. 3.3 Intersection of solids, Boolean operations. 3.4 Design of moulds for machine parts.	04
Unit-IV **Assembly Drawing**	4a. Create assemblies out of different parts 4b. Create assembly drawings	4.1 Concept of Top-down and Bottom-up assemblies 4.2 Assembly of different parts of mould 4.3 Relative degrees of freedom and constraints of assembly 4.4 Exploded views of assembly	02
Unit-V **Analysis of Assembly**	5a. Analyzing the various motions of assembly 5b. Mould flow analysis	5.1 Rotational and translational motions of assembly 5.2 Constraining motions 5.3 Simulation of material flow, tool path	02
Unit-VI **Drafting**	6a. Generate orthographic projections 6b. Apply dimensions, tolerances and geometric tolerances 6c. Prepare part list	6.1 **Projections** Generate various views Sectional, auxiliary and isometric views 6.2 **Bill of Materials** Prepare part lists, name plate on sheet Page set up and plotting drawing	02
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Know the Solid Modeling Software	02
2	II	Create 2D drawing of simple machine parts like pulley, shaft, flywheels, hooks, chairs, tables etc	04
3	II	Create 2D drawings of complicated machine parts like bearings clutch, cupboard, table etc	04
4	III	Create 3D models of simple machine elements from the sketches above	06
5	III	Create 3D models of simple machine elements for various machine parts used in assemblies	06
6	IV	Create an assembly of at least five pieces	04
7	IV	Create simulation of an assembly like slider crank mechanism	04
8	VI	Create various views and prepare bill of materials	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Solve assignments from books.
2. Practice given drawings by faculty.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Demonstrations through LCD projector.
2. Expert lectures on CAD /CAM/ CAE and Reverse Engineering.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	CATIA V5R17 for Designers Soft cover,	Sham Tickoo	Cadcim Technologies
2	Pro/Engineer Wildfire for Designers Soft cover,	Sham Tickoo	Cadcim Technologies
3	Solid Works For Designers Release 2006 Soft cover,	Sham Tickoo	Cadcim Technologies
4	NX 4 for Designers Soft cover,	Sham Tickoo, Deepak Maini	Cadcim Technologies
5	Solid Edge V19 for Designers Soft covers.	Sham Tickoo, Deepak Maini	Cadcim Technologies
6	Various advance 3d modeling software manuals	--	--

B) Software/Learning Websites

Pro-Engineer

1. http://catiatutor.com/
2. http://www.cadenv.com/Tutorials/catia_tutorials/Catia.htm
3. http://www.frotime.com/
4. http://www.proetutorials.com/
5. http://www.solidworks.com/sw/resources/solidworks-tutorials.htm
6. http://www.solidengineering.co.nz/solidworks_free_tutorials.htm
7. http://www.solidedgetutorials.com/
8. http://appsci.queensu.ca/courses/APSC161/SETutorials.php
9. http://homepages.cae.wisc.edu/~me232/ug_tutorials/ug_tutorials.htm
10. http://www.jqoc.com/soft/Unigraphics-Tutorial/

C) Major Equipments/ Instruments with Broad Specifications

1. High end configuration desktops PCs (Minimum 04 GB RAM with Integrated Graphics Card)
2. LCD Projector

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	M	M				H	L		
CO2		H	M	M				H	L		
CO3		H	H	H							
CO4	M		H								
CO5			H	M				M			H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Professional Practices (PPR) **COURSE CODE :** 6410

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Most of the diploma holders join industries. Due to globalization and completion in the industrial and service sectors, the selection for the job is based on campus interviews or competitive tests. While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude in addition to basic technological concepts.

The purpose of introducing professional practice is to provide opportunity to students to undergo activities which will enable them to develop confidence. Information search, industrial visits, expert lectures and case study will increase participation of students in learning process.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand techniques of data collection.
2. Study professional techniques through industrial visits and expert lectures.
3. Understand and find solutions for technical problems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Collect technical information from different sources.
2. Write industrial visit reports.
3. Acquire technical knowledge through expert lecture.
4. Develop problem solving techniques through case studies.

4.0 COURSE DETAILS:

Note: The relevant theory has to be discussed during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Information Search and Data Collection**	1a. Use sources of information search. 1b. Sort out relevant information. 1c. Tabulate the information collected.	1.1 Student shall search the information on any one topic related to plastics and polymer, social, economical and should submit the report on the same.
Unit-II **Industrial / Field Visits.**	2a. Develop technical report writing skills on industrial visits.	2.1 Minimum 3 visits to be arranged at local/ nearby Industries to give exposure of industrial culture, process and practices to the students. Types of industries like blow moulding, injection moulding, extrusion, rotomoulding, FRP hand lay up, rubber reclamation etc. Student shall submit a brief report after visit.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-III **Expert Lectures**	3a. Write summary of the expert lecture to obtain the professional knowledge.	3.1 Minimum 3 Expert lectures related to the field of Plastics and Polymer Engineering by personnel from industries, academics, RandD and other shall be arranged. Students shall write summary of each lecture.
Unit-IV **Market Surveys / Case Study**	4a. Problem solving by case study technique. 4b. Draw conclusion after survey. 4c. Report writing.	4.1 Batch of maximum 7 students will undertake and complete the market survey/ case study. Market survey/ case study may include plastic product manufacturing, processing, product cost, waste management etc. The student should submit the brief report on it.
Unit-V **Group Discussion**	5a. Problem solving through group discussion. 5b. Interpret conclusion of discussion.	5.1 One Group Discussion shall be arranged on topic which has social /technical/hygienic relevance. Duration-for 5-7 students-30 min.

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	**Information search, data collection and writing a report on the topic (Any One)** a. Collection of information related to polymer synthesis, plastics processing, testing, quality management, advanced polymers, advanced applications of polymers, fibre reinforced plastics, rubbers, moulds, waste management, new product development. b. Collection of information regarding different software used in Plastic Engineering.	14
2, 3 and 4	II	**Industrial visits (Any Three)** a. Visit to plastics processing industries. b. Visit to rubber industries. c. Visit to polymer synthesis industries. d. Visit to poly houses. e. Visit to plastics recycling industries/waste management plant. Summary of the visit to be submitted by each student as a part of term work.	10
5, 6	III	**Expert Lectures (Any Three)**	12

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
and 7		The lectures of academicians/ professionals/ industry expert / researchers to be organized (2 hrs. duration) on any 3 topics of following suggested areas or any other suitable topic. a. Advanced polymers. b. Advanced plastic processing techniques. c. Production management and planning. d. Quality management. e. Software for Plastics Engineering. f. Personality development of students. g. Green technology. A brief report of expert lecture to be submitted by each student as a part of term work.	
8	IV	**Market Survey (Any One)** a. Survey of local plastics industries. b. Survey of raw material manufactures/suppliers. c. Survey of plastics product manufacturers. d. Survey of machine manufacturers. e. Survey of mould designers/manufacturers. A detail report of survey to be submitted by each student as a part of term work.	08
9	IV	**Case Study (Any One)** a. Study of applications of plastics in diversified areas such building construction, automobile, aerospace, agriculture, marine, electronics, electrical and other. b. Study of advanced polymers, recent applications. c. Study of advances in plastics processing techniques. d. Collection of plastics products and making a museum. A detail report of case study to be submitted by each student as a part of term work.	08
10	V	**Group Discussion** a. **One Group Discussion** shall be arranged on topic which has social /technical/hygienic relevance. Duration-for 5-7 students-30 min. b. Observations shall be recorded by each student.	12
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information as instructed by teacher from books, magazines, journals, internet or any other source.
2. Visit different organizations and collect data/information.
3. Observe a video on expert lectures from internet on plastic engineering topic and draft a report on it.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software, arrange industrial visits, expert lectures, case studies, group discussions related to Plastics Engineering.

9.0 LEARNING RESOURCES:

A) Books

1. National and international journals and magazine related to plastic and polymer.
2. Reference books.

B) Software/Learning Websites

1. www.omnexus.com
2. www.nptel.in
3. www.wikipedia.com
4. www.plastemart.com
5. www.plasticspackaging.com
6. www.popularplastics.com

C) Major Equipments/ Instruments with Broad Specifications

Not applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H			H		H	H	H		M
CO2		H						M	H		M
CO3		H			M	M	M				M
CO4	H	H	H	H	M			M			H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Seminar (SEM) **COURSE CODE :** 6411

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	02	02	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

An engineer or technician has to carry out variety of tasks and face problems and situations in his Professional life. He has to convey his ideas, communicate with people. Effective presentation of ideas, thoughts and information becomes a requisite skill for him.

The involvement of student in the seminar course will help him to plan and prepare the related topic by searching information from various sources, interact with others, analyze the information, document the content and present.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop abilities to search information
2. Suggest ideas through seminar
3. Collect data, information from various resources
4. Develop planning of seminar activities
5. Develop skill to communicate the problems and solutions
6. Develop skill to prepare reports
7. Develop presentation skills

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes as applicable to seminar

1. Know and select seminar topic or problem statement in engineering field
2. Draft Problem statement or topic of seminar
3. Carry out literature survey from various resources
4. Write review of information search
5. Develop document preparation skills
6. Use of presentation skill for seminar delivery
7. Keep updated with latest trends in areas of engineering discipline

4.0 COURSE DETAILS:

Activity No	Activities
1	Briefing about selection for seminar topics in class: Discussion in class
2	Search seminar topics and approval of topic from guide from searched topics.
3	Collection of data and literature for seminar from: internet / visit / Journals / Books / EBooks
4	Preparation of synopsis of seminar topic: print draft copy
5	Submission of seminar synopsis to guide (Printed copy)
6	Guidance about preparation of document by guide
7	Preparation of document by students
8	Editing document
9	Submission of Seminar and presentation document: Hard copy and Soft copy of power point
10	Submission of diary
11	Seminar Presentation

The activities mentioned above shall be monitored and guided by the guide every week during the contact hours provided for the same.

5.0 AREAS FOR SELECTION OF SEMINAR:

S. No.	Areas For Selection
1	Plastic waste/recycling
2	Nanotechnology
3	Advances in plastic processing methods like injection, extrusion etc
4	Polymer blends
5	Diversified applications of plastics like automobile, medical, electrical, aircraft
6	Adhesives
7	Polymer composites
8	Nano composites
9	Advanced polymers
10	Automations in plastic processing plants

6.0 SUGGESTED INSTRUCTIONAL STRATEGIES:

1. Classroom Teaching, Library Assignment, Group Discussion, Case Studies

7.0 LEARNING RESOURCES:

Magazines, Journals, Papers: National and international Reference Books, Internet, Previous seminars, Text Books, Codes of Practices e. g. IS Codes, Video Cassettes, Audio Cassettes, Compact Discs, Charts, Transparencies, Software, Models, Industrial visits, expert lectures/workshops

8.0 GUIDELINES FOR SEMINAR:

1. **Selection of topic for seminar:**
   a. The student shall search from various resources and get the topic approved.
   b. Topic of seminar shall be based on curriculum with new developments.
   c. Topic of seminar should not be from the project taken by the group or by individual.
   d. Selection of topic should be finalised in consultation with teacher guide allotted for the seminar.

2. **Submission of Seminar Document:**
   a. The student shall get the seminar draft approved from Guide and complete final document.
   b. Each student shall prepare two hard copies of final seminar document and retain one copy with student and submit one hard copy along with soft copy for department.
   c. The structure of the seminar document shall be as per the following format: Certificate / Acknowledgement / Index / Introduction / Detailed content / Conclusion / References.
   d. The seminar report shall be of minimum 10 pages and max. 20 pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2 cm, bottom margin 2 cm, header and footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified. It should be certified by seminar Guide and Head of department.

3. **Evaluation of Seminar:**

Evaluation of seminar will consist of Progressive Assessment, Presentation

i. Progressing Assessment:

1. Progressive assessment will be based on attendance, searching of various seminar topics, selection of title, collection of data from internet, Journals, Literatures, organization of data and preparation of document.
2. The student has to get seminar document assessed from guide regularly.
3. The attendance of the student shall carry 05 marks as follows
   a. Below 75 % : 00 marks
   b. 75 % and below 80 % : 02 marks
   c. 80 % and below 85 % : 03 marks
   d. 85 % and below 90 % : 04 marks
   e. 90 % and above : 05 marks

ii. Presentation of Seminar:

1. The time for presentation shall be 7 to 10 minutes per student
2. The question answer session time shall be 2 to 3 minutes per student
3. Evaluation of presentation of seminar will be carried out by a panel of teaching staff from institute based on the following point
   a. Confidence and courage
   b. Technical knowledge acquired
   c. Presentation skill
   d. Use of presentation medium e.g. A/V aids, animation

iii. Marking scheme for Seminar.

Progressive assessment	Confidence and courage	Technical knowledge	Presentation skill	Use of media	Total
25	05	05	10	05	50

9.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1								H			
CO2								M		H	
CO3		H						M			
CO4			H		M					L	
CO5									H	M	
CO6											
CO7											H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Project (PRO) **COURSE CODE** : 6412

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	50	50*	100
					Min.	--	--	--	--	20	20	--

*TW to be assessed by internal and external examiner both

1.0 RATIONALE:

An Engineer or technician has to work on various projects in profession or Plastic Engineering field work. The aim of project is to develop the ability of "learning to learn' on its own, work in team. This would go a long way helping the students in keeping pace with future changes in technology and acquisition of Knowledge and skills as and when needed. The scientific way of solving the problems and ability to apply it to find alternative solutions for the problems will help a technician in his professional life. This course will help to inculcate leadership skills, decision making, participative learning, resource management, cost considerations, documentation and report writing skills with effective communication.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Integrate the knowledge of engineering programme
2. Develop the skill to identify the problem and define the problem statement
3. Develop scientific attitude for stepwise solutions to the problems
4. Develop attitude to work in team and act as leader of project
5. Develop planning and execution skills
6. Build multidisciplinary concept with cost considerations
7. Understand recent developments in engineering fields and prepare report

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate some of course outcomes as applicable to project

1. Participate effectively in group work
2. Collect, analyse and synthesise the data
3. Conduct a survey and investigate the activities
4. Make appropriate decision
5. Act as leader for group task
6. Develop cost consideration
7. Prepare technical reports

4.0 COURSE DETAILS:

Activity No	Activities
1	Formation of Group
2	Selection of Project: Individual/Group discussions
3	Define Problem statement for project work
5	Decide Strategies/Methodology to carry out project
6	Literature Survey/data survey
7	Submission of synopsis: by each group
8	Project activity plan-Defining activities, strategy, duration
9	Allocation of work responsibility to individual/team
10	Visits to Industries / Institutions / Market/field work/sites
11	Collection of Data /Survey/Analysis

Activity No	Activities
12	Design of Components, preparation of drawing, estimates wherever required, printed circuits design, its checking,
13	Fabrication, Assembling, Model/Prototype development, Testing as per project requirements
14	Progressive presentation of work and recording in diary
15	Consolidation of work allotted to individual or team
16	Presentation of initial draft: pre submission draft
17	Final Project Report: Printed: Submission: soft and Hard copy
18	Group presentation of project work at the time of final evaluation

The activities mentioned above shall be monitored and guided by Project Guide every week during the contact hours provided for the same.

The Project is also included with Seminar with the aim to develop certain set communication skills (preparation of report, writing survey report writing Lab. experiment results writing conclusions of the work done and physical phenomenon observed, participating in group discussions, verbally defending the project in the form of Seminar etc.)

5.0 AREA OF SELECTION FOR PROJECT

These are only guidelines; any project related to Plastic Engineering depending upon the availability of projects may be included. Preference should be given to practical oriented projects according to the local needs.

S. No.	Areas For Selection
1	Design and fabrication of model for any Plastic Engineering Processes
2	Design of moulds and working Drawing
3	Manufacturing of a mould
4	Software development for analysis, design evaluation of Plastic Product, mould, die and m/c
5	New plastic material development under areas like Blending, Composites and nano-composites
6	Automation, installation of plastic processing plants
7	On line quality control of plastic processing techniques
8	Maintenance management for seek units/machines
9	Plastic waste management
10	Design of a product

6.0 GUIDELINES FOR PROJECT:

A. Group Formation:

1. The department Head / Officer in Charge shall make sure that the project groups are formed within **one week** of the beginning of academic term and assign a faculty as project guide.
2. The students may be asked to work in groups of five students. The group size may be varied in accordance with the effective compliance of project work.
3. The group can decide the leader and distribute work and prepare the group management structure.

B. Finalization of Project Title:

1. The students are expected to take up a project with the guidance of a Project Guide from the institute/Industry Expert/Sponsored by industry, Institute, society, self.
2. Industrial project shall be encouraged.
3. The students can seek help from TPO/ HOD/Guide.

4. The group of students/Project guide/authority shall see the viability/ feasibility of project over the duration available with the students and capabilities and setup available.

C. Note:

1. The group / student shall prepare Project Diary with Name of Project, Name of Students in group, their attendance, and progress and get assessed from guide from time to time during project hours.
2. The title of the project should be finalized within **two weeks** after the group formation and a synopsis of the project should be submitted to the guide.
3. An abstract (synopsis) not exceeding 100 words, indicating salient features of the work shall be submitted to guide.
4. Modify format suitably as per requirement of the project.

D. Project Execution:

1. Guide shall monitor the work and help the students from time to time.
2. The progress shall be presented before the guide every week during project hours.
3. The students shall design parts, prepare their drawing showing all details, and manufacture within the institute / sponsoring industry / workshop in local areas.
4. The guide should maintain a record of progressive / continuous assessment of project work and observe the progress of each group member on weekly basis.
5. The same shall be kept ready for submission to the external examiner before the final examination.

E. Evaluation of Project:

1. The continuous evaluation of individual progress shall be followed
2. External examiner and guide shall jointly evaluate the project.
3. The project can be evaluated on site if it is difficult to bring or demonstrate the trials in the institute
4. The attendance of the student shall carry 05 marks as follows
   i. Below 75 % : 00 marks
   ii. 75 % and below 80 % : 02 marks
   iii. 80 % and below 85 % : 03 marks
   iv. 85 % and below 90 % : 04 marks
   v. 90 % and above : 05 marks
5. The details of project assessment are mentioned in Annexure II

F. Project Report:

1. The student shall get the initial draft copy of the project approved from the Project Guide.
2. Structure: It shall be as follows
   - Title page, Inner title page (white), Certificate, Certificate from Industry, Synopsis, Acknowledgment, Table of Contents, List of table and figures (optional), Introduction, Objectives of the Project, Methodology used, Design, Drawing of the part and assembly, Testing, Costing, Result, Conclusions and Scope for future, Merits, Demerits, Applications, Bibliography
   - Annexure consists of various designed parts and assembly drawings, photographs, charts, statistical data
   - CD of video clips /Power Point presentation
3. Each group has to submit one copy of project report to the library and one soft and hard copy to the department apart from the individual copy.
4. The project report will be of 40 to 50, A4 Size pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2.5 cm, bottom margin 1.5 cm, header and footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified.

5. Chapters (to be numbered in Arabic) containing Introduction-which usually specifies scope of work and the present developments. Main body of the report divided appropriately into chapters, sections and subsections. The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.
6. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.
7. The figures and tables must be numbered chapter wise.
8. The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.
9. Reference OR Bibliography:

   The references should be numbered serially in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [4]. The section on references should list them in serial order in the following format.

   1. For textbooks-Dr. V.L. Shah and Veena Gore, Limit State Design of Steel Structures, Structures Publications, 1 Edition, 2009.
   2. For papers-David, Insulation design to combat pollution problem, Proc of IEEE, PAS, Vol 71, Aug 1981, pp 1901-1907.
   3. Only SI units are to be used in the report. Important equations must be numbered in decimal form.
   4. All equation numbers should be right justified.

10. Each student from group shall have one copy with individual certificate only.

11. The project report and progressive assessment sheets are to be submitted before the end of term declared in the Academic Calendar of the institute.

7.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H										
CO2		H									
CO3							M				
CO4	M					L					
CO5				L			M				
CO6			H				H				
CO7			H								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Composites and Blends (CAB) **COURSE CODE** : 6419

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Properties of plastics can be modified as per the need of application which can be achieved by blending of two or more polymers and reinforcing the polymers with high modulus fibers. This course imparts the relevant knowledge of polymer blends and composites and its processing techniques.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand role of constituents of composites.
2. Explain manufacturing, trouble shooting and uses of composites.
3. Acknowledge importance of commercial Blends.
4. Describe different methods of blending.
5. List applications of Composites and Blends.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select matrix and reinforcements.
2. Enlist properties of different matrix and reinforcement.
3. Select suitable process for production of composite products.
4. Prepare polymer blend.
5. Carry out trouble shooting in composites.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of composites**	1a. Identify constituents of composite. 1b. Classify composites. 1c. Select suitable additive.	1.1 Definition of Composites, its main elements, their role, examples-Resin System, Reinforcements. 1.2 Curing agents for Matrices, Accelerators, Inhibitors, Coupling Agents, Release agents-their role and examples. 1.3 Classification of composite. 1.4 Advantages of composites.	06
Unit-II **Polymer Matrix**	2a. Explain curing of different matrix. 2b. State properties and applications of matrices. 2c. Select suitable molding compounds.	2.1 Curing reaction, properties and applications of unsaturated polyester, Epoxy, Vinyl esters, Phenolics. 2.2 Properties and applications of Polyimides, PC, PP, Polyamides. 2.3 Prepreges and Moulding compounds-SMC, BMC.	14

Unit-III **Reinforcements**	3a. Predict effect of loading and orientation of fiber. 3b. Explain preparation of fibers. 3c. Compare different fibers. 3d. Describe structural composite.	3.1 Types of Reinforcements, Effect of loading and orientation on strength of composites. 3.2 Preparation, properties applications of Glass, Carbon, Graphite, Aramid, Boron containing fibres, Natural Fibres. 3.3 3.3 Manufacture of Hybrid and Sandwich Composite.	12
UNIT-IV **Processing of Composites**	4a. Describe various processing technique. 4b. Trouble shoot the problems in composite process. 4c. State applications of composites.	4.1 Various Processing Techniques-Hand Lay Up, Spray Up, Vacuum Bag/ Pressure Bag Moulding, Matched Die Moulding, Pultrusion, Filament winding, Centrifugal Casting, Injection Moulding, Resin Transfer Moulding, Compression Moulding, Continuous Sheet Manufacturing. 4.2 Common faults observed in Composites and their remedies 4.3 Applications of Composites in Sports, Construction, Automobile, Aerospace, Telecommunication, Marine.	20
Unit-V **Polymer Blends**	5a. Explain types of blend 5b. Select suitable blending method.	5.2 Definition and Significance of Polymer Blend. 5.3 Miscible Blend, Immiscible Blend 5.4 Criteria for Miscibility 5.5 Methods of Blending-melt, solution and latex blending.	06
Unit-VI **Commercial Polymer Blends**	6a. Compare polymer blends on basis of property 6b. Recommend the suitable blend for particular application.	6.1 Properties and applications of commercial polymer blends such as PVC-NBR, ABS-PC, PP-EPDM, and PPO based blends.	06
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamentals of Composites	04	04	02	10
II	Polymer Matrix	04	06	06	16
III	Reinforcements	--	08	08	16
IV	Processing of Composites	06	08	08	22
V	Polymer Blend	04	--	04	08
VI	Commercial Polymer Blends	--	--	08	08
	TOTAL	**18**	**26**	**36**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours.
1	I	Determination of density of FRP specimen.	04
2	II	Determination of Matrix and Fibre Content of Composite.	04
3	III	Preparation of sandwich composites.	08
4	III	Determination of water absorption by Composite	04
5	IV	Manufacturing of rubber mould and statue by resin casting.	08
6	IV	Preparation of polymer composite product by Hand Lay Up Process.	08
7	IV	Preparation of polymer composite product by compression moulding.	04
8	IV	Preparation of FRP pipe.	08
9	IV	Demonstration of repair of FRP structures.	04
10	V	Report on applications of FRP.	04
11	V	Preparation of Polymer Blend.	04
12	V	Processing of Polymer Blend. (Injection / Compression Moulding)	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information about various FRP products.
2. Collect information about new areas of applications of blends.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange expert lectures by inviting engineers from related industries.
2. Arrange visit to nearby FRP industry.
3. Show video/animation of different composite operations.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Hand Book of Polymer Composite.	S. Peter	Chapman and Hall
2	Fundamentals of Polymer Composites.	Bren Strong	SPE
3	FRP Technology	Weather head	Applied Science
4	Hand Book of Reinforced Plastics	John Murphy	Elsevier
5	Polymer Blends and Alloys	Hope	Chapman and Hall
6	Polymer Blends Handbook	L.A. Utracki	Kluwer Academic Publishers

B) Software/Learning Websites

1. www.omnexus.com
2. http://www.moldedfiberglass.com/sites/default/files/docs/MFG_Selecting_FRP_Composite_for_Projects.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Muffle furnace.
2. Compression molding machine.
3. Filament winding unit.
4. Weighing balance.
5. Oven.
6. Brush.
7. Roller.
8. Mould.
9. Resin, Fibres, Curing agent, Release agent, Rubber solution.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1				H							
CO2			M								
CO3		H		H							
CO4			H	H		M		H			
CO5			H	H							

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Elastomer Technology (EST) **COURSE CODE** : 6420

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

An 'Elastomer' is an important material from the field of polymers because of their valuable and surprising properties, so it is necessary to study these materials in details. The content of course includes types of elastomer, their manufacturing, properties, applications and testing.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand preparation of different grades of natural rubber.
2. Describe the working of compounding equipment.
3. Suggest procedure for conversion of raw rubber into finished product.
4. List properties and applications of synthetic rubbers.
5. State the role and manufacturing of TPE.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify different grades of natural rubber
2. Perform the compounding of rubber.
3. Select appropriate vulcanization system.
4. Synthesize the different synthetic rubbers.
5. List applications of Natural and Synthetic rubber.
6. Determine various properties of elastomeric products.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Classification of Elastomer**	1a. Explain molecular requirement of rubbery material. 1b. Differentiate between natural and synthetic rubber.	1.1 History of rubber. 1.2 Molecular requirements of rubbery materials. 1.3 Natural and synthetic rubber.	04
Unit-II **Natural Rubber**	2a. State sources of natural rubber. 2b. Select suitable latex processing technique. 2c. Compare different grades of natural rubber.	2.1 Sources of natural rubber 2.2 Latex technology-tapping, collection, preservation, processing of latex. 2.3 Grades of natural rubber-conventional grades, TCR, TSR, applications of natural rubber.	12
Unit-III **Compounding of Rubber**	3a. Explain necessity of compounding. 3b. Select suitable method of	3.1 Principle and need of mastication. 3.2 Compounding ingredient Activator, Antioxidant, Antiozonant, Processing Aid, Fillers, Plasticizer-its need,	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	compounding. 3c. State recipes for various rubber products.	function and sequence of addition. 3.3 Equipments for compounding-Two roll mill, Banbury Mixer, Kneader. 3.4 Compound recipes for seals, O rings, tubes, gasket, conveyor belt, hoses.	
Unit-IV **Vulcanization of Rubber**	4a. Compare different vulcanization methods. 4b. Select suitable vulcanizing system.	4.1 Introduction to vulcanization 4.2 Need and Effect of Vulcanization 4.3 Vulcanization types-Sulphur, accelerated sulphur, peroxide and metal oxide vulcanization. 4.4 Vulcanization Techniques Injection moulding, Compression moulding, Transfer moulding. 4.5 Open cures-Autoclave, Microwave vulcanization.	12
Unit-V **Synthetic Rubber**	5a. Describe manufacturing of synthetic rubber. 5b. Select synthetic rubber for suitable application.	Manufacturing, properties and applications of- 5.1 Nitrile Rubber 5.2 Styrene Butadiene Rubber 5.3 EPM and EPDM Rubber 5.4 Neoprene Rubber 5.5 Silicone Rubber 5.6 Butyl Rubber	16
Unit-VI **Thermoplastic Elastomers**	6a. Explain the need and advantages of TPE. 6b. Classify thermoplastic elastomers. 6c. List out the application of TPE.	6.1 Introduction, need and advantages of TPE. 6.2 Classification of TPE- • PU based block copolymers. • Polyolefin based block copolymers. • Styrene based block copolymers.	08
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Classification of Elastomer	04	--	--	04
II	Natural rubber	06	08	04	18
III	Compounding of rubber	04	08	04	16
IV	Vulcanization of rubber	02	04	08	14
V	Synthetic rubber	04	08	10	22
VI	Thermoplastic Elastomer	02	--	04	06
	TOTAL	**22**	**28**	**30**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive,**

psychomotor and affective domain) so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	II	Determination of tear strength of vulcanized rubber.	04
2	III	Preparation of rubber compound by using Two-Roll mill.	08
3	III	Preparation of rubber compound by using Internal Mixer.	08
4	III	Determination of viscosity of rubber.	04
5	IV	Preparation of polysulphide rubber.	08
6	V	Identification of different types of rubbers.	04
7	V	Determination of hardness of rubbery material.	04
8	V	Determination of abrasion resistance of elastomer.	04
9	V	Determination of compression set of rubber by constant deflection method.	04
10	V	Determination of change in mass of rubber after ageing in fuel /oil.	04
11	V	Determination of rheological properties rubber compound.	04
12	V	Measure rebound elasticity of rubber.	04
13	VI	Determination of ozone resistance of rubber in static or dynamic condition.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect market rates of different rubbery materials.
2. Comparison of data based on grade, make, trade name and end use.
3. Search information about rubber synthesis industries.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Expert lecture of industry person in the area of compounding of rubber.
2. Demonstration of samples of different type of materials in the class while teaching about the concerned material.
3. Video Show on tapping, processing of latex and latex products.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Rubber Technology	C. N. Blow, Hephurn	Multitech
2	Synthetic Rubbers Chemistry and Technology	DC Bluckley	Applied Science
3	Rubber Technology	Moris, Morten	E. Arnold
4	Rubbery Materials	Bridson	NIIR
5	Rubber Technology Handbook	J.R. White, S.K. De	Rapra Technology
6	Polymer Blends Handbook	L. A. Utracki	Kluwer Academic Publishers

B) Software/Learning Websites

1. www.omnexus.com
2. www.rubberasia.com

3. http://iisrp.com/synthetic _rubber
4. www.westernrubber.com
5. http://cdn.intekopen.com/pdf_wm34065/pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Two roll mill
2. Banbury mixer
3. Rebound elasticity tester
4. Universal testing machine
5. Hardness tester
6. Abrasion tester
7. Compression set tester
8. Tear strength tester
9. Weighing balance
10. Beaker
11. Oscillating disc rheometer
12. Ozone chamber
13. Moony viscometer
14. Brook field viscometer
15. Round bottom flask

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H		H							
CO2		H	H	H		M					M
CO3		H	H	H		M					
CO4		H	H	H							M
CO5		H	H								
CO6			H	H				M			M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Moulds and Dies for Plastics (MDP) **COURSE CODE** : 6421

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	04	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Mould or die is an important tool used in plastics processing which imparts shape and size to the product. This course imparts the knowledge of the construction, function and working of basic parts of different types of mould and dies used with plastics. This is essential for the technician for designing and maintaining plastic moulds in plastics industries.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Explain the construction of various injection moulds and dies.
2. Understand the functioning of various moulds and extrusion dies.
3. Suggest suitable heating systems to a particular mould or die.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Draw an injection mould and state function of its parts.
2. Compare various types of injection mould.
3. Design cooling circuit for given injection mould.
4. Select suitable type of compression mould for a product.
5. Elaborate features of different types of die.
6. Select appropriate heating system for given mould.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Injection Moulds**	1a. Draw parts of an injection mould and state its function. 1b. Select single or multi cavity mould for application. 1c. Draw various types of gates and runners. 1d. Select suitable type of runner and gate. 1e. Determine number of cavities. 1f. List out types of ejection system. 1g. Select suitable ejection system for injection mould.	1.1 Basic parts of mould: Core, cavity, core and cavity plate, Single and Multi cavity mould, Integer core and cavity, inserts, bolster, back plate, guide pin, guide bush, sprue bush, cold slug well, draft, fixed half, moving half, register ring, shrinkage allowance and venting. 1.2 Feed system of mould: Sprue, runner, types of runner, runner layout and balancing of runner/gate, gate, types of gates-submarine, tab, edge, pinpoint, disc, positioning of gate, determination of number of cavities. 1.3 Ejection system for mould: Ejector grid, ejector plate assembly, Types of	10 11 04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1h. Draw and select suitable cooling circuit. 1i. Draw sketch of various injection moulds. 1j. Select suitable type of mould.	ejection technique-pin-blade and bar, stripper plate, sleeve, air ejection. 1.4 Cooling System: Cooling circuit for integer type and insert type core and cavity-U, Z circuit, rectangular, angular, bubbler, baffle, heat pipe. 1.5 Types of mould: Description and constructional details of two plate mould, three plate mould, hot runner mould, split mould using finger cam and dogleg cam.	04 08
Unit-II **Compression Moulds**	2a. Distinguish between various types of compression mould. 2b. Draw constructional features of mould. 2c. Calculate required depth of cavity.	2.1 Description and constructional details of compression mould-Positive, semi positive and flash moulds. 2.2 Single and multi cavity moulds, Calculations for depth of cavity/loading chamber	04
Unit-III **Blow Moulds**	3a. Draw basic parts of blow mould and explain its functions. 3b. Draw basic parts of parison die and explain its functions.	3.1 Basic parts of blow mould, Basic design features of pinch off and neck insert. 3.2 Basic design features of parison die, cooling, blowing, and venting system.	08
Unit-IV **Extrusion Dies**	4a. Identify various components of die. 4b. Draw sketch of various die parts. 4c. Explain function of various parts of die. 4d. Distinguish among various types of die. 4e. Select suitable type of die.	4.1 Die terminology-mandrel, adjusting screw, die bush, die ring, adapter, spider, land length, angle of entry. 4.2 General design consideration and constructional details of the following extrusion dies. i. Pipe die-Inline and offset die, ii. Sheet die and cast film die-Coat hanger and T-die, control of thickness. iii. Blown film die-side fed and bottom fed die. iv. Wire and cable coating die	12
Unit-V **Heating Systems**	5a. Select suitable method of heating to mould or die. 5b. Explain working of heating system	5.1 Types of heating-thermic fluid heating, steam heating and electrical heating. 5.2 Types of electrical heaters-band and cartridge heaters-its selection and rating.	03
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Injection Moulds				
	1.1 Basic Parts of Mould	04	04	04	12
	1.2 Feed System of Mould	02	04	08	14

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
	1.3 Ejection System for Mould	02	--	04	06
	1.4 Cooling System	02	04	--	06
	1.5 Types of Mould	02	04	04	10
II	Compression Moulds	02	--	04	06
III	Blow Moulds	04	04	--	08
IV	Extrusion Dies	02	04	08	14
V	Heating Systems	04	--	--	04
	TOTAL	**24**	**24**	**32**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Draw various parts of injection mould.	04
2	I	Assembling and disassembling of injection mould.	08
3	I	Draw various types of runner and gate.	04
4	I	Draw various types of cooling circuit.	04
5	I	Draw various types of ejector system.	04
6	I	Draw two plate injection mould.	04
7	I	Draw three plate injection mould.	04
8	I	Draw injection mould using CAD/ split injection mould.	08
9	I	Determine number of cavities on the basis of clamping capacity and shot capacity.	04
10	II	Draw positive, semi positive and flash type compression mould.	04
11	III	Draw extrusion blow mould.	04
12	IV	Draw pipe die (straight/offset die).	04
13	IV	Draw blown film die (side fed / bottom fed).	04
14	IV	Draw sheet die (Manifold – T / fishtail / coat-hanger)	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts for types of injection mould.
2. Prepare charts for types of extrusion dies.
3. Collect different shaped injection molded articles and identify the type of mould suitable for that product.
4. Collect information related to split mould.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video for mould operation.
2. Demonstrate computer software related to mould design.
3. Arrange a visit to a mould making / processing industry during mould change.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Injection Mould Design	R. W. Pye	Hanser
2	Plastic Mould Design	R. H. Beeb	Hanser
3	Handbook of Blow Moulding	Rosato	Hanser
4	Handbook of Injection Moulding	Rosato	Hanser
5	Extrusion Dies	M. V. Joshi	McMillan India
6	SPI Plastic Engineering Handbook	Michael L. Berins	Chapman and Hall
7	Plastic Mould Design Handbook	Dubois and Pribble	Rockport
8	Mould Engineering	Herbert Rees	SPE
9	Fundamentals of Plastics Mould Design	S. K. Nayak P. C. Padhi	McGraw Hill

B) Software/Learning Websites

1. http://webhotel2.tut.fi/projects/caeds/tekstit/mould/mould_structure.pdf
2. http://mould-technology.blogspot.in/2008/02/basic-functions-of-mold-base-parts.html
3. http://www.ferris.edu/htmls/academics/course.offerings/hillm/myweb7/Basic%20Molds/Basic%20Molds.html

C) Major Equipments/ Instruments with Broad Specifications

1. Hand injection mould
2. Machine injection mould
3. Extrusion dies
4. Measuring instruments such as Vernier Calliper

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H			M						
CO2		H	M		L						
CO3		H	M		L						
CO4			H			L				M	
CO5				H						M	
CO6	M							M		L	L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Additives for Plastics (AFP) **COURSE CODE** : 6422

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Plastics are used for various applications. However they cannot be used as it is. Various applications need plastics with different properties. The properties can be modified as per application requirements by using additives. The course acquires the basic knowledge of different additives, their function and mode of action, selection criteria and incorporation of additives in to the polymers.

2.0 COURSE OBJECTIVES:

The student will be able to

1. List different additives and their functions, classifications.
2. Understand the effect of additives on the properties of polymers.
3. Explain the mechanism of working of additives.
4. Describe the principle, construction, working and use of the compounding equipments.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select suitable additive for specific application.
2. Suggest property modifier for polymers.
3. Prepare polymer formulations.
4. Appraise processability of polymer.
5. Select suitable compounding method.
6. Operate compounding equipments.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Additives and its Types**	1a. Classify additives. 1b. Select additive. 1c. Optimise level of addition of additive.	1.1 Different additives, Need, function, level of addition and classification. 1.2 Criteria for selection of additives.	04
Unit-II **Stabilizing Additives**	2a. List stabilizing additives. 2b. Explain the need for stabilizing additives. 2c. Select stabilizing additive for particular application. 2d. Describe working of stabilizing additives.	2.1 Antioxidants: Auto oxidation, Mechanism of oxidation, Mechanism of antioxidants-primary and secondary, examples. 2.2 Light stabilizers, heat stabilizers: Photo oxidation, Mechanism of photo oxidation, Types-UV absorbers, Quenchers, Hydro peroxide Decomposers, Free radical Scavengers with examples.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		2.3 Metal deactivators: Introduction, Mechanism of inhibition, requirements for metal deactivators. 2.4 Flame retardants: Theory of flame retardancy, Classification, Halogen containing flame retardants-mode of action and examples. 2.5 Phosphorus containing flame-retardants, Inorganic flame-retardants, Halogen Free Flame Retardant.	04 03 04
Unit-III **Property Modifiers**	3a. Explain the need for property modification. 3b. Select property modifier for particular application. 3c. Optimise the cost of production. 3d. Modify properties of polymers as per requirement.	3.1 Plasticizers: Need, function, classification, theories of plasticization, selection criteria and examples. 3.2 Fillers: Need, function, classification, criteria for selection, examples, brief introduction of nanoclays. 3.3 Colorants: Pigment and Dyes, types, function and examples. 3.4 Blowing agents: Requirements for blowing agent, methods of incorporation, important classes and examples. 3.5 Impact modifiers: Need, function and examples.	05 03 04 04 02
Unit-IV **Processing Aids**	4a. Select processing aids. 4b. Incorporate / Apply processing aids. 4c. Appraise processability of plastics.	Need, function, classification and examples of, 4.1 Lubricants 4.2 High polymeric Processing aids for PVC. 4.3 High polymer additives for improving impact strength 4.4 Slip, anti-slip, anti-block agents, antistatic agents 4.5 Mould release agents	09
Unit-V **Miscellaneous Additives**	5a. Explain function of curing agent / bio stabilizer/coupling agent /nucleating agent / anti fogging agent. 5b. Select curing agent / bio stabilizer /coupling agent / nucleating agent/ antifogging agent.	5.1 Need, function and examples of • Curing agents • Bio-stabilizers • Coupling agents (Silanes) • Nucleating agents (Clarifiers) • Anti fogging agents	06
Unit-VI **Compounding**	6a. Describe working of compounding equipments. 6b. Select suitable compounding equipment. 6c. Operate compounding	6.1 Need for compounding 6.2 Equipments used for compounding (Construction and working only)- Two roll mill, Ban burry mixer, High speed mixer, Kneader, Extruder, twin-screw extruder.	01 09

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	equipment. 6d. Formulate master batches.	6.3 Master batches and their preparation.	02
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Additives and its Types	02	02	--	04
II	Stabilizing additives	06	08	08	22
III	Property Modifiers	08	08	08	24
IV	Processing Aids	02	04	04	10
V	Miscellaneous Additives	--	04	04	08
VI	Compounding	02	02	08	12
	TOTAL	**20**	**28**	**32**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	II, III, IV, VI	Trial on high speed mixer.	04
2	II, III, IV, VI	Trial on tumbler mixer.	04
3	II, III, IV, VI	Trial on compounding extruder.	08
4	II, III, IV, VI	Trial on Banbury mixer.	04
5	II, III, IV, VI	Trial on bus co kneader.	08
6	II, III, IV, VI	Trial on two roll mill.	04
7	II, III, IV, VI	Trial on continuous mixer.	04
8	II, III, IV, VI	Trial on continuous compounding line.	08
9	II, III, IV, VI	Preparation of master batch.	08
10	III	Determination of filler content in plastic sample.	04
11	I, II	Determination of Carbon Black content in plastic sample.	04
12	III	Determination of plasticizer absorption by PVC.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect market rates of various additives.
2. Prepare charts of information of additives.
3. Refer literature regarding impact modification of plastics.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to compounding of additives.
2. Arrange a visit to nearby compounding industry.
3. Arrange expert lecture on additives and compounding methods.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Handbook of Additives For Plastics	Muller	Hanser
2	Mixing in Polymer Processor	Rauwendaal	Hanser
3	SPI Plastic Engineering Handbook	M. Berins	Chapman & Hall

B) Software/Learning Websites

1. www.directindustry.com Plastics Processing
2. www.amazon.in/Plastics-Compounding-Equipment processing.../dp/ 1569902364

C) Major Equipments/ Instruments with Broad Specifications

1. Weighing balance.
2. High speed mixer.
3. Tumbler mixer.
4. Compounding extruder.
5. Kneader.
6. Master batch production line.
7. Two roll mill.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	M			L					
CO2		H	H	M				L		L	L
CO3			H	M	M	L		L		L	L
CO4				H	M		L	L	L		
CO5				H	L	L					L
CO6				H				M		M	L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastics Moulding Techniques (PMT) **COURSE CODE** : 6423

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Plastics materials are converted into useful end products by various methods. This course imparts knowledge about some of moulding techniques along with machines, auxiliary equipments, process optimization and trouble shooting of each.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the working principle of various moulding machines.
2. Elaborate the features of various moulding techniques with their applications.
3. Quote specification of moulding machines.
4. Analyze and overcome the processing defects.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Operate compression moulding machine.
2. Operate injection moulding machine.
3. Operate rotomoulding machine.
4. Operate thermoforming machine.
5. Optimize the process parameters for different techniques.
6. Select suitable method of casting.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Compression Moulding**	1a. Explain the principle of process. 1b. Enlist steps in compression moulding. 1c. Troubleshoot defects in compression moulding. 1d. Select type of machine. 1e. Describe effect of the process parameters.	1.1 Basic process and moulding compounds. 1.2 Types of m/c-hand operated/automatic/semiautomatic 1.3 Effects of bulk factor, flow properties, curing time, temperature and pressure on the quality of product. 1.4 Effects of preheating and preforming. 1.5 Preforming machine and Preheaters (Hot air circulatory oven, high frequency and infra-red). 1.6 Advantages and limitations of compression moulding. 1.7 Moulding defects, their causes and remedies**.**	10
Unit-II	2a. Compare different methods.	2.1 Basic process and principle. 2.2 Types of transfer moulding-pot, plunger	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Transfer Moulding	2b. Troubleshoot the defects.	and screw type. 2.3 Effect of material properties and process parameter on transfer moulded articles. 2.4 Advantages and limitations of transfer moulding. 2.5 Moulding defects, their causes and remedies.	
Unit-III **Injection Moulding**	3a. Explain the function of various parts of the machine. 3b. Select suitable type of machine on the basis of specification. 3c. Calculate cycle time and production rate. 3d. Distinguish between various types of machine. 3e. Optimize the process parameters. 3f. Elaborate the significance of special types of machine.	3.1 Basic process, types of injection moulding machine-plunger type, screw type moulding machine, criteria for its selection. 3.2 Injection moulding cycle, moulding materials. 3.3 Constructional features of hopper, barrel, screw, nozzle, drives and concept of torque, non-return valves-ball and ring type. 3.4 Description of injection unit, shot capacity, plasticizing capacity, injection pressure, suck back. 3.5 Description of locking unit, mould clamping force, size of platen, daylight opening. 3.6 Comparison between mechanical and hydraulic clamping system, hydro mechanical clamping system. 3.7 Effect of processing parameters on quality of product. 3.8 Advantages and limitations of injection moulding. 3.9 Moulding defects, causes and remedies. 3.10 Advances in injection moulding: Injection Moulding of thermosets, Gas assisted injection moulding, Reaction Injection moulding-basic process, materials and applications.	20
Unit-IV **Rotational Moulding**	4a. Enlist the steps in rotomoulding process. 4b. Select the suitable type of machine depending on the product. 4c. State the limitations of the process. 4d. Troubleshoot defects.	4.1 Basic process and principle, materials, applications. 4.2 Types of rotational moulding machines-batch type, independent arm type, straight-line, jacketed mould machine, carousel type. 4.3 Merits and demerits of rotational moulding. 4.4 Moulds for rotomoulding. 4.5 Moulding defects, causes and remedies.	08
Unit-V **Thermoforming**	5a. Describe methods of thermoforming. 5b. Select suitable machine	5.1 Basic process, materials and applications. 5.2 Methods of Thermoforming, Vacuum forming, Pressure forming, plug assist forming, Drape forming, Plug and Ring	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	depending on the quantity required. 5c. Comparison with injection moulding. 5d. Set and optimize the process parameters for quality production.	forming, Slip forming, Ridge forming, Reverse Draw with plug Assists, Snap back forming, Matched mould forming, Dual-sheet forming, trimming methods. 5.3 Machines for thermoforming-single stage, multiple stages, in-line machines. 5.4 Process variables: air, temperature, mould temperature, plastic memory, hot elongation /strength 5.5 Remedies and causes of defects in thermoforming. 5.6 Advantages and limitations of thermoforming. 5.7 Comparison of thermoforming with injection moulding.	
Unit-VI **Casting**	6a. State basic principle of casting. 6b. Suggest suitable method for casting products.	6.1 Principle, materials, advantages and limitations. 6.2 Types of casting techniques and their description-Simple, film, hot melt, slush, rotational and dip casting.	06
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Compression Moulding	04	04	04	12
II	Transfer Moulding	02	04	04	10
III	Injection Moulding	08	08	08	24
IV	Rotational Moulding	04	04	04	12
V	Thermoforming	06	04	04	14
VI	Casting	02	02	04	08
	TOTAL	**26**	**26**	**28**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Trial on hand operated/semi automatic compression moulding machine.	08
2	II	Demonstration of transfer moulding.	08
3	III	Trial on hand operated injection moulding machine	04
4	III	Loading and unloading of mould on injection moulding machine.	04
5	III	Trial on plunger injection moulding machine.	04
6	III	Trial on screw type injection moulding machine.	08
7	III	Trouble shooting on injection moulding.	08
8	IV	Trial on rotational moulding machine.	08
9	V	Trial on vacuum forming machine.	04
10	V	Trouble shooting on vacuum forming.	04
11	VI	Casting of PMMA/Polyester.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect moulded products for show case.
2. Prepare chart for typical moulding conditions.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video or arrange industrial visit for compression / transfer/ injection/ roto moulding/ thermoforming.
2. Arrange expert lecture on moulding of plastics.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Compression and Transfer Moulding	J. Butler	McMillan India
2	SPI Plastics Engineering Handbook	Michael L. Berins	Chapman and Hall
3	Handbook of Injection Moulding	Rosato	Kluwer Academic Publishers
4	Handbook of Thermoforming	Throne	HANSER
5	Basic Principles of Thermoforming	Bruins	SPE
6	Industrial Plastics-Theory and Applications	Terry L. Richardson	Robert Lynch
7	Plastics Engineering	Crawford R. J.	Macmillan

B) Software/Learning Websites

1. www.vinodrai.com
2. www.neelkamal.com
3. www.ukayindustries.co.in
4. www.storewel.com
5. www.satishinjecto.com
6. www.vipbags.com
7. www.technologystudent.com
8. www.paulsontraining.com
9. www.traininteractive.com/knowledge/previews/injection/
10. www.people.bath.ac.uk/en3hl/inject

C) Major Equipments/ Instruments with Broad Specifi

1. Compression moulding machine 35 tones
2. Injection moulding machine 60 g shot weight, 40 tones
3. Rotational moulding machine

4. Vacuum forming machine
5. Scrap grinder
6. Tool kit
7. Crane or Chain-pulley block

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H	H	H				L	L		
CO2		H	H	H				L	L		
CO3		H	H	H				L	L		
CO4		H	H	H				L	L		
CO5		H	H	H				L	L		
CO6		H	H								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastics Processing Techniques (PPT) **COURSE CODE** : 6424

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Course imparts knowledge about conversion of raw materials into finished products by applying various plastics processing techniques. With the aid of these techniques one can trouble shoot the defects in order to develop acceptable quality products.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand principles of various processing techniques.
2. Elaborate the features of various processes and their applications.
3. Describe plant layout of various processing techniques.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Operate extrusion plant.
2. Operate blow moulding machine.
3. Operate calendaring unit.
4. Troubleshoot the processing defects.
5. Select suitable surface treatment method on plastics.
6. Perform various plastics decorating operations.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I Extrusion	1a. Identify and state functions of various parts of extruder. 1b. State principle of various extrusion processes. 1c. Troubleshoot the problems during extrusion process. 1d. Explain working of various extrusion plants. 1e. Select suitable auxiliary equipment	1.1 Basic process, materials, applications, mechanism, fundamentals, nomenclature. 1.2 Single screw extruder-constructional features of different parts such as hopper, barrel, screw, heating and cooling systems, zones of extruder, thrust bearing, breaker plate and screen pack 1.3 Twin screw extruder-types of screw, co-rotating, counter-rotating, its comparison. 1.4 Drive systems for single screw and twin screw extruder and features of reduction gear box. 1.5 Advantages of twin screw over single screw extruder. 1.6 Pipe extrusion-Process plant layout and auxiliary equipments such as sizing device, cooling trough, take-off unit, cutter, coiler, tilting platform, socketing. 1.7 Blown film extrusion-process plant layout and auxiliary equipments such as venture	02 02 02 02 02 02 02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		ring support, bubble blowing unit, cooling unit, bubble collapsing plates, film treater, winder unit, co extrusion-2 and 3 layer (brief idea)	
		1.8 Sheet extrusion-process layout and auxiliary equipments such as cooling unit, stripping gadget unit, gauging heads, cut-out unit, sheet stacker and coiler.	02
		1.9 Trouble shooting in extrusion i.e. defects, causes and remedies.	02
		1.10 Cable/wire coating-process layout and auxiliary equipments such as take-off unit, sizing unit, cooling tank	02
Unit-II **Blow Moulding**	2a. List the steps in blow moulding process 2b. Select suitable type of blow moulding process. 2c. Explain Parison programming. 2d. Describe function of various parts of blow moulding machine. 2e. Troubleshoot the problems in blow moulding process.	2.1 Basic process, materials and application. 2.2 Extrusion(Intermittent and continuous blow moulding), coextrusion blow moulding 2.3 Injection blow moulding and stretch blow moulding. 2.4 Parison wall thickness control 2.5 Blow up ratio, hoop ratio 2.6 Process parameters/variables, their effect on quality of products. 2.7 Trouble shooting in blow moulding process.	01 02 02 02 01 01 01
Unit-III **Calendaring**	3a. Explain working of calendaring unit. 3b. Illustrate different configurations of calendars. 3c. Select appropriate mechanism of thickness control. 3d. Differentiate between calendaring and extrusion.	3.1 Basic process, materials and applications. 3.2 Process layout, auxiliary equipments such as gauge measuring device, take-off unit, embossing unit, winding unit. 3.3 Types of calendar units 2, 3, and 4 roll calendar, their configurations, constructional features of calendar rolls, drives, heating and cooling system of rolls. 3.4 Significance and features of roll crowning, roll bending and roll crossing. 3.5 Comparison of calendaring versus extrusion.	01 02 04 02 01
Unit-IV **Cellular Plastics**	4a. Explain preparation of various foam. 4b. Select suitable foam material.	4.1 Structural foams-concept, blowing agent and its type, Polyurethane foam, PVC foam, PS foam, their processing, properties and applications.	06
Unit-V **Fabrication With Plastics**	5a. Select suitable finishing process. 5b. Explain various welding techniques.	5.1 Basic process and purpose of finishing-filing, drilling, grinding, buffing, mechanical fastening. 5.2 Solvent cementing and adhesive bonding. 5.3 Welding Techniques-High frequency welding, dielectric heat sealing, thermal sealing of film and sheet, hot gas welding, hot plate welding, induction welding, spin or friction welding, ultrasonic welding.	03 02 05
Unit-VI	6a. Explain preparation	6.1 Surface treatment-washing, solvent	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Decorating Plastics	of surface for decoration. 6b. Select suitable decoration method.	cleaning, flame treatment, corona treatment. 6.2 Decorating techniques such as-Printing (screen, pad, flexographic, rotogravure), hot transfer processes, laser marking, dyeing, electroplating, vacuum metallizing, labels and decals, flocking, dip coating.	06
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Extrusion	04	08	12	24
II	Blow Moulding	02	04	08	14
III	Calendaring	04	06	04	14
IV	Cellular Plastics	02	04	02	08
V	Fabrication with Plastics	02	04	04	10
VI	Decorating Plastics	02	04	04	10
	TOTAL	**16**	**30**	**34**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Trial on pipe extrusion.	08
2	I	Trial on blown film extrusion plant.	08
3	II	Trial on blow moulding machine.	08
4	II	Demonstration of injection stretch blow moulding process.	08
5	III	Demonstration of calendaring process.	08
6	IV	Demonstration of EPS bead steam process / PVC foam sheet extrusion.	08
7	V	Joining of plastic using solvent cement.	04
8	V	Joining of plastics by adhesive bonding.	04
9	V	Trial on ultrasonic welding machine.	04
10	VI	Screen printing on given plastic sample.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect various products like pipes, wires, films, bottles to identify the different plastics processing techniques.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to Plastic processing industries.
2. Arrange expert lecture/ video demonstration in the area of plastics processing.
3. Assignment on identification of processing and decorating techniques for the different products.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Polymer Extrusion	Rauwandaal	Hanser
2	Plastic Extrusion technology	Hensen	Hanser
3	SPI's Plastic Engineering Handbook	Michael Berins	Chapman & Hall
4	Blow moulding Handbook	Rosato	John Willey & sons
5	Industrial Plastics-Theory and Applications	Terry L. Richardson	Robert Lynch

B) Software/Learning Websites

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

C) Major Equipments/ Instruments with Broad Specifications

1. Pipe Extrusion unit 50 mm diameter
2. Blown film plant
3. Extrusion blow moulding plant 2 L(liter) capacity
4. Ultrasonic welding machine
5. Screen printing machine
6. Adhesives and solvents
7. Pipe joints

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H	M	H	M				H			M
CO2		M	H	M				H			M
CO3		M	H	M				H			M
CO4	M	M	H			L		H			M
CO5	M	M	M	L							
CO6	H	M	H					H			

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Testing of Plastics (TOP) **COURSE CODE** : 6425

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

This course helps to acquire the basic knowledge of the testing of plastics with the advent of engineering and technology. The concept of testing is an integral part of the research and development, product design and manufacturing. This course gives the relevant knowledge of testing procedure, applications and significance.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Explain meaning and purpose of testing.
2. List out standards and purpose of specifications.
3. Describe sample preparation and conditioning.
4. Determine strength of plastics materials and product.
5. Compare and classify the materials/ products.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select material/ test specimen as per standard for the test.
2. Prepare test specimens for testing.
3. Operate various testing equipments.
4. Perform various tests as per standard.
5. Identify the factors affecting test results.
6. Interpret the test results.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Testing and Standards.**	1a. Explain meaning and purpose of testing. 1b. State importance of standards and specifications. 1c. List out the organizations for standards. 1d. Describe sample preparation and conditioning procedure.	1.1 Importance and need of Testing. 1.2 Specifications and Standards-ASTM, DIN, ISO. 1.3 Sample preparation and conditioning.	03
Unit-II **Physical Properties**	2a. Determine density and bulk factor.	2.1 Density, Specific Gravity-Methods of determination. 2.2 Bulk Density, Bulk Factor.	03
Unit-III **Mechanical**	3a. Explain the need for mechanical properties. 3b. Operate various	3.1 Tensile Properties and Test Methods, Flexural Properties and Test Methods, Compression	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Properties	mechanical testing equipments. 3c. Calculate strength of plastic materials. 3d. Compare plastics materials	Properties and Test Methods. 3.2 Creep Test, Fatigue Test. 3.3 Impact Properties and Test Methods-Izod, Charpy, Dart, Falling weight. 3.4 Hardness test-Shore, Rockwell. 3.5 Abrasion Resistance.	 03 06 03 02
Unit-IV **Thermal Properties**	4a. Perform the standard test procedures for HDT/ VSP. 4b. Interpret test results. 4c. Identify the flame resistance. 4d. Classify the material.	4.1 Introduction, Thermal Conductivity, Coefficient of Thermal Expansion and Contraction, Brittleness Temperature. 4.2 Heat Deflection Temperature (HDT), Vicat Softening Point. 4.3 Flammability-Limiting Oxygen Index Test.	03 03 02
Unit-V **Electrical Properties**	5a. Measure electric properties 5b. Classify materials based on electrical properties	5.1 Introduction, Dielectric Strength, Dielectric Constant. 5.2 Electrical Resistance Test-Volume resistivity, Surface resistivity. Dissipation Factor. 5.3 Arc resistance test.	03 02 01
Unit-VI **Flow Properties**	6a. Understand flow behavior of thermoplastics 6b. Identify flow behavior of thermosets. 6c. Describe capillary rheometer.	6.1 Melt Flow Index for Thermoplastics 6.2 k-value for PVC 6.3 Cup method for Thermosets 6.4 Introduction to Capillary Rheometer.	02 02 01 01
Unit-VII **Chemical Properties**	7a. Perform the chemical tests. 7b. Interpret the test results.	7.1 Immersion test 7.2 Stain resistance test 7.3 Solvent stress cracking resistance 7.4 Environmental Stress Cracking Resistance.	01 01 01 02
Unit-VIII **Optical Properties**	8a. Apply optical properties in selection of material.	8.1 Refractive Index 8.2 Gloss 8.3 Haze and Luminous Transmittance.	02 01 02
Unit-IX **Specific Test**	9a. Measure weather resistance of materials. 9b. Describe DSC and TGA. 9c. Perform tests on pipes and containers. 9d. Interpret the test results.	9.1 Weathering Resistance-Resistance to UV, Resistance to Fungi, Bacteria. 9.2 Differential Scanning Calorimetry, Thermo Gravimetric Analysis. 9.3 Tests for Pipe and Containers-Burst strength Test, Acetone Immersion test, Drop Test for container.	03 03 02
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Testing Standards	02	--	--	02
II	Physical Properties	02	02	--	04

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
III	Mechanical Properties	04	06	20	30
IV	Thermal Properties	02	04	04	10
V	Electrical Properties	02	04	04	10
VI	Flow Properties	--	02	04	06
VII	Chemical Properties	--	02	04	06
VIII	Optical Properties	--	--	04	04
IX	Specific Tests	--	04	04	08
	TOTAL	**12**	**24**	**44**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	II	Determination of Density and Specific Gravity of given polymer sample.	04
2	III	Determination of Tensile Strength of plastics specimen.	06
3	III	Determination of Flexural Strength of plastics specimen.	06
4	III	Determination of Compression Strength of plastics specimen.	04
5	III	Determination of Izod Impact Strength of plastics specimen.	04
6	III	Determination of Charpy Impact Strength of plastics specimen.	04
7	III	Determination of Dart Impact Strength of plastics film.	04
8	III	Determination of Shore Hardness of plastics specimen (Shore-A and D).	04
9	IV	Determination of Vicat Softening Point of plastics specimen.	04
10	IV	Determination of Heat Deflection Temperature of plastics specimen.	04
11	VI	Determination of Melt Flow Index of given plastic material.	04
12	VI	Determination of k-value of given PVC.	06
13	IX	Determination of Burst Strength of Pipe.	06
14	IX	Determination of Impact strength of RPVC Pipe.	04
TOTAL			**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare samples for testing.
2. Find out the reasons for variation in results (beyond expectation variation if any)
3. Prepare charts for ASTM codes of various tests.
4. Collect information about various standards organization.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to testing of plastics.
2. Arrange expert lecture on SQC and SPC by Quality Manager/Engineer of a plastic industry such as six sigma, TQM etc.
3. Arrange a visit to nearby plastic industry and show students different testing procedure being carried out there.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Plastics Testing technology Hand Book	Vishnu Shah	Wiley Inter-science.
2	Hand Book of Polymer testing	R.P. Brown	Marcel-Dekker Inc.
3	Testing of Plastics	A. S. Athalye	Tata McGraw Hill.
4	Fundamentals of Plastics Testing	S. K. Nayak	Springer.

B) Software/Learning Websites

1. http://www.ipolytech.com
2. http://www.ulttc.com
3. http://www.intertek.com
4. http://www.labtesting.com

C) Major Equipments/ Instruments with Broad Specifications

1. Vernier caliper.
2. Refractometer.
3. Dial thickness gauge.
4. Oxygen Index tester.
5. Universal Testing Machine.
6. ESCR tester.
7. Shore Hardness Tester.
8. DSC/ TGA tester.
9. Abrasion tester.
10. Izod/ Charpy impact tester.
11. Dielectric strength and constant tester.
12. Drop tester.
13. HDT cum VST tester.
14. Dart impact tester.
15. MFI tester.
16. Hazemeter.
17. Viscometer.
18. Whetherometer.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	H	M			L	M			L
CO2		H	H	M	L		L	M			L
CO3		M	H	M				M	L		L
CO4		M	H	M				M			L
CO5		H	M	M	L			H	L		M
CO6							L	H	M		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Mould Manufacturing (MMF) **COURSE CODE** : 6521

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	02	02	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Plastic Mould making is one of the specialized areas in manufacturing. A trend of replacing the metal by plastic material is ever growing. Hence need of Mould maker is always in demand and ever increasing.

This course is manufacturing sector which describe the Mould manufacturing methods by using various conventional and modern machining tools like lathe, milling, shaping, slotting, grinding, super finishing and electro discharge machine, CNC machines etc.

This course imparts knowledge, skills and competences for selections of materials, manufacturing various Mould components their assembly and heat treatment methods.

It also provides the knowhow of applications for different Mould making software's.

The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on Mould manufacturing by using different manufacturing processes.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand various mould making materials and its manufacturing.
2. Understand working principle of various machine tools.
3. Illustrate importance of different heat treatment methods.
4. Acknowledge the significance of mould finishing techniques.
5. Know different mould manufacturing software in practices.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify different components of mould.
2. Select suitable mould making material.
3. Select and use particular machine tool for manufacturing mould components.
4. Select and apply suitable heat treatment for a particular mould.
5. Select and apply suitable finishing method for a mould.
6. Assemble various mould parts.
7. Identify and select mould making software.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **General Mould Construction**	1a. Explain the construction details of moulds used for plastic moulding processes. 1b. State function of various mould parts.	1.1 Introduction to Basic mould terminology-impression, cavity and core plates, sprue bush, runner and gate system, register ring, guide pillars and bushes, fixed half and moving half, integer cavity and core plates, cavity and core insert.
Unit-II	2a. Describe various types	2.1 Mould steel, Mild Steel, EN series 9-12 steel

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Mould Making Materials	of steel and its properties. 2b. Select suitable mould making material.	alloys, tool steel other than steel-Beryllium, Copper, sheet metal, Aluminium, their essential properties and uses for particular mould parts, criteria for selection of material.
Unit-III **Conventional and Modern Machining Techniques**	3a. Illustrate principle of operation of various machine tools. 3b. Select specific machine tool for a particular job.	3.1 Machine tool, lathe, cylindrical grinding, surface grinding machine, shaping and slotting machine, milling m/c, electro discharge m/c, cold hobbing, spark erosion, concept of CNC machining and steps in CNC machining. Programming principle and methods 3.2 (Aspects to be covered are principle of operation, tools, machinery, catalyst required, accuracy and application of processes.) 3.3 Pattern making, pattern material, selection, Types of pattern various allowances, colour coding. Casting, moulding sand, types and properties of moulding sand.
Unit-IV **Heat Treatment**	4a. Explain the need of heat treatment. 4b. Select and apply appropriate heat treatment method.	4.1 Purposes and methods of heat treatment, principle of heat treatment, object, methods of heat treatment, nitriding, hardening, carburising, annealing, normalizing, tempering, heat treatment furnaces-hearth and bath furnace, their construction and principle of working.
Unit-V **Polishing and Finishing**	5a. Select suitable material, tool and method for mould finishing. 5b. Select appropriate finishing method.	5.1 Polishing and finishing tools, equipment and material, methods like etching, emery polishing, diamond polishing, metal deposition, diffusion coating.
Unit-VI **Mould Assembly**	6a. Mould assembling and inspection. 6b. Identify and select the appropriate mould making software for a particular application.	6.1 Inspection of all tool element, bench fitting, step for mould assembly, attachment of mould to platen-direct and indirect bolting methods, introduction to application of computer software for mould making such as CAD, CAM, CAE, CATIA, PRO-E, Moldflow.

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I to VI	1. Manufacturing of any one type of simple mould using machine tool and techniques such as-Lathe Machine, Surface Grinding, Milling Machine, Shaping and Slotting Machine, Drilling, CNC/ EDM, Heat treatment and Finishing. 2. Costing of mould components and assembly as a whole. 3. Assignments on different mould manufacturing machines.	32
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare chart for mould parts and its function.
2. List out materials for different parts of injection mould, blow mould etc.
3. Select one mould drawing from industry. Estimate the cost of mould by using bill of material and machining cost from market.
4. Download four mould manufacturing machines catalogues and study their technical specifications.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show demo of CAI computer software related to mould manufacturing.
2. Arrange a visit to tool room such as IGTR or any other mould manufacturing industry.
3. Arrange expert lecture on non-conventional or advanced mould manufacturing techniques.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Workshop Technology vol. 1 and 2	Hajra Chaudhary	Media Promoters and Publishers, Bombay.
2	Workshop Technology	Raghuwanshi	Dhanpat Rai and Sons.
3	Injection Moulds Design	R. G. W. Pye	Rockport
4	Handbook of Plastic Engineers	Rubin	Chapman and hall
5	Mould Engineering	Herbert Rees	SPE
6	Plastic Mould Engineering Handbook	Buckleitner	Hanser

B) Software/Learning Websites

1. http://www.lathemachinesindia.com/lathe-machine.html
2. http://www.hnsa.org/doc/pdf/lathe.pdf
3. http://www.hnsa.org/doc/pdf/milling-machine.pdf
4. http://uhv.cheme.cmu.edu/procedures/machining/CH8.PDF
5. http://www.efunda.com/processes/heat_treat/introduction/heat_treatments
6. http://web.iitd.ac.in/~suniljha/MEL120/L4_Heat_Treatment_of_Metals.pdf
7. http://www.technologystudent.com/equip1/heat1.html
8. http://www.makeyourownmolds.com
9. http://www.makeyourownmolds.com/silicone-plastique-video
10. http://www.ceramicartsdaily.org/.../ceramic-mold-making-techniques
11. http://www.hacknmod.com/hack/8-mold-making-tips-and-techniques/
12. http://www.cimatrontech.com/
13. http://www.mmsonline.com/articles/from-mold-making-to-mold-manufacturing

C) Major Equipments/ Instruments

Sr.No.	Name Of Equipments/ Instruments	Qty
1	Lathe machine with standard accessories and attachments.	10
2	Drilling machine with standard accessories and attachments.	1
3	Shaping machine with standard accessories and attachments.	1
4	Milling machine and M1TR Milling machine with standard accessories and attachments.	1 each
5	Boring machine with standard accessories and attachments.	1
6	Grinding machine with standard accessories and attachments.	1 each
7	Metallurgical microscope	1
8	Hardness tester	1
9	Induction furnace	1
10	Required cutting tools and tool holders.	LS
11	Required Measuring tools.	1 set each
12	Etching and Polishing machine with standard accessories and attachments.	1 each
13	EDM with standard accessories and attachments.	1
14	Slotting machine with standard accessories and attachments.	1

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H	H						M	L	
CO2	H	H	H						M	L	
CO3		H	H	H							
CO4	H	H	H								
CO5	H	H	H								
CO6		H	H	H			M	M		M	M
CO7		H	H			M	M				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Maintenance of Plastics Processing Machines (MPM) **COURSE CODE :** 6522

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

In plastics industry different types of machines are used. Maintenance of machinery has great importance in plastics industry for breakdown free production. This course gives basic idea about maintenance, types of maintenance and significance of maintenance.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Explain the problems related to machine functioning.
2. Help to keep the machine in working condition.
3. Know the types of maintenance.
4. Co-ordinate various departments related to maintenance.
5. Maintain record of maintenance.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Operate various measuring and controlling instruments.
2. Explain fundamentals of machine mechanism.
3. Perform routine, preventive and break down maintenance.
4. Apply maintenance schedule.
5. Maintain lubricating mechanisms for prevention of wear and corrosion.
6. Organize maintenance activities in co-ordination with different departments

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Types of Maintenance**	1a. State the types of maintenance and their significance.	1.1 Types of maintenance, routine, preventive, breakdown and their significance for all plastic processing machinery.	04
Unit-II **Routine Maintenance**	2a. Illustrate minor repair work. 2b. Select appropriate lubricant. 2c. Predict quantity of lubricant. 2d. Select lubrication methods.	2.1 Routine maintenance, oiling, lubrication, types of lubrication lubrications system, cleaning calibration.	03
Unit-III **Preventive Maintenance**	3a. Identify the faults 3b. Prepare preventive maintenance chart. 3c. Appreciate need of safety.	3.1 Preventive maintenance-Its importance, repair cycle, systematic recording, preventive maintenance scheduling, types of schedules. 3.2 Manpower of machine planning,	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		economy with preventive maintenance case studies, safety aspects, spare part inventories, equipments required. Expected life of valves, heaters, o-ring, seals.	
Unit-IV **Breakdown Maintenance**	4a. Identify the fault. 4b. Prepare inventories of spare parts and equipments required.	4.1 Breakdown maintenance-Causes, solutions, breakdown maintenance of major equipments pumps, compressors, valve. 4.2 Attending joints, valves, pumps and other equipments, leakage, electrical, hydraulic, pneumatic circuits.	03
Unit-V **Record Keeping**	5a. Organize maintenance activities with various departments. 5b. Maintain records of maintenance.	5.1 Organization of maintenance department, control and coordination of various dept., related functions such as stores, equipment record, maintenance and repair records.	02
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Prepare the list of tools, accessories and equipments used for maintenance.	04
2	II	Demonstrate the lubrication systems used in plastics processing machines.	04
3	III	Prepare list of activities of preventive maintenance.	02
4	II, III	Carry out plant maintenance of moulds and dies.	02
5	II, III, IV	Carry out plant maintenance of hydraulic and pneumatic systems.	04
6	IV, V	Demonstration of electrical control assembly of plastics processing machine from service manual and actual practice.	04
7	III, IV	Report on safety features and controls provided in injection moulding machine and its maintenance schedule from service manual.	02
8	II, III, IV	Carry out plant maintenance of extrusion plant.	04
9	II, III, IV	Carry out plant maintenance of injection moulding machine.	04
10	II, III, IV	Find out and resolve problems in any plastics processing machines.	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Measurement of temperature and pressure related to injection moulding.
2. Removing rust from machines, moulds and dies.
3. Lubricating and greasing of machines.
4. Preparation of maintenance schedule for plastics processing machines.
5. Collect information about hydraulic and pneumatic circuits.
6. Collect information about spare parts suppliers and their cost.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show videos / animated films regarding working principle and constructional details of plastics processing machines.
2. Arrange visit to plastics industry and demonstrate students to different preventive and breakdown maintenance activities being carried out.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	SPI Plastic Engineering Handbook	M. Berins	Chapman & Hall
2	Maintenance Engineering Handbook	Higgins and Morrow	McGraw Hill
3	Plastics Industry Safety Hand book	Rosato	Cahners Books, Boston

B) Software/Learning Websites

1. www.processinst.com

C) Major Equipments/ Instruments with Broad Specifications

1. Maintenance tool kit.
2. Multimeter
3. Injection molding machine.
4. Extrusion plant.
5. Grease gun.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		M	H	H	L			M	L		M
CO2	H	M		M					L		
CO3	H	H	M	M	M		L	M	L	L	L
CO4			H	M					M	M	L
CO5			H	H	M	L		M		L	
CO6							L	H	M	L	L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Fibre Technology (FTY) **COURSE CODE** : 6523

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Polymers are used in the form of fibre for applications like rope, fabrics etc. This Course is introduced to give the basic knowledge about types, manufacturing techniques and applications of synthetic fibres.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know polymers suitable for fibre forming.
2. Understands the methods of fibre preparation.
3. State advantages of synthetic fibre over natural fibres.
4. Elaborate the properties and applications of synthetic fibres.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select suitable method for fibre synthesis.
2. Select suitable fibre for particular application.
3. Apprehend importance of high performance fibres.
4. Convert fibre into final form.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Types of Fibre**	1a. Classify fibres. 1b. State advantages and limitations of fibres. 1c. Compare natural fibres with synthetic fibres.	1.1 Fibre and its classification. 1.2 Molecular requirement of fibre forming polymers. 1.3 Difference between natural and synthetic fibres. 1.4 Advantages and limitations of synthetic fibres.	06
Unit-II **Melt Spinning**	2a. Elaborate stages in fibre forming. 2b. Illustrate melt spinning. 2c. Justify post spinning operation.	2.1 Stages in preparation of synthetic fibres. 2.2 Melt spinning: Different techniques of melt spinning, Melt spinning line, cooling system, Melt spinning variables, Structure formation during melt spinning, Spin finish application, Post Spinning operations.	06
UNIT-III **Solution Spinning**	3a. Explain dry spinning 3b. Describe wet spinning. 3c. Compare dry versus wet spinning.	3.1 Dry spinning: Process variables for solution spinning, Preparation of the dope, Steps in Dry Spinning Process, Post Spinning Operations. 3.2 Wet spinning: Solution preparation and transport, Coagulation, Development of structure and morphology, Finish	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		application and winding, Post Spinning Operations. 3.3 Difference between dry and wet spinning. 3.4 Dry jet wet spinning, Steps in Dry jet wet spinning, Post Spinning Operations.	
Unit-IV **Important Synthetic Fibres**	4a. Elaborate synthesis of PET and Nylon fibres. 4b. Explain properties and applications of PET and Nylon Fibres.	4.1 PET fibres: Polymer production, Fibre production, Different melt spinning processes based on spinning speed, Production of staple fibre, LOY, POY, HOY, FOY spinning processes, PET staple fibre problems and their causes, Stress-strain behaviour of PET fibres, Properties and Applications of PET Fibres. 4.2 Nylon fibres: Nylon 66 Polymer production, Fibre Production, LOY, POY, HOY, FOY spinning processes, Post spinning operations, Properties and Applications of Nylon Fibres.	08
Unit-V **Other Synthetic Fibres**	5a. Elaborate synthesis of PP, Acrylic and Cellulose fibres. 5b. Explain properties and applications of PP, Acrylic and Cellulose fibres. 5c. Select suitable fibre for particular application.	5.1 PP fibres: Polymer manufacture, Fibre Production, Different processes of fibre production, Properties and Limitations of fibres, Applications of fibres. 5.2 Acrylic fibres: Polymer manufacture, Spinning processes, Tow processing, Gel spinning, Properties and Applications of Acrylic fibres. 5.3 Modified cellulose fibres: Manufacturing of modified cellulose fibres, Properties and Applications of Modified cellulose fibres	08
Unit-VI **High Performance Fibres**	6a. Elaborate manufacturing of various high performance fibres. 6b. Select appropriate high performance fibre.	6.1 Manufacturing, Properties and applications of following: Aramid fibres, Aromatic polyesters fibres, Glass Fibres, Boron fibres, Carbon fibres, Graphite fibres.	10
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Types of Fibre	04	06	--	10
II	Melt Spinning	04	04	04	12
III	Solution Spinning	04	04	06	14
IV	Important Synthetic Fibres	04	04	06	14
V	Other Synthetic Fibres	02	04	08	14
VI	High Performance Fibres	08	04	04	16
	TOTAL	**26**	**26**	**28**	**80**

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Determination of tensile strength of the fibre.	04
2	II	Determination of size of the fibre.	02
3	II	Demonstration of spinning of the fibre.	04
4	III	Demonstration of post spinning operations.	04
5	IV	Demonstration of manufacturing of PET fibre.	02
6	IV	Demonstration of manufacturing of Nylon fibre.	02
7	V	Demonstration of manufacturing of PP fibre.	02
8	V	Report on the information about applications of fibres.	04
9	VI	Demonstration of woven sack/mat making.	04
10	VI	Demonstration of manufacturing of fibres like glass.	04
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare chart for spinning processes.
2. List out materials for fibre making.
3. Collect finished products made from fibres and identify materials.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show demo of CAI computer software related to fibre spinning.
2. Arrange visit to fibre making industry and ask student to identify process.
3. Arrange expert lecture on fibre technology.
4. Arrange visit to mat making or woven sack industry.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Synthetic Fibres	Vaidya	Sci-Tech
2	Synthetic Fibres	V. B. Gupta	Sci-Tech
3	Synthetic Fibres	Datye	Sci-Tech

B) Software/Learning Websites

1. www.garwarepolyesters.com
2. www.nptel.com

C) Major Equipments/ Instruments with Broad Specifications

1. Spinning machine
2. Weaving machine
3. Sizing machine
4. Thickness gauge

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H									
CO2		H	M	M				M	L		
CO3		H	M						L		
CO4		H	M	M				M	L		

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Tyre Technology (TYT) **COURSE CODE** : 6524

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Tyre is one of the major polymer product increasingly used with growing number of vehicles. Course deals with different tyre manufacturing techniques with the study of tyre components, types of tyre and assembly of tyres. Course also focuses on retreading of tyres and tyre testing techniques.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Explain construction of tyre.
2. Understand sandwich fabric construction by extrusion for building tyre.
3. Explain different curing methods of tyre.
4. Elaborate standardization and inspection procedure for tyre.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify the components of tyre.
2. Differentiate among various types of tyre.
3. Assemble tyre components.
4. Perform various tests with tyre.
5. Retread old tyre.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Development of Tyre**	1a. Explain manufacturing of tyre. 1b. Explain need, scope and importance of tyres.	1.1 Historical development of tyre, cycle and animal drawn vehicle tyres, leading to development to modern pneumatic tyres, process flow chart for tyre manufacturing.	02
Unit-II **Types of Tyre**	2a. Select suitable tyre. 2b. Compare different types of tyre.	2.1 Types of tyre (Standard diagonal ply, Radial ply, tubeless tyre) raw materials used in tyre industries, different unit operations in tyre industries.	10
Unit-III **Tyre Components**	3a. Identify different component of tyres. 3b. Explain different techniques of building tyres.	3.1 Tyre Component, Compounding and fabric sandwich construction by calendaring and extrusion techniques for building of tyre.	12
Unit-IV **Assembling of Tyre**	4a. Assemble tyre. 4b. Describe different methods of curing of tyres.	4.1 Assembly of tyres, types of moulds for pneumatic tyres and different methods of curing of tyres namely autoclave, air blade curing and built in diaphragm	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		curing.	
Unit-V **Finishing of Tyre**	5a. State the different techniques of flash removal of tyre. 5b. Inspect and standardize tyres.	5.1 Techniques of flash removal and finishing of tyres, inspection and standardization of tyres.	04
Unit-VI **Tyre Testing and Retreading**	6a. Select the suitable method of tyre testing. 6b. Interpret test result. 6c. Differentiate between hot and cold retreading of tyre.	6.1 Tyre testing techniques, flex testing, abrasion resistance, burst strength. 6.2 Retreading of tyres such as cold and hot techniques.	08
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Development of Tyre	02	02	--	04
II	Types of Tyre	02	04	10	16
III	Tyre Components	04	06	08	18
IV	Assembling of Tyre	04	06	08	18
V	Finishing of Tyre	02	02	04	08
VI	Tyre Testing and Retreading	06	06	04	16
	TOTAL	**20**	**26**	**34**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hours
1	I	Identify type of tyre and reasons.	02
2	I	Identify components of tyre taking sectional view.	04
3	III	Demonstration of building of tyre.	04
4	VI	Determination of abrasion resistance of given tyre sample.	04
5	VI	Flex testing of tyre.	04
6	VI	Perform standardization and inspection procedure for tyres.	04
7	VI	Testing of reinforcement material used in tyre construction.	04
8	VI	Demonstration of retreading of tyre.	02
9	VI	Determination of the noise property of tyre.	02
10	VI	Determination of the slip strength of the tyre.	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect market rates for various tyres.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to tyre industries.
2. Arrange expert lecture of industry person in the area of tyre technology.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Automobile tyre	J. K. K. Streight	Chapman and Hall
2	Tyre Technology	F. J. Kovac	Goodyear
3	Rubber Technology and Manufacture	C. M. Blow	Butterworth-Heinemann
4	Applied Science of Rubber	W. J. S. Norton	E. Arnold

B) Software/Learning Websites

1. www.ceattyres.com
2. http://www.tiretechnology-expo.com
3. http://tcstire.com/websites
4. http://www.goodyear.eu/home_en/goodyear-quality/technology

C) Major Equipments/ Instruments with Broad Specifications

1. Cutter
2. Extruder
3. Rotary Drum type abrasion tester
4. Flex tester
5. Tyre retreading unit
6. Slip tester

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	M	H	H								
CO2		H	H	M							M
CO3	M	H	H	M							
CO4		H	H	L				H			
CO5		H	H	M				H			

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastics Waste Management (PWM) **COURSE CODE :** 6525

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

This course helps to acquire the basic knowledge of the disposal of plastics waste, ways of waste management, recycling of plastics waste and applications of plastics waste with the advent of engineering and technology.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the hazards of the environmental pollution and waste accumulation.
2. Explain the need of waste management.
3. Describe process of recycling of the plastic waste.
4. Explain biodegradation of plastics.
5. List limitations in the plastic waste management.
6. Suggest the various additives necessary for recovery of the properties.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Identify sources of plastic waste.
2. Select waste disposal method.
3. Identify various separation methods.
4. Select proper sorting method.
5. Demonstrate recycling methods for plastics waste.
6. Identify biodegradable plastics.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Waste and Pollution**	1a. Explain the hazards of the environmental pollution and waste accumulation.	1.1 Definition of Waste, Waste Management. Hazards to Environment due to accumulation of Waste. 1.2 Pollution-Types of Pollutants. Ways to control the Pollution.	03
Unit-II **Sources and Need**	2a. State sources of plastics waste. 2b. Classify plastics waste. 2c. Express need for plastics waste management.	2.1 Sources of waste-Domestic, Industrial, Commercial, Medical etc. 2.2 Need of Plastic Waste Management.	04
Unit-III **Ways of**	3a. Explain steps in waste management.	3.1 Steps in Waste management of plastics. 3.2 4R Terminology of waste management	01 01

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Management	3b. Select suitable waste disposal method. 3c. Analyze various methods of recycling. 3d. Describe role of biodegradation in waste management.	3.3 Land filling. 3.4 Incineration. 3.5 Recycling-(Physical, Chemical) 3.6 Melt Processing, Solvolysis (Nylon, PET), Pyrolysis, Gasification. 3.7 Biodegradation-Mechanism of Biodegradation, Enzymes for biodegradation, Additives for biodegradation. Degree of Biodegradability, Tests to measure resistance of Plastics to Biodegradation (Resistance to Fungi, Bacteria), Properties and applications of PHA, PHB.	03 03 04 06 10
Unit-IV **Collection, Recovery, Sorting**	4a. Explain various separation methods. 4b. Select proper sorting method.	4.1 Collection, Recovery, Sorting and Separation of Plastic Waste 4.2 Various Techniques, Methods and Equipments used for Sorting, Separation.	08
Unit-V **Additives**	5a. Select suitable additive.	5.1 Additives used for improving the properties of plastics waste.	02
Unit-VI **Applications**	6a. Assess applications of recycled and biodegradable plastics.	Advantages, Limitations and Applications of 6.1 Recycled Materials. 6.2 Biodegradable Materials.	03
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Waste and Pollution	04	04	--	08
II	Sources and Need	02	04	--	06
III	Ways of Waste Management	06	18	20	44
IV	Collection, Recovery, Sorting	04	04	04	12
V	Additives	--	04	--	04
VI	Applications	02	--	04	06
	TOTAL	**18**	**34**	**28**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

A student has to submit a detailed report on case study for any one of the following in a group of maximum 05 students per case study.

Sr.No.	List of Topics	Hours
1	Recycling and Recovery of Domestic Plastics.	32
2	Recycling and Recovery of Medical Plastics.	
3	Recycling and Recovery of Nylons.	
4	Recycling and Recovery of PET.	
5	Disposal of waste plastics.	
6	Biodegradable plastic manufacturing.	
7	Government Resolutions and Norms for waste disposal.	
8	Bio Polymers and their applications.	
9	Demonstration of recycling of single plastic waste.	
	TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect different plastic products with recycling codes.
2. Prepare flow chart of plastic cycle.
3. Prepare posters for plastics waste recycling.
4. Prepare demonstrative model of plastics waste recycling.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to dumping yards, land filling sites.
2. Arrange expert lecture on waste management and green technology.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Recycling of plastics	Adobe and Chandra	NIIR
2	Recycling and recovery of plastics	Brandup	NIIR
3	Emerging technology in plastics recycling	Gerald D Andrews	Multitech
4	How to Manage Plastics Waste	Hanser	Hanser
5	SPI Plastic Engineering Handbook	Michel Berins	Chapman & Hall

B) 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

C) Major Equipments/ Instruments with Broad Specifications

1. Extruder.
2. Shredder/ Scrap grinder.
3. Float and sink separator.
4. Electrostatic/ Magnetic separator.
5. Washing tanks.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H						M			L
CO2		H	H	M	M	M		L		L	L
CO3			H	M				M	L	M	L
CO4		H	H	M		M		L		M	
CO5			H	M		M	L		M	L	L
CO6		H				M		L			L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastics Packaging (PPG) **COURSE CODE** : 6526

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Applications of plastics in substituting conventional materials used in packaging are increasing at a faster rate. One can start a packaging plant if having a prerequisite knowledge of it. This course intends to create awareness among the student about packaging materials, methods, technologies and tests.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the need and types of plastics packaging.
2. Suggest suitable material for packaging on the basis of properties.
3. Explain various conversion processes for packages.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Acknowledge functions and applications of plastics packaging.
2. Select the material for specific packaging application.
3. Select suitable conversion process for packaging.
4. Differentiate various methods of rigid and flexible packaging.
5. Perform testing of packaging.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Plastics in Packaging**	1a. Compare plastics packaging with others. 1b. State the properties of plastics used in packaging. 1c. Select the material of packaging.	1.1 Advantages of plastics packaging, special requirements of food and medical packaging, Function of packaging. 1.2 Introduction to packaging plastics-PE, PP, PS, PVC, PET, PVAl, PVDC, EVA, EVOH, PA, PC, Fluoropolymers. 1.3 Selection criteria for packaging materials.	10
Unit-II **Flexible packaging**	2a. Select suitable conversion process for flexible packaging. 2b. State limitations of flexible packaging.	2.1 Extrusion, cast film and blown film, multilayer film, Extrusion and adhesive lamination, Extrusion coating. 2.2 Advantages of flexible packaging, flexible packaging products and specialized packaging for food products (Aseptic and vacuum/modified atmosphere packaging).	10
Unit-III **Rigid**	3a. Select suitable conversion process for rigid	3.1 Blow moulding-Extrusion and injection blow moulding. 3.2 Thermoforming, drape forming, pressure	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
packaging	packaging. 3b. State limitations of rigid packaging.	forming, vacuum forming, plug assist forming, bubble forming, vacuum snap-back forming, matched mould forming, scrap less, dual sheet, melt-to-mould thermoforming, twin sheet thermoforming, skin packaging, blister packaging and thermoform-fill-seal system. 3.3 Foams-PS (expanded and extruded), PU, Polyolefins.	
Unit-IV **Conversion Processes**	4a. Differentiate among various conversion processes. 4b. Enlist applications of conversion processes. 4c. Select suitable sealing method for packages.	4.1 Skin, Shrink and Blister packaging, Stretch Wrapping, Pouching, Bag making. 4.2 Sealing methods-Bar, Band, Impulse, Wire, Ultrasonic, Friction, Gas, Contact, Hot melt, Dielectric, Induction and solvent sealing. 4.3 Decoration processes-Hot stamping, Screen printing, Pad printing, Flexographic printing, Rotogravure printing, in-mould decoration, Labelling, Vacuum metallization. 4.4 Form-Fill-Seal-vertical and horizontal	12
Unit-V **Testing**	5a. Explain various tests for packages. 5b. Describe packaging hazards.	5.1 Tests-Compatibility, Product loss, stress crack resistance, migration test, stack load test, drop test and vibration test. 5.2 Packaging hazards and their controls.	04
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Plastics in Packaging	04	04	08	16
II	Flexible packaging	04	08	08	20
III	Rigid packaging	04	08	08	20
IV	Conversion processes	04	08	08	20
V	Testing	--	--	04	04
	TOTAL	**16**	**28**	**36**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***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 **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
1	I	Identification of plastic film.	04
2	II	Measurement of the gauge of plastic film.	02
3	III	Demonstration of reseal zipper for plastics pouch and bags.	02
4	IV	Demonstration of printing on plastic film.	04
5	IV	Demonstration of box strapping.	04
6	IV	Demonstration of Shrink packaging.	04
7	IV	Demonstration of cutting and thermal sealing of plastic film.	04
8	V	Determination of tear strength test of plastic film.	04
9	V	Drop test of the container.	04
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information on advances in plastics packaging and sealing.
2. Collect samples of plastics pouches.
3. Prepare charts for packaging applications of plastics.
4. Collect IS standards for food contact plastics.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video / arrange visit for packaging processes
2. Arrange expert lecture in the area of plastics packaging.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Food Packaging Science and Technology	Lee, Yam, Piergiovanni	CRC Press
2	Plastic in Packaging	A. S. Athaley	TATA McGraw Hill
3	Plastic Films	John Bristoll	Longman Scientific and Technology
4	Plastic in Food Technology	W. E. Brown	Marcell Dekker
5	Packaging Technology	A. S. Athaley	Multitech

B) Software/Learning Websites

1. www.popularplastics.com
2. www.omnexus.com
3. www.plasticspackaging.com

C) Major Equipments/ Instruments with Broad Specifications

1. Cutting and sealing machine
2. Stretch wrapping setup
3. Shrink wrapping setup
4. Screen printing setup
5. Blown film extrusion machine
6. Thermoforming machine

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H										
CO2		H									
CO3							M				
CO4	M					L					
CO5				L			M				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Adhesives (ADH) **COURSE CODE** : 6527

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Polymers are used for the synthesis of adhesives to a larger extent. The course helps to acquire basic knowledge about preparation of adhesives, its method of applications and uses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand functions of adhesives.
2. Describe synthesis of various types of adhesives.
3. Differentiate among different types of adhesives.
4. Apprehend necessity of surface modification before adhesive application.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Select type of adhesive and mechanism of adhesion.
2. Classify adhesives.
3. Identify mechanical behavior of adhesives joints.
4. Select method of application of adhesives.
5. Perform test on adhesives.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basic Terminology**	1a. Classify adhesives 1b. List advantages and limitations of adhesive 1c. Explain criteria for selection of adhesives.	1.1 Functions of adhesives 1.2 Advantages and limitations of adhesive bonding 1.3 Adhesion and adherent, surfaces, interfaces, inter phases, boundary layers, tack relating joint, fracture. 1.4 Energy to intrinsic adhesion, strength of adhesives and joints. 1.5 Auto adhesion, Inter diffusion. 1.6 Criteria for selection of adhesives.	06
Unit-II **Surface and Their Characteristics**	2a. Characterize different surfaces 2b. Explain mechanism of adhesion.	2.1 Surface and their Characterization-Solid, Liquid, Inter phase, Characterization of Surface Topology and Topography. 2.2 Mechanisms of Adhesion Mechanical interlocking, Diffusion theory, Adsorption theory. 2.3 Thermodynamics of Adhesion, Contact angle, Work of Adhesion, Acid Base considerations, Wettability, Spreading, Interfacial contact, surface tension.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-III **Surface Treatment**	3a. Describe requirement of surface treatment 3b. Select surface treatment method.	3.1 Surface Treatment-Surface preparation of high energy and low energy surfaces, Aluminium, Copper, Steel, Polymer. 3.2 Corona discharge, acid etching, Plasma treatment.	08
Unit-IV **Types of Adhesives**	4a. Describe synthesis of different types of adhesives 4b. Compare different types of adhesives.	4.1 Synthesis of different adhesives-Pressure Sensitive, NR and SR based Adhesives, Epoxy based adhesive. PU, Inorganic Adhesives, Water based adhesive, animal glues, Casein, Starch, Cellulose.	16
Unit-V **Latex Based Adhesives**	5a. Select latex base adhesive for suitable application.	5.1 Introduction 5.2 Applications for Latex based Adhesives 5.3 Advantages and limitations of Latex based adhesives relative to other types of adhesives 5.4 Additives	08
Unit-VI **Evaluation of Adhesives**	6a. Perform various tests on Adhesives.	6.1 Bonding of polymeric materials to various substrates. 6.2 Techniques for evaluation of adhesives. 6.3 Applications of adhesives.	04
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A and above Levels**	**Total Marks**
I	Basic Terminology	04	02	O4	10
II	Surface and Their Characteristics	04	08	--	12
III	Surface Treatment	02	04	08	14
IV	Types of Adhesives	04	08	12	24
V	Latex Based Adhesives	--	04	08	12
VI	Evaluation of Adhesives	--	04	04	08
	TOTAL	**14**	**30**	**36**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
1	I	Determine the peel strength of adhesive joint.	02
2	I	Determine tackiness of given substrates.	02
3	III	Demonstration of corona-discharge treatment for surface preparation.	02
4	IV	Prepare solvent based adhesive.	04
5	IV	Prepare an epoxy base adhesive.	04
6	IV	Report on commercial adhesives available in the market.	04
7	IV	Demonstration of hardening of adhesive by chemical reaction.	04
8	VI	Prepare sample using common joint design such as single lap joint, double lap joint, modified lap joint, peel joint.	04
9	VI	Test strength of adhesive joints such as environmental attack, service life.	04
10	VI	Join substrates by using commercial adhesive.	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the information about different adhesives.
2. Collect information about surface modification processes.
3. Compare adhesives information based on grade, make, trade name and end use.
4. Prepare chart to show mechanism of adhesion.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange expert lecture of industry person in the area of surface modification before application of adhesives.
2. Arrange visit to industries.
3. Show PPT, Videos.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Adhesion and Adhesive	A. J. Kinloch	Hanser
2	A Textbook of Polymer (Chem. and Tech. of Polymer) Vol. I, II	M. S. Bhatnagar	S. Chand
3	Adhesive Technology Handbook	Landrock	Hanser
4	Handbook of Adhesives	Skiest	Hanser
5	Fundamentals of Adhesive	Lee	V. S. P.
6	Fundamentals of Adhesive and Interfaces	D. S. Remay	V. S. P.
7	Handbook of Synthetic Dyes and pigment	K. M. Shah	Multitech

B) Software/Learning Websites

1. www.pidilite.com
2. http://www.frankinaadhesivesandpolymers.com
3. http://www.polymericsystems.com/epoxies_adhesives/index.html

C) Major Equipments/ Instruments with Broad Specifications

1. Beaker
2. Glass rod
3. Tear strength tester
4. Universal testing machine
5. Corona discharge treatment unit

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H			H			H			
CO2	M	H									
CO3		H	H	H							
CO4			H	H	H			H			
CO5			H	H				H			

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Plastic Engineering (PS)
COURSE : Plastics Paints (PLP) **COURSE CODE** : 6528

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Polymers are used for various applications. This course helps to acquire the basic knowledge of paints, role of polymers in paints, types and applications of paints.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Describe classification of paints.
2. Explain raw materials required for paints manufacturing.
3. Locate role of polymer in paints.
4. Distinguish principle, working and applications of paints.
5. Examine testing and characterization of paint.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes

1. Classify surface coatings.
2. Select binders for paints.
3. Identify colourants and extenders.
4. Choose suitable solvent for paints.
5. Select additives for paints manufacturing.
6. Select proper manufacturing technique for paints.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Types of Paint**	1a. Classify paints and surface coatings. 1b. Explain constituents of paints.	1.1 Definitions of Paints, Varnishes and Lacquers, their constituents and functions, Classification of Paints, 1.2 General classification of surface coatings, mechanism of film formation, Convertible and non-convertible coatings.	04
Unit-II **Binders Used in Paints**	2a. Classify binders. 2b. List properties of binders. 2c. Select suitable binder for paint.	2.1 Oils and classification, Sources, Composition, physical and chemical properties and uses of some commonly used drying, semidrying and non drying oils. 2.2 Polymerization of drying oils, thermal and oxidative 2.3 Polymerization of oils. Modification of oils. Role of driers. Dehydrated castor oil, Stand Oils, Boiled Oils and Blown Oils. Bodying rate and viscosity relationship. Film formation by drying oils.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		2.4 Binders based on Natural and Synthetic resins like-Rosin, Shellac, Alkyds, Polyesters, Aminos, Polyurethanes, Epoxies, polyamides.	10
Unit-III **Colorants and Extenders**	3a. Classify colorants and extenders. 3b. Explain properties of colorants and extenders.	3.1 Definition and classification of pigment, dyes and 3.2 Extenders (examples and chemical formulae only), General properties of pigment like-particle size and shape, refractive index, hiding power, specific gravity, oil absorption, tinting strength, reducing power. 3.3 Fastness properties like-resistance to light, water, heat and chemicals, bleeding. Corrosion inhibition and toxicity of pigments.	08
Unit-IV **Solvents**	4a. Classify solvents. 4b. List properties of solvents. 4c. Select suitable solvent.	4.1 Types of volatile solvents, general properties of solvents like salvation power, toxicity, rate of evaporation, boiling point etc. 4.2 Classification like true solvents, latent solvents and diluents, effect of solvent on film properties, classes of solvents with their sources, properties, evaluation of solvents.	06
Unit-V **Additives for Paints**	5a. List out the various additives. 5b. Select suitable additive.	5.1 General introduction to wetting and dispersing agents, anti-settling agents, anti-sagg agents, anti-skinning agents, coalescing agents, freeze-throw stabilizers, drier and plasticizers	05
Unit-VI **Manufacturing Techniques of Paints**	6a. Illustrate the steps in paints manufacturing. 6b. Formulate the paint.	6.1 Steps in Paint manufacturing-Dispersion Techniques, Tinting, Thinning and Packaging.	05
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A and above Levels**	**Total Marks**
I	Types of Paint	02	04	--	06
II	Binders used in Paints	04	14	18	36
III	Colorants and Extenders	02	04	08	14
IV	Solvents	02	04	04	10
V	Additives for Paints	02	04	--	06
VI	Manufacturing Techniques of Paints		04	04	08
	TOTAL	**12**	**34**	**34**	**80**

Legends: R = Remembrance (Knowledge); 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.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

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* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
1	I	Determination of Refractive Index and Specific gravity of Oils and Resins used in paints.	04
2	IV	Determination of Distillation range, specific gravity of solvent and solvent mixtures used in paints.	04
3	IV	Determination of Evaporation rate, acidity, alkalinity of solvent and solvent mixtures used in paints.	04
4	III	Determination of oil absorption Value of pigment.	04
5	VI	Determination of viscosity of paint by Ford Cup.	02
6	VI	Determination of fineness of grind by Hegmann Gauge.	04
7	III, V	Determination of weight per litre of paint by Weight Per Litre Cup.	04
8	VI	Determination of thickness of paint film.	02
9	VI	Determination of Gloss of paint film.	04
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information about various types of paints.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to nearby paint gallery.
2. Arrange expert lecture on paints and surface coatings.
3. Arrange visit to binder manufacturing industry.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Outline of Paint Technology	Morgan W. M.	CBS Publishers and Distributors, New Delhi
2	Paint Technology Manuel "Solvents, Oils, Resins and Driers"	Taylor and Marks	OCCA, London.
3	Paints Technology	Prof. Malshe	Sci-Tech books
4	Introduction To Paints Chemistry	G. P. A. Turner	Oxford and IBH Publishing Co, Mumbai.

B) Software/Learning Websites

1. www.madehow.com/Volume-1/Paint.html

C) Major Equipments/ Instruments with Broad Specifications

1. Refractometer.
2. Stirrer.
3. Resin kettle.
4. Weighing balance.
5. Distillation assembly.
6. Ford cup.
7. Hegmenn gauge.
8. Glossmeter.
9. Dry film thickness tester.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	M	H	M	L				L			
CO2		H	M	M	L	L		L		M	
CO3	M	H	M		L	L	L			L	
CO4	M	H	M		L	L	L			L	
CO5		M	H	H	M	L				M	
CO6		M	H	M	M	L		M		M	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

Annexure : I

Rules for Registration and Examination

Important Rules of Registration for courses.

1. An eligible student must register to minimum three courses and maximum seven courses during each term.
2. While registering for a course at the beginning of a term, a student shouldn't have backlog of more than seven courses of any term as carried over due to failure or any other reason.
3. A student can register for a Project work only after acquiring minimum 100 credits.
4. A student will have to re - register for a course/s if he / she is detained from the course/s for any reason.

Important Rules regarding Registration for Examination

1. A student can register for examination of only those courses for which he has registered and kept term.
2. A student can register for examination for not more than 10 courses in one examination.
3. A student will have to re-register for examination of theory or Practical / oral of a course if he / she fails in examination.
4. A student will be allowed to re-register for examination in accordance with rules if he / she was eligible to appear for last Examination but he/ she failed to appear last examination for any reason.
5. A student will not be able to cancel his registration after he / she is Registered for examination

Other Important Rules

1. A candidate will be eligible for the award of diploma when he / she acquires the required number of credits for a Programme.
2. No candidate will be allowed to appear for examination of any course unless the Head of the Department certifies that
   2.1 Attended at least 75% of the prescribed lecture hours, tutorial hours, practical hours or any other kind of work and or assignment for the course as the case may be in conformity with the provision laid down in the course contents.
   2.2 Satisfactorily completed specified laboratory practical, term work prescribed in curriculum for the course.
3. No candidate will be permitted to reappear to any course of any examination in which he has once passed.

Standard of Passing

1. Theory, total of theory and periodic test, practical, oral and term work examination shall be separate head of passing.
2. To pass examination of any course, a candidate must obtain a minimum of 40% marks in each head of passing prescribed for that course taken separately.

Periodic Test

1. Two periodic tests will be conducted during each term for the courses as per their examination scheme.
2. Average marks of the two period tests will be considered for each course separately.
3. Reappearing for the periodic test for improvement of marks is not allowed.

Term Work

1. Term work is a document submitted by the candidate consisting of report of site / field visit and / or laboratory work and / or drawing sheets / sketch books / jobs / model. Such term work shall be submitted before the end of academic term and it shall be satisfactory in the opinion of concern faculty member, Head of the Department and Principal of Institute.

Grace Marks

1. Grace marks shall be applicable if the rules of "standards of passing" are fulfilled.
2. The grace of maximum three marks will be given in either in "Theory marks", or "Periodic test" or "total of theory and periodic test marks", if it falls short by maximum three marks to pass a course.
3. The grace of maximum three marks shall not be applicable twice for the same course. i.e. for "theory" and "total of theory and periodic test" of same course.
4. The grace marks are not applicable to practical, oral, term work examination.

Award of Class

First Class with Distinction	:	70% or more
First Class	:	60% and above but less than 70%
Second Class	:	50 % and above but less than 60%
Pass Class	:	40% and above but less than 50 %

Annexure : II

Evaluation Scheme for Project

Term Work : Max. Marks : 50 Min. Marks : 20.
Oral : Max. Marks : 50 Min. Marks : 20.

Progressive Assessment

Name of the student: Enrolment No.:
Term : II / III ODD / EVEN
Programme: Plastic Engineering
Course : Project **Code :** 6412 **Project Guide :**

Title of Project :

SN	Project Activities	Date / Week	Leader ship	Understanding	Observation &Accuracy	Contribution	Timely Completion	Total	Signature of Student	Signature of Guide	Signature of HOD
			5	5	5	5	5	25			
1	Formation of team & finalization of project	1									
2	Submission of synopsis : by each group	2									
3	Project activity plan	3									
4	Maintenance Project Diary	6									
5	Visits to Industries / Institutions / Market	7									
6	Collection of Data / Survey	9									
7	Analysis and Presentation of data.	10									
8	Pre submission seminar	13									
9	Presentation of Rough Work : hand written	14									
10	Final Project Report : Submission	15									
	Total by Internal : out of 250										

The Term Work : Convert the total given by internal to "out off 25".

Signature of Project Guide

Project assessment :

Term Work			**Oral**		
Internal	External	Total	Internal	External	Total
25	25	50	25	25	50

Annexure : III

Committees

1. Governing Body (GB)

Sr. No	Name & Office Address	Governing Body Designation
1	**Shri. Pramod Naik** Joint Director, Directorate of Technical Education, M.S. Mumbai	Chairman
2	**Shri. Mahendra Kothari** Chairman, Maharashtra State Pipe & Allied Industry, D-5, MIDC Satpur, Nashik.	Member
3	**Shri. Ashok Katariya** Chairman, Ashoka Group of Companies, Ashoka House, Ashoka Marg, Nashik.	Member
4	**Dr. Ramesh Unnikrishnan** Regional Officer and Director, Regional Office, (AICTE) Regional Office, Western Region, Mumbai.	Member
5	**Shri. B. S. Joshi** The Joint Director, Industries, Regional Office, Nashik	Member
6	**Shri. V. D. Patil** Coordinator, NITTR-Bhopal Extension Center, Pune.	Member
7	**Shri. S. P. Wagh** Chairman, Consumer Grievances Redressal M.S.E. Dist.Co.Ltd, Nashik	Member
8	**Shri. Kishor Patil** Institute Of Career & Skills, 3, Adgaonkar plaza basement, ABB circle, Mahatma Nagar, Nashik-422007	Member
9	**Shri. Harishankar Banerjee** President, NIMA, MIDC, Satpur, Nashik.	Member
10	**Shri. F. A. Khan** Principal, Govt. Polytechnic, Aurangabad.	Member
11	**Shri. Manish Kothari** Chairman, Institution of Engineers Nashik Local Centre, Nahik.	Member
12	**Prof. Dnyandeo P. Nathe** Principal, Government Polytechnic, Nashik	Member Secretary

2. Board of Studies (BOS)

Sr. No.	Name & Office address	BOS Designation
1	**Shri. S. P. Wagh** Chairman, Consumer Grievances Redressal M.S.E. Dist.Co.Ltd, Nashik	Chairman
2	**Shri. Sunil Bhor** Project Management Consultant, 659/A wing second floor market, Shopping complex Dindori Road, Nashik.	Member
3	**Shri. Bhalchandra R. Patwardhan** Plot No.24, Atharva Raw House, Bhavik Nagar, Gangapur Road, Nashik-13.	Member
4	**Shri. Kishor T. Patil** Institute Of Career & Skills, 3, Adgaonkar plaza basement, ABB circle, Mahatma Nagar, Nashik-422007	Member
5	**Shri. Kishor Vyas** Digilog System Pvt. Ltd., 15, Shriram sankul, Opp. Hotel Panchavati, Vakilwadi, Nashik.	Member
6	**Shri. Chandrashekhar. B. Dahale** F1, Computer Service, No. 2, Sukhraj, Near Parijatnagar bus stop,Nashik 422005	Member
7	**Shri. M. M. Dube** Sr. Executive, Systems, M & Q, C-1, MIDC, Ambad, Nashik-10	Member
8	**Shri. Anant Tagare** Principal Engineer, Validation, Mahindra & Mahindra Ltd., R & D Centre, 89, MIDC, Satpur, Nashik-422007	Member
9	**Shri. Aaush Potdar** Director, Poddar Clothing Industries, Nashik.	Member
10	**Shri. Vijay Sanap** Architect & Consultant, Soham Constructions, Nashik.	Member
11	**Shri. Pramod U. Wayse** Deputy Secretary (T), MSBTE, Regional Office, Osmanpura, Aurangabad-431005.	Member
12	**Shri. P. T. Kadve** Principal, K.K. Wagh Polytechnic, Nashik.	Member
13	**Shri. R. N. Vaidya** HOD Civil Engg., Govt. Polytechnic, Nashik.	Member
14	**Shri. S. R. Deshkukh** HOD Civil Engg (II Shift), Govt. Polytechnic, Nashik	Member
15	**Dr. C. Y. Seemikeri** HOD, Mech. Engg., Govt. Polytechnic, Nashik.	Member
16	**Dr. Sanjay Ingole** HOD, Mechanical Engg (II Shift), Govt. Polytechnic, Nashik	Member
17	**Shri. J. B. Modak** I/C, HOD Plastic Engg., Govt. Polytechnic, Nashik.	Member
18	**Shri. L. S. Patil** I/C, HOD Elect. Engg., Govt. Polytechnic, Nashik.	Member

Sr. No.	Name & Office address	BOS Designation
19	**Shri. Yogesh Sanap** I/C, HOD Info. Tech. & Comp. Tech., Govt. Polytechnic, Nashik.	Member
20	**Shri. A. S. Laturkar** HOD, Electronics and Telecommunication Engg., Govt. Polytechnic, Nashik.	Member
21	**Dr. S. D. Pable** HOD, Electronics and Telecommunication Engg (II Shift), Govt. Polytechnic, Nashik	Member
22	**Shri. T. G. Chavan** I/C, HOD Automobile Engg., Govt. Polytechnic, Nashik.	Member
23	**Ms. T. J. Mithari** I/C, HOD, Dress Design & Garment Manufacturing, Govt. Polytechnic, Nashik	Member
24	**Ms. N. P. Adke** I/C, HOD, Interior Design & Decoration, Govt. Polytechnic, Nashik	Member
25	**Shri. V. H. Chaudhari** I/C, Training & Placement Officer, Govt. Polytechnic, Nashik	Member
26	**Shri. G. G. Wankhede** Controller of Examination, Govt. Polytechnic, Nashik.	Member
27	**Shri. S. P. Dikshit** Lecturer in Civil Engg., I/C CDC, Govt. Polytechnic, Nashik	Member Secretary

3. Programme wise committee(PWC)

Sr. No.	Name & Office address	PWC Designation
1	**Shri. Jayant B. Modak** Head, Department of Plastic Engineering, Government Polytechnic, Nashik.	Chairman
2	**Shri. Abhijit N. Chandra** Apras Polymers Limited, Ambad MIDC, Nashik.	Member
3	**Shri. Dinesh M. Devi** Deputy General Manager, VIP Industries Ltd, Satpur, Nashik.	Member
4	**Shri. Devendra R. Gawande** Lecturer in Plastic & Polymer, Government Polytechnic, Amravati.	Member
5	**Shri. Nitin N. Thakare** Lecturer in Plastic Engineering, Government Polytechnic, Nashik.	Member
6	**Ms. Surbhi P. Choudhari** Lecturer in Plastic Engineering, Government Polytechnic, Nashik.	Member
7	**Ms. Shamli A. Chopde** Lecturer in Plastic Engineering, Government Polytechnic, Nashik..	Member
8	**Shri. Pramod U. Wayse** Deputy Secretary (T), MSBTE, Regional Office, Osmanpura, Aurangabad-431005.	Member
9	**Shri. Sanjay P. Dikshit** Lecturer in Civil Engg., Incharge CDC, Government Polytechnic, Nashik.	Member secretary

4. PROGRAMME CURRICULUM DEVELOPMENT COMMITTEE

Institute Level Curriculum Development Cell

Sr. No.	Name of the Faculty	Designation
1	Prof. D. P. Nathe	Principal, Government Polytechnic, Nashik
2	Shri. R. N. Vaidya	Head of Civil Engineering Department and Academic co-ordinator, Government Polytechnic Nashik
3	Shri. S. P. Dikshit	CDC Incharge, Lecturer in Civil Engineering, Government Polytechnic, Nashik
4	Dr. N. L. Patil	Lecturer in Civil Engineering, Government Polytechnic, Nashik.
5	Dr. S. V. Bhangale	Lecturer in Electrical Engineering, Government Polytechnic, Nashik.
6	Dr. S. J. Gorane	Lecturer in Mechanical Engineering, Government Polytechnic, Nashik.
7	Shri. N. N. Thakare	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.

Department Level Committee

Sr. No.	Name of the Faculty	Designation
1	Shri. J. B. Modak	Head, Department of Plastic Engineering, Government Polytechnic, Nashik
2	Shri. N. N. Thakare	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.
3	Ms. S. P Choudhari	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.
4	Ms. S. A. Chopde	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.

NITTTR Committee

Sr. No.	Name of the Faculty	Designation
1	Prof. R. G. Chouksey	Dean Student Welfare, Department of Vocational Education and Entrepreneurship Development, NITTTR, Bhopal.
2	Dr. Nishith Dubey	Professor, Department of Vocational Education and Entrepreneurship Development, NITTTR, Bhopal.

5. Contributors to Course Curriculum Development

Sr. No.	Name of the Faculty	Designation
1	Dr. A. R. Thete	Consultant. Director Center For Development of Leadership in Education Pvt. Ltd. Aurangabad.

Sr. No.	Name of the Faculty	Designation
2	**Plastic Engineering Department, Government Polytechnic Nashik**	
	Shri. J. B. Modak	Head, Department of Plastic Engineering, Government Polytechnic, Nashik
	Shri. N. N. Thakare	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.
	Ms. S. P Choudhari	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.
	Ms. S. A. Chopde	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.
3	**Applied Mechanics Department, Government Polytechnic Nashik**	
	Shri. R. G. Sonone	Co-ordinator and Lecturer in Applied Mechanics
	Shri. S. P. Pagare	Lecturer in Applied Mechanics
	Shri. V. R. Gaikwad	Lecturer in Applied Mechanics
4	**Civil Engineering Department, Government Polytechnic Nashik**	
	Dr. S. S. Pathak	Lecturer in Civil Engineering
5	**Mechanical Engineering Department, Government Polytechnic Nashik**	
	Shri. S. P. Muley	I/C Head of Department
	Shri. R. V. Rupavate	I/C Head of Department (second shift)
	Shri. S. D. Sanap	Lecturer in Mechanical Engineering
	Dr. S. G. Gorane	Lecturer in Mechanical Engineering
	Shri. P. S. Kulkarni	Lecturer in Mechanical Engineering
	Shri. Y. S. Kokate	Lecturer in Mechanical Engineering
	Shri. K. A. Jagtap	Lecturer in Mechanical Engineering
6	**Other Departments, Government Polytechnic Nashik**	
	Shri. P. G. Kochure	Workshop Superintendent
	Dr. K. V. Nemade	Controller of Examination, Lecturer in Automobile Engineering
	Dr. S. V. Bhangale	Lecturer in, Electrical Engineering
7	**Science and Humanities Department, Government Polytechnic Nashik**	
	Shri. S. M. Shinde	Lecturer in Mathematics
	Mrs. A. S. Salunkhe	Lecturer in Mathematics
	Mrs. A. S. Salunke	Lecturer in Mathematics
	Shri. C. N. Pagare	Lecturer in Chemistry
	Shri. S. A. Padwal	Lecturer in Physics
	Shri. R. P. Landage	Lecturer in English
	Mrs. A. N. Patil	Lecturer in Chemistry
	Mrs. Y. S. Patil	Lecturer in Physics
	Mrs. P. S. Joshi	Lecturer in English
	Mrs. K. S. Shinde	Lecturer in Chemistry

Sr. No.	Name of the Faculty	Designation
	Dr. Mrs. K. D. Talele	Lecturer in Physics

Certificate

The curriculum of the programme has been revised in the year 2016, as per the provision made in curriculum development process of Government Polytechnic, Nashik. This is the **outcome based Curriculum of Diploma in Plastic Engineering programme**, which shall be implemented from academic year 2016-17.

Verified by

Department Level CDC Representative
Government Polytechnic, Nashik

Head of Department
Plastic Engineering
Government Polytechnic, Nashik

Incharge, Curriculum Development Cell
Government Polytechnic, Nashik.

Principal
Government Polytechnic, Nashik.