GOVERNMENT POLYTECHNIC
NASHIK

(AN ACADEMICALLY AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)

CURRICULUM - 2016

DIPLOMA PROGRAMME
IN
MECHANICAL ENGINEERING

INDEX

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 Mechanical Engineering is being offered since 1989 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 Mechanical Engineering Programme these domains are **Fluid Flow and Heat Transfer, Manufacturing Engineering, Industrial Engineering and Design, Drawing and Mechanism.** 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 Mechanical 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 10th. However, the curriculum provides "Multi Point Entry and Credit system (MPEC)" for the students opting admission after passing 12th, ITI, MCVC. At higher entry level, the students will get exemptions in certain courses as per the rules.

There is a 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 10th. 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 passouts will acquire the requisite knowledge and skills to satisfy the industrial needs.

(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.

MECHANICAL ENGINEERING DEPARTMENT

VISION

The Department envisions being the center for excellence in training and entrepreneurship development in the field of emerging areas in mechanical engineering like automation and robotics. The department shall be the center for innovation and business incubation leading to entrepreneurial activity.

MISSION

Department of Mechanical Engineering is committed

M1. Imparting the quality education and enhancing their skills to develop competitive mechanical engineers.
M2. Develop a entrepreneur, innovators and lifelong learners for socioeconomic development of nation.
M3. Establish the effective learning environment for achieving academic excellence with modern teaching learning processes.

JOB PROFILE OF MECHANICAL ENGINEER

A Diploma Mechanical Engineer has to carry out various activities in various areas during his implementation of engineering knowledge.

Mechanical Engineering job opportunities are available in following domains:

a. Fluid Flow and Heat Transfer.
b. Manufacturing Engineering.
c. Industrial Engineering.
d. Design, drawing and mechanism.

In the above domain areas Diploma Mechanical Engineer has to perform following duties.

a. Maintenance and after sales Engineer.
b. Quality control Engineer.
c. Maintenance Engineer.
d. Production Engineer.
e. Operating different CNC Machines/ Robots.
f. Measurement and Control.
g. Metallurgical Engineer.
h. Shop floor Supervisor.
i. Line Manager.
j. Store and Purchase Manager.
k. Design and Drawing Engineer.

Skills to be developed :

In above domain areas Diploma Mechanical Engineer has to perform following duties and functions.

1. Prepare & interpret production drawing.
2. Design machine elements.
3. Handle various machine tools.
4. Use & calibration of various measuring instruments.
5. Analyse statistical data.
6. Test various hydraulics machines.
7. Test & maintain I.C. engines.
8. Solve engineering problems using mathematics.
9. Maintain & repair automobiles.
10. Handle shop floor situation.
11. Communicate with subordinate & superiors.
12. Programme operates & maintains CNC machines.
13. Design hydraulics & pneumatics circuits for machine tools & materials handling equipment.
14. Design tools and tooling.
15. Start and run own enterprise.
16. Maintain and repair refrigeration system.
17. Design machine tools.
18. Test various engineering materials.
19. Select lubricants and suggest method of lubrication.
20. Develop and use software as per requirement.

DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING

RATIONALE:

Almost all Engineering work involves Mechanical Engineering activities right from design / manufacturing to maintenance. So today's scenario, to cope up with fast industrialization in all engineering areas and needs of the society, creates deep requirement of Mechanical Engineers with a wide scope. The programme of diploma in Mechanical Engineering aims to produce the engineers to undertake supervisory role in various Mechanical Engineering fields such as Industries, Defences, Government departments, Maintenance, Design etc and to produce young entrepreneurs.

The programme also offers courses to develop the students with necessary competencies to fulfil the needs arising out of emerging allied areas of Mechanical Engineering. The programme also offers the opportunities through courses in diversified fields as per current needs in Mechanical Engineering.

In the prevailing situation and as a basic need, the programme also offer courses to develop the students in computer area by imparting knowledge of fundamentals of computers related softwares and Auto CAD.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Be a professional and competitive Mechanical Engineer.
II. Acquire entrepreneurial skills, creativity and engage in lifelong learning.
III. Fulfill the need of society by solving technical problems.
IV. Demonstrate leadership skills and work ethically in the organization/ society.

PROGRAMME OUTCOMES (POs)

On successful completion of Diploma Programme in Mechanical Engineering, the passouts will be able to,

a. **Basic Knowledge**: An ability to apply knowledge of mathematics, science, and engineering.

b. **Discipline Knowledge**: An ability to identify, formulate, and solve engineering problems.

c. **Experiments and Practice**: Ability to design and conduct experiments, as well as to analyze and interpret data.

d. **Engineering Tools**: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

e. **The Engineer and Society**: Understand and serve the technical needs of society.

f. **Environment and Sustainability**: Adhere to the safety and environmental norms considering sustainability while executing the work.

g. **Ethics**: An understanding of the professional and ethical responsibility.

h. **Individual and Team work**: An ability to function in multidisciplinary teams.

i. **Communication**: An ability to communicate effectively.

j. **Project Management and Finance**: Estimating, costing and execution of project work.

k. **Lifelong learning**: Ability to learn new concepts and technology to satisfy the changing needs.

PROGRAMME SPECIFIC OUTCOME (PSOs)

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

PSO 1. Apply the fundamental of thermal and fluid engineering in operations and maintenance of machinery and equipments.

PSO 2. Adopt state of the art manufacturing technology to work in multidisciplinary.

PSO 3. Analyze data, design and develop mechanical system / components.

PSO 4. Provide socially responsible, eco friendly, broad base solution to mechanical engineering related problems adopting professional ethics.

MAPPING OF MISSION AND PROGRAMME EDUCATIONAL OBJECTIVES

Sr. No.	Mission	Component of Mission Statement	PEO/s
1	M1	Imparting the quality education and enhancing their skills to develop competitive mechanical engineers.	I and II
2	M2	Develop a entrepreneur, innovators and lifelong learners for socioeconomic development of nation.	II, III and VI
3	M3	Establish the effective learning environment for achieving academic excellence with modern teaching learning processes.	I and III

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOMES

Sr. No.	Programme Educational Objectives (PEOs)	Programme Outcomes (POs)
1	Be a professional and competitive Mechanical Engineer.	a, b, c, e, f, g, i, j
2	Acquire entrepreneurial skills, creativity and engage in lifelong learning.	b, c, d, e, i, j, k
3	Fulfill the need of society by solving technical problems.	b, c, d, e, f, h
4	Demonstrate leadership skills and work ethically in the organization/ society.	d, e, g, h, i

MAPPING OF PROGRAMME SPECIFIC OUTCOMES AND PROGRAMME OUTCOMES

Sr. No.	Programme Specific Outcomes (PSOs)	Programme Outcomes (POs)
1	Apply the fundamental of thermal and fluid engineering in operations and maintenance of machinery and equipments.	a, b, c, d, f, g, h, k
2	Adopt state of the art manufacturing technology to work in multidisciplinary.	b, c, d, g, h, i, k
3	Analyze data, design and develop mechanical system / components.	c, d, j, k
4	Provide socially responsible, eco friendly, broad base solution to mechanical engineering related problems adopting professional ethics.	e, f, g, h, i, j, k

MAPPING OF PROGRAMME OUTCOME AND COURSES

Sr. No.	Programme Outcome (POs)	Courses
a	**Basic Knowledge**: an ability to apply knowledge of mathematics, science, and engineering.	Applied Chemistry Applied Mathematics Applied Physics Basic Mathematics Engineering Graphics Engineering Mathematics Engineering Mechanics Workshop Practice
b	**Discipline Knowledge**: an ability to identify, formulate, and solve engineering problems	Design of Machine Elements Engineering Drawing Fluid Mechanics and Machinery Mechanical Engineering Drawing Power Engineering Refrigeration and Air conditioning Strength of Materials Theory of Machines and Mechanisms Thermal Engineering
c	**Experiments and Practice**: ability to design and conduct experiments, as well as to analyze and interpret data.	Electrical Technology Engineering Graphics Fluid Mechanics and Machinery Industrial Hydraulics and Pneumatics Mechanical Measurements Metrology and Quality Control Power Engineering Power Plant Engineering Principles of Electronics Theory of Machines and Mechanisms Thermal Engineering Workshop Practice
d	**Engineering Tools**: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Advanced Computer Applications Advanced Manufacturing Processes Automobile Engineering Computer Aided Drawing and Drafting Engineering Graphics Manufacturing Processes Mechatronics Metrology and Quality Control Production Processes Refrigeration and Air conditioning Workshop Practice
e	**The Engineer and Society**: Understand and serve the technical needs of society.	Advanced Computer Applications Advanced Manufacturing Processes Alternate Energy Sources Automobile Engineering Design of Machine Elements

Sr. No.	Programme Outcome (POs)	Courses
		Entrepreneurship Development Entrepreneurship Development and Management Environmental Studies Industrial Engineering Industrial Hydraulics and Pneumatics Industrial Organization and Management Mechanical Estimation and Costing Mechatronics Metrology and Quality Control Plant Maintenance and Safety Power Engineering Power Plant Engineering Project Refrigeration & Air-Conditioning
f	**Environment and Sustainability**: Adhere to the safety and environmental norms considering sustainability while executing the work	Alternate Energy Sources Environmental Engineering Industrial Organization and Management Plant Maintenance and Safety Professional Practices Supervisory Skills
g	**Ethics**: an understanding of the professional and ethical responsibility	Development of Life Skills Industrial Organization andl Management Marketing Management Professional Practices Supervisory Skills
h	**Individual and Team work**: an ability to function in multidisciplinary teams.	Development of Life Skills Entrepreneurship Development Entrepreneurship Development and Management Industrial Organization and Management Marketing Management Material Management Professional Practices Project Seminar Supervisory Skills
i	**Communication**: an ability to communicate effectively	Communication Skills Industrial Organization and Management Marketing Management Professional Practices Project Seminar Supervisory Skills
j	**Project Management and Finance**: Estimating, costing and execution of project work	Entrepreneurship Development Industrial Engineering Industrial Organization and Management Marketing Management Material Management

Sr. No.	Programme Outcome (POs)	Courses
		Mechanical Estimation and Costing Project Supervisory Skills
k	**Lifelong learning**: Ability to learn new concepts and technology to satisfy the changing needs	Advanced Computer Applications Development of Life Skills Professional Practices Project Seminar

PROGRAMME-DIPLOMA IN MECHANICAL ENGINEERING
PROGRAMME STRUCTURE
SCHEME AT A GLANCE

Level	Name of Level	Number of Courses offered	Number of Curses to be Completed	TH	TU	PR	Total Credits	Marks
Level-1	Foundation Courses	09	09 Compulsory	24	04	18	46	950
Level-2	Basic Technology Courses	11	11 Compulsory	35	02	30	67	1325
Level-3	Allied Courses	09	05 (03 Compulsory & 02 Electives)	10	---	04	14	400
Level-4	Applied Technology Courses	09	09 Compulsory	23	01	22	46	1125
Level-5	Diversified Courses	09	05 (03 Compulsory & 02 Electives)	19	---	08	27	700
TOTAL		**47**	**35 Compulsory + 04 Electives -- 39**	**111**	**07**	**82**	**200**	**4500**
Grand Total		**47**	**39**	**111**	**07**	**82**	**200**	**4500**

Abbreviations:
TH: Theory, TU: Tutorial, PR: Practical.

PROGRAMME-DIPLOMA IN MECHANICAL 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	6107	Engineering Graphics	EGR	02	--	04	06	--	--	--	25	--	25	50
08	6108	Engineering Mechanics	EMH	04	--	02	06	03	80	20	--	--	50	150
09	6109	Workshop Practice	WSP	--	--	06	06	--	--	--	--	--	50	50
TOTAL			**--**	**24**	**04**	**18**	**46**	**18**	**480**	**120**	**25**	**--**	**325**	**950**

Level: 1

Total courses : 09
Total Credits : 46
Total marks : 950

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 & Fourth digit : 01 : Indicates Course Number.

Assessment of PR / OR / TW:

1) All orals and practical are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.
4) # indicates Online theory Examination

PROGRAMME-DIPLOMA IN MECHANICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL-2
BASIC 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	6211	Thermal Engineering	TEG	04	--	02	06	03	80	20	--	25	25	150
02	6212	Engineering Drawing	EDG	02	--	04	06	04	80	20	--	--	25	125
03	6213	Strength of Materials	SOM	04	--	02	06	03	80	20	--	--	25	125
04	6214	Mechanical Engineering Drawing	MED	03	--	04	07	04	80	20	--	25	25	150
05	6215	Fluid Mechanics and Machinery	FMM	04	--	04	08	03	80	20	25	--	25	150
06	6216	Theory of Machines and Mechanisms	TOM	04	--	02	06	03	80	20	--	--	25	125
07	6217	Manufacturing Processes	MPR	03	--	04	07	03	80	20	--	--	25*	125
08	6218	Mechanical Engineering Materials	MEM	04	02	--	06	03	80	20	--	--	--	100
09	6219	Computer Aided Drawing and Drafting	CDR	01	--	04	05	--	--	--	--	--	25	25
10	6220	Electrical Technology	ETE	03	--	02	05	03	80	20	--	--	25	125
11	6221	Principles of Electronics	POE	03	--	02	05	03	80	20	--	--	25	125
TOTAL				**35**	**02**	**30**	**67**	**32**	**800**	**200**	**25**	**50**	**250**	**1325**

Level: 2

Total Courses : 11
Total Credits : 67
Total Marks : 1325

Assessment of PR / OR / TW:

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

PROGRAMME-DIPLOMA IN MECHANICAL 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					
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
Elective I: Any **ONE** of the following														
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
Elective II: Any **ONE** of the following														
05	6309	Entrepreneurship Development	EDP	01	---	02	03	---	---	---	---	---	50	50
	6311	Advanced Computer Applications	ACA	01	---	02	03	---	---	---	---	---	50	50
	6312	Plant Maintenance and Safety	PMS	01	---	02	03	---	---	---	---	---	50	50
TOTAL				**10**	---	**04**	**14**	**09**	**240**	**60**	---	---	**100**	**400**

Level: 3

Total Courses : 5
Total Credits : 14
Total Marks : 400

Assessment of PR / OR / TW:

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

PROGRAMME-DIPLOMA IN MECHANICAL 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	6413	Metrology and Quality Control	MQC	04		02	06	03	80	20	25	--	25	150
05	6414	Design of Machine Elements	DME	04	01	02	07	04	80	20	---	25	50	175
06	6415	Mechanical Measurements	MMS	04	--	02	06	03	80	20	--	--	25	125
07	6416	Power Engineering	PEG	04	--	02	06	03	80	20	--	25	25	150
08	6417	Production Processes	PPS	03	--	02	05	03	80	20	25	--	25	150
09	6418	Advanced Manufacturing Processes	AMP	04	--	02	06	03	80	20	25	--	50	175
TOTAL				**23**	**01**	**22**	**46**	**18**	**480**	**120**	**75**	**100**	**350**	**1125**

Level: 4

Total Courses : 9
Total Credits : 46
Total Marks : 1125

Assessment of PR / OR / TW:

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

PROGRAMME-DIPLOMA IN MECHANICAL 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					
01	6512	Industrial Hydraulics and Pneumatics	IHP	04	--	02	06	03	80	20	--	25	25	150
02	6513	Automobile Engineering	AEG	04	--	02	06	03	80	20	--	25	25	150
03	6514	Industrial Engineering	IEN	03	--	--	03	03	80	20	--	--	--	100
Elective III: Any **Two** of the following														
04 and 05	6515	Power Plant Engineering	PPE	04	--	02	06	03	80	20	---	25	25	150
	6516	Refrigeration and Air conditioning	RAC	04	--	02	06	03	80	20	---	25	25	150
	6517	Alternate Energy Sources	AES	04	--	02	06	03	80	20	---	25	25	150
	6518	Mechanical Estimation and Costing	MEC	04	--	02	06	03	80	20	---	25	25	150
	6519	Mechatronics	MTX	04	--	02	06	03	80	20	---	25	25	150
	6520	Entrepreneurship Development and Management	EDM	04	--	02	06	03	80	20	---	25	25	150
TOTAL				**19**	**---**	**08**	**27**	**15**	**400**	**100**	**---**	**100**	**100**	**700**

Level: 5

Total Courses : 05
Total Credits : 27
Total Marks : 700

Assessment of PR / OR / TW:

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

PROGRAMME-DIPLOMA IN MECHANICAL 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	6412	Project	PRO	--	--	04	04	--	--	--	--	50	50*	100
03	6413	Metrology and Quality Control	MQC	04	--	02	06	03	80	20	25	--	25	150
04	6414	Design of Machine Elements	DME	04	01	02	07	04	80	20	--	25	50	175
05	6416	Power Engineering	PEG	04	--	02	06	03	80	20	--	25	25	150
06	6418	Advanced Manufacturing Processes	AMP	04	--	02	06	03	80	20	25	--	50	175
07	6512	Industrial Hydraulics and Pneumatics	IHP	04	--	02	06	03	80	20	--	25	25	150
08	6513	Automobile Engineering	AEG	04	--	02	06	03	80	20	--	25	25	150
09	6514	Industrial Engineering	IEN	03	--	--	03	03	80	20	--	--	--	100
Any **ONE** from **Elective II**														
10	6309	Entrepreneurship Development	EDP	01	---	02	03	---	---	---	---	---	50	50
	6311	Advanced Computer Applications	ACA	01	---	02	03	---	---	---	---	---	50	50
	6312	Plant Maintenance and Safety	PMS	01	---	02	03	---	---	---	---	---	50	50
Any **TWO** from **Elective III**														
11 and 12	6515	Power Plant Engineering	PPE	04	---	02	06	03	80	20	---	25	25	150
	6516	Refrigeration and Air-Conditioning	RAC	04	---	02	06	03	80	20	---	25	25	150
	6517	Alternate Energy Sources	AES	04	---	02	06	03	80	20	---	25	25	150
	6518	Mechanical Estimation and Costing	MEC	04	---	02	06	03	80	20	---	25	25	150
	6519	Mechatronics	MTX	04	---	02	06	03	80	20	---	25	25	150
	6520	Entrepreneurship Development And Management	EDM	04	---	02	06	03	80	20	---	25	25	150
TOTAL				**39**	**01**	**22**	**62**	**31**	**800**	**200**	**50**	**200**	**350**	**1600**

Total Courses : 12
Total Credits : 62
Total Marks : 1600

Assessment of PR / OR / TW:

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

PROGRAMME-DIPLOMA IN MECHANICAL 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	6105 (06) PHY	6301 (03) AMT	6417 (05) PPS	6415 (06) MMS	6303 (03) IOM	
	6106 (06) CHY	6108 (06) EMH	6220 (05) ETE	6211 (06) TEG	6416 (06) PEG	6512 (06) IHP	
	6103 (04) BMT	6212 (06) EDG	6221 (05) POE	6215 (08) FMM	6413 (06) MQC	6414 (07) DME	
	6107 (06) EGR	6104 (04) EMT	6213 (06) SOM	6216 (06) TOM	6513 (06) AEG	6418 (06) AMP	
	6109 (06) WSP	6219 (05) CDR	6218 (06) MEM	6214 (07) MED	6411 (02) SEM	6412 (04) PRO	
	6302 (02) EVS	6102 (03) DLS	6217 (07) MPR			6514 (03) IEN	
			6410 (04) PPR				
Total Credit (Compulsory)	**29**	**30**	**36**	**32**	**26**	**29**	**182**
Elective	--		--	Any **ONE** course from **Elective I** 6305 SSL, 6306 MKM, 6307 MMT **: (03)**	Any **ONE** course from **Elective III** 6515 PPE, 6516 RAC, 6517 AES, 6518 MEC, 6519 MTX, 6520 EDM **: (06)** **And** II) Any **ONE** course from **Elective II** 6309 EDP, 6311 ACA, 6312 PMS **: (03)**	Any **ONE** course from **Elective III** 6515 PPE, 6516 RAC, 6517 AES, 6518 MEC, 6519 MTX, 6520 EDM **: (06)**	
Total Credit (Elective)	**--**	**--**	**--**	**03**	**09**	**06**	**18**
Total courses	**06**	**06**	**07**	**06**	**07**	**07**	**39**
Total Credit (Elective + Compulsory)	**29**	**30**	**36**	**35**	**35**	**35**	**200**
Grand Total of 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,	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	distance 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 competencies. 6c. Explain steps to comprehend	6.1 Reading for comprehension 6.2 Reading styles 6.3 Developing vocabulary 6.4 Methods of word formation: prefixes, suffixes, collocations, synonyms, antonyms, Homophones, Homonyms. 6.5 Comprehension of unseen passages	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	passage		
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	R. C. Sharma and Krishna	Tata McGraw Hill

Sr.No.	Title of Book	Author	Publication
	Report writing	Mohan	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 (SLT**)	2a. Explain the self learning techniques by enhancing memory and concentration	2.1 Need & importance of SLT 2.2 Information source-Primary, secondary, tertiary 2.3 Enhancing Memory and concentration 2.4 Learning Practical Skills-need of Practical	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2b. Apply practical skills for effective learning 2c. Identify the information sources	Skills types of practical skills-technical, organizational, 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.

1.0 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)P 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

2.0 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 matrices, Transpose of	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.	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 trigonometric 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	9.1 Slope and intercepts of straight line, various form of straight line, angle between two lines, condition for two parallel or perpendicular lines,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	problems.	perpendicular distance formula, distance between two parallel lines.	
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

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.

9.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

10.0 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.

11.0 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. 3b. Differentiate various	3.1 Concept and definition of derivative, Notation, standard Formulae and rules of derivative 3.2 Methods of differentiation, derivative of composite functions, implicit function.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	types of functions 3c. Calculate second order of derivative.	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:

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
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):

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. Shastri	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.

11.0 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	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
	resistance of 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,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		numericals.	
Unit-VIII **(ONLY For CE / ME / PS / AE)** **Viscosity**	8a. Identify applications of Pascal's law. 8b. Gain knowledge about viscosity of fluids. 8c. Find viscosity of fluids using Stoke's law 8d. Distinguish between types of flow of fluid. 8e. Identify significance of Reynold's number.	8.1 Pressure, pressure due to liquid 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, Reynold's number and its significance, Bernoulli's principle & its applications, application of viscosity, Numericals.	06
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, numericals.	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
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

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
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
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. -	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
		city water supply, corrosion, effluent 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.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
	7d. Explain selection of lubricants for various machines	7.5 Properties and names of lubricants used 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 Book	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 / EE / IF / CM / EL / AE
COURSE : Engineering Graphics (EGR) **COURSE CODE** : 6107

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	--	Max.	--	--	--	25	--	25	50
					Min.	--	--	--	10	--	10	--

1.0 RATIONALE:

Engineering Graphics is the language of engineers. The concepts of Engineering Graphics are used to develop & express the ideas and convey the instructions, which are used to carry out jobs in the Engineering field. This preliminary course aims at 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 use of drawing tools and equipments.
2. Understand the significance of engineering curves for various applications.
3. Understand the projections of point and line inclined to one reference plane.
4. Interpret the pictorial view and understand orthographic projection of the simple object.
5. Interpret the orthographic projection and understand pictorial view of the simple object.
6. Understand the significance of sectional view in 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. Draw the engineering curves for given engineering applications.
2. Draw the projections of point and lines inclined to one reference plane only.
3. Draw and dimension orthographic projections of given object.
4. Interpret orthographic projections of object and draw isometric view.
5. Draw sectional view of simple objects as per IS convention.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Drawing instruments and their uses**	1a. Use Instruments for drawing, Scales, Lines, & their applications.	1.1 Letters and numbers (single stroke vertical) 1.2 Convention of lines and their applications. 1.3 I.S. codes for planning and layout. 1.4 Scale (reduced, enlarged & full size) plain scale and diagonal scale. 1.5 Geometrical constructions and drawing polygons	04
Unit-II **Engineering curves**	2a. Draw Conic curves, involutes, Cycloid. 2b. State the applications of engineering curves.	2.1 Methods for drawing an ellipse concentric circle, directrix focus and arc of circle method. 2.2 Methods for drawing parabola by directrix focus and rectangular method. 2.3 Methods for drawing a hyperbola by directrix focus and rectangular method. 2.4 Procedure for drawing involutes of	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		circle and polygon (up to hexagon) 2.5 Procedure for drawing cycloid, epicycloid and hypocycloid 2.6 Loci of points on Single slider crank mechanism with given specifications.	
Unit-III **Projections of Point and Line**	3a. Draw the projection of point 3b. Draw projection of line	3.1 Projection of point in the different quadrants. 3.2 Projection of line parallel to one plane and inclined to another reference plane only.	04
Unit-IV **Orthographic Projections**	4a. Interpret & draw orthographic views from given pictorial view.	4.1 Concept of Orthographic projections. 4.2 Conversion of pictorial view into Orthographic views only first angle projection method for simple objects.	06
Unit-V **Isometric Projections**	5a. Interpretation of isometric view. 5b. Draw isometric view from given orthographic views	5.1 Use of Isometric scale. 5.2 Comparison of true scale with isometric scale 5.3 Conversion of orthographic views into isometric View / projection	06
Unit-VI **Sectional View**	6a. Draw sectional view of simple drawing	6.1 Representation of sectional plane 6.2 Conversion of orthographic views into sectional View	04
		TOTAL	**32**

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. Hrs. required
1	I	Two sheets on letters, numbers and representation of lines and redraw the figures.	08
2	II	Sheet on six engineering curves	12
3	III	Sheet on projections of line. (04 problems)	12
4	IV	Sheet on orthographic projection. (02 problems)	12
5	V	Sheet on isometric views and projection. (04 problems)	12
6	VI	Sheet on sectional view. (02 problems)	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the information about application of engineering curves.
2. Sketch the orthographic views of simple engineering product in sketch book.
3. Sketch isometric view of simple engineering product in sketch book.
4. Sketch sectional view of simple engineering product in sketch book.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show Three Dimensional models of different objects.
2. Use software's, CAI packages for better imagination.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering Drawing	N. D. Bhatt	Charotar Publishing House
2	Engineering Drawing	P. J. Shaha	S. Chand
3	Engineering Drawing and Graphics	K. Venugopal	New Age International

B) Software/Learning Websites

1. AutoCAD
2. Solid works.

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								L
CO2	H	H									
CO3	H	M	M	M					L		L
CO4	H	M	M	M					L		
CO5	H	M		H							

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 problems related to forces acting on body. It also helps in understanding concepts and applications of Equilibrium, friction, centroid and Kinetics.

It helps in understanding concepts 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, Reinforced concrete structures and Design of steel 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. 1.5 Newton's laws.	04
Unit-II	2a. Compute M.A, V.R., Efficiency,	2.1 Basic concepts-load, effort, input, output, mechanical advantage, velocity ratio,	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Simple Lifting Machines	Law of Machine for given Machines	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	
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 diagram (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 beam, 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 any direction	07
Unit-VI **Centroid and Centre of Gravity**	6a. Distinguish between Centroid and Centre of Gravity 6b. Compute Centroid and Centre of Gravity of	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.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	different plane laminas and solids	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.	
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. (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

C) Software/Learning Websites

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

D) 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 / PS / EE / 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 in the students.
2. Impart basic know how 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:

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 **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

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		the workshop.
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	5a. Select appropriate	5.1 Types, specification, material and

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Welding Section	equipment and consumables for required application. 5b. Prepare the simple jobs as per specification using proper metal joining and cutting method.	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 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	04

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
		demonstrated.	
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 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	12
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 and 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

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. Student's 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

Sr.No.	Name Of Equipments/ Instruments	Qty
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
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

Sr.No.	Name Of Equipments/ Instruments	Qty
	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 Mechanical Engineering(ME)/Automobile Engineering(AE)
COURSE : Thermal Engineering (TEG) **COURSE CODE :** 6211

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:

Mechanical / Automobile Engineers have to work with various power producing & power absorbing devices like IC Engines, boilers, turbines, compressors, pumps, plastic processing machines etc. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Hence it is important to study the course of Thermal Engineering, which is a core course. It includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbines and condensers are the major component of any steam power plant. IC Engines is the heart of the Automobile vehicles. Plastic processing works with heat transfer. Mechanical / Automobile Engineer should understand working and application of these devices.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know various sources of energy & their applications.
2. Understand fundamental concepts of thermodynamics systems.
3. Understand various laws of thermodynamics.
4. Understand Gas laws & ideal gas processes to various thermodynamic systems.
5. Understand properties of system by using steam tables/ Mollier charts.
6. Know construction & working of boilers, mountings & accessories.

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 different sources of energy.
2. Explain different gas laws & process for thermodynamic system.
3. Select the boiler for various ranges of pressure.
4. Determine of quantity of steam for different application.
5. Identify sources of leakage in condenser.
6. Select heat exchanger as per application.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Sources of energy**	1a. Classify the energy sources. State its example. 1b. Describe a. Solar water heater b. Wind mill c. Tidal energy	1.1 Brief description of energy sources • Classification of energy sources • Renewable, Non-Renewable 1.2 Fossil fuels, including CNG, LPG. 1.3 Solar flat plate and concentrating collectors & its application. • Solar Water Heater • Photovoltaic Cell, Solar Distillation.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	d. Biogas plant	1.4 Wind, Tidal, Geothermal 1.5 Biogas, Biomass, Bio-diesel 1.6 Hydraulic, Nuclear 1.7 Fuel cell-list of fuel cells	
Unit-II **Fundamentals of Thermodynamics**	2a. Differentiate between extensive & intensive properties with example 2b. Differentiate between heat and work. 2c. Explain second law of thermodynamic 2d. Apply steady flow equation for boiler, engine, nozzle, turbine, compressor & condenser.	2.1 Concepts of pure substance, types of systems, properties of systems, Extensive and Intensive properties with units and conversion like P, V, ρ and temperature. Point function and path function. 2.2 Work and Energy Thermodynamic definition of work, heat, difference between heat and work, P. E., K. E, Internal Energy, Flow work, concepts of enthalpy, entropy. 2.3 Laws of Thermodynamic Zeroth Law, Temperature measurement, principle of energy conservation, irreversibility, First & second Law of Thermodynamics, Kelvin Plank, Clausius statements and their equivalence, Concept of perpetual motion machine 1 and 2. 2.4 Application of Thermodynamic laws Steady Flow Energy equation and its application to open system like boiler, engine, nozzle, turbine, compressor & condenser. 2.5 Application of Second law to Heat Engine, Heat Pump and Refrigerator.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-III **Ideal Gases**	3a. Write the characteristic gas equation. 3b. Differentiate between Isobaric & Isochoric process for ideal gases 3c. Compare Adiabatic & polytropic process 3d. Calculate enthalpy, entropy and work done for various gas processes	3.1 Equation of state, characteristic gas constant and universal gas constant 3.2 Ideal gas processes: • Isobaric, Isochoric, Isothermal, Adiabatic, Polytropic, Isentropic with representation of the processes on P-V and T-S diagram (only simple numerical)	08
Unit-IV **Steam and Steam Boiler**	4a. Explain generation of steam with help of T.H chart & T.S. chart. 4b. Compare constant enthalpy & constant entropy processes. 4c. Explain Rankin cycle for vapour processes 4d. Differentiate between mounting & accessories 4e. Calculate enthalpy of steam	4.1 Generation of steam at constant pressure with representation on various charts such as T-H, T-S, H-S, P-H. Properties of steam and use of steam table (simple numerical on properties of steam), Quality of steam and its determination with Separating, throttling and combined Separating and throttling calorimeter (no numerical on calorimeter). 4.2 Vapour process: • Constant pressure, constant volume, constant enthalpy, constant entropy (numerical using steam table and Mollier chart), Rankin Cycle. 4.3 Steam Boilers: • Classification of boilers. • Construction and working of • Cochran, Babcock and Wilcox, Lamont and Loeffler boiler. Boiler, draught natural and Mechanical. 4.4 Boiler mounting and accessories [to be covered in practical].	14
Unit-V **Steam Turbines and Condensers**	5a. Classify steam turbines 5b. Explain construction and working of steam turbines 5c. Compare Impulse turbine & Reaction turbine 5d. Describe Regenerative feed heating with sketch. 5e. Explain the Working of condenser 5f. Differentiate	5.1 Steam nozzle: • Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles. 5.2 Steam turbine: • Classification of turbines, Construction and working of Impulse and Reaction turbine. 5.3 Compounding of turbines, Regenerative feed heating, bleeding of steam, nozzle control governing of steam turbine & types (no velocity diagrams) 5.4 Steam condenser:	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	between force draught & natural draught for cooling tower.	• Dalton's law of partial pressure, function and classification of condensers, construction and working of condensers. 5.5 Sources of air leakage, concept of condenser efficiency, vacuum efficiency 5.6 Cooling Towers. need, types • Force draught, natural draught and induced draught. (**No numerical on above contents**)	
Unit-VI **Heat Transfer**	6a. Explain modes of Heat transfer 6b. Describe Heat transfer by various modes. 6c. Explain various Heat exchangers. 6d. Calculate heat transfer for composite wall	6.1 Modes of heat transfer: • Conduction, convection and radiation. 6.2 Heat transfer by conduction • Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls, combined conduction and convection (Simple numerical) 6.3 Heat transfer by Radiation: • Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Stefan-Boltzman law. 6.4 Heat Exchangers: • Shell and tube, plate type, multiphase heat exchangers. Materials Used and applications of heat exchangers.	10
		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	Sources of energy	04	02	02	08
II	Fundamentals of Thermodynamics	06	04	06	16
III	Ideal gases	04	04	08	16
IV	Steam and steam Boiler	08	04	04	16
V	Steam turbines and condensers	08	04	04	16
VI	Heat transfer	04	02	02	08
	TOTAL	**34**	**20**	**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/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	Collection of technical data and specification of photovoltaic cell by referring to manufacturers' catalogues.	04
2	I	Demonstration of solar water heating system.	02
3	I	Report on application of non-conventional energy, wind power generation plant / biogas plant / hydraulic plant.	04
4	IV	Demonstration of mountings & accessories of boilers with help of model.	04
5	V	Demonstration of steam turbine & compounding of steam turbine.	04
6	V	Compare different types of condensers and its applications.	02
7	VI	Calculation of thermal conductivity of a solid metallic rod.	02
8	V	Report on cooling towers.	02
9	VI	Compare various heat exchangers.	04
10	IV	Demonstration of boiler with the help of model to trace flue gas path & water circuit (fire tube & water tube boiler.)	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect specification of photovoltaic cell and market rates of prizes.
2. Collect technical specification of solar water heater.
3. Collect technical specification of windmill.
4. Identify condenser used in power plant.
5. Find different materials used for heat exchanger.
6. Check thermal conductivity of various materials.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to thermal power plant.
2. Arrange a visit to heat exchanger manufacturing unit.
3. Arrange expert seminar of industry person in the area of renewable energy sources.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A Course in Thermal Engineering	Domkundwar V. M.	Dhanpat Rai & Co.
2	A Course in Thermal Engineering	P. L. Ballaney	Khanna Publishers
3	A text book of Thermal Engineering.	R. S. Khurmi	S. Chand & co. Ltd.
4	A Course in Thermal Engineering	R. K. Rajput	Laxmi Publication, Delhi
5	Heat Engine Vol.-I & II	Patel and Karmchandani	Acharya Publication
6	Engineering Thermodynamics	P. K. Nag	Tata McGraw Hill
7	Thermal Engineering	B. K. Sarkar	Tata McGraw Hill

B) Software/Learning Websites

1. www.forbesmarshall.com
2. www.studyvill.com

C) Major Equipments/ Instruments with Broad Specifications

1. Measurement of thermal conductivity by Searle's apparatus.
2. Model/charts/PPT

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	M	H	H								
CO3	L		H			H					
CO4	M	H	H	M							
CO5	H	M	L								
CO6	H	L	L								

H: High Relationship, M: Medium 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-I **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-II **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-III **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-IV **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-V **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-VI 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

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	Authors	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).	15

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		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 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 & 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 & 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	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-IV **Principal Planes & 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 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 unsymmetrical sections of beam. Simple numerical problems on standard sections. (No problems on built up sections)	07
Unit-VI **Direct and Bending Stresses**	6a. Calculate Direct & 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 & 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 & principal stresses	02	02	06	10

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
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.*

S. 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 & Row, Publishers, New York
2	Mechanics of Materials	Beer & Johnson	Mc Gr. Hills
3	Strength of Materials	Schaum's outline Series William Nash	McGraw Hill
4	Strength of Materials	Timo Shenko and Young	CBS Publisher & 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 Mechanical Engineering(ME)/Automobile Engineering(AE)
COURSE : Mechanical Engineering Drawing(MED) **COURSE CODE :** 6214

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	--	04	07	04	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

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

For expressing the ideas & communicating the instructions to shop level, knowledge of production drawing is essential. This course aims to impart the knowledge of production drawing, assembly drawing & develop the drawing & drawing reading skill.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Interpret industrial drawing.
2. Interpret instructions related to manufacturing components.
3. Use IS convention of representing various machine components.
4. Visualize the assembly of given set of details of machine components.
5. Know the significance and use of tolerances of size, forms and positions.

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 and draw the intersection of surfaces.
2. Interpret and draw standard conventions of different machine components.
3. Apply tolerances and surface roughness symbols to drawing.
4. Identify and draw production drawing for assembly and detail.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Intersection of Surfaces**	1a. Draw intersection or penetration of any two surfaces or solids	1.1 Prism with prism 1.2 Cylinder with cylinder 1.3 Prism with cylinder (Axis of both the solids are perpendicular with each other) 1.4 Cylinder with cone	06
Unit-II **Conventions used for representation**	2a. Draw conventional representation of pipes, welded joints, bearings, pulleys etc. 2b. Know various types of engineering materials.	2.1 Long & short break in pipes, rods & shafts. 2.2 Bearings. 2.3 Engineering materials 2.4 Half, removed, revolved, off set, partial, local broken & aligned section. 2.5 Wheels & pulleys containing hubs spoke, holes in section. 2.6 Welded joints representation of different welds preparation of working drawing as per IS.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		2.7 Standard conventions for the pipe fitting in pipe lines e. g. nipple, coupling, reducing socket, elbows, bends, plugs, tee, cross etc. 2.8 Standard conventions for flanged joint, union joint, hydraulic joint, socket & spigot joint as per IS code	
Unit-III **Machine/Engine Parts.**	3a. Draw various types of Keys, couplings, joints. 3b. Sketch engine parts and valves	3.1 Keys-sunk, saddle, taper, woodruff, cone. 3.2 Couplings: muff, flanged, flexible, universal & Oldham. 3.3 Joints: pin & cotter. 3.4 Pulleys: solid type built up, V-belt, rope & fast and loose. 3.5 Engine parts-piston connecting rod crank shaft, eccentric, stuffing box etc. 3.6 Valves-stop valves & non-return valves. 3.7 Bearings-journal, ball, footstep, Plummer block.	08
Unit-IV **Limits, Fits and Tolerances.**	4a. Calculate the limits and tolerances. 4b. Apply geometrical tolerances on part drawing.	4.1 Limit systems 4.2 Tolerances (dimensional form & position) 4.3 Fits-types 4.4 Calculation of limits, tolerances 4.5 Geometric tolerances.	04
Unit-V **Surface Roughness Symbols**	5a. State the various machining symbols. 5b. Apply roughness and surface finishing symbols to machine parts drawing.	5.1 Surface roughness symbols. 5.2 Machining symbols. 5.3 Indication of surface roughness & machining symbols.	04
Unit-VI **Production Drawing and Processes Sheets**	6a. Prepare process sheet and production drawing. 6b. Draw production drawing and give details of Mfg. process.	6.1 Processes sheets 6.2 Production drawing 6.3 Preparation of production drawing & process sheet of component such as tenon, slip bushes, gears, flange, shaft, connector.	10
Unit-VII **Production Drawing of Assembles/ Details to assembly/ Assembly to details.**	7a. Draw assembly drawing of machine parts. 7b. Draw detail drawing of machine parts. 7c. Prepare bill of material for the assembly and details.	7.1 Part references on assembly drawings 7.2 Production drawing on assemblies like • Protected type flange coupling • Universal coupling / Oldham Coupling • I. C. Engine piston • Footstep bearing & pedestal bearing. • Stuffing box. • Steam stop valve. • Hydraulic cylinder • Petrol / Diesel engine connecting rod • Screw Jack	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		• Square tool post • Feed check valve • Milling machine / lathe tail stock • Non return valve	
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	Intersection of surfaces	04	04	04	12
II	Conventional Representation	04	04	04	12
III	Machine/Engine Parts	04	04	04	12
IV	Limits, fits and Tolerances	--	02	06	08
V	Surface Roughness Symbols	--	02	02	04
VI	Production Drawing and Process Sheets	04	04	06	14
VII	Production Drawing of Assembles/ Details to assembly/ Assembly to details	04	08	06	18
	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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Draw sheet on Intersection of Surfaces (Four Problems)	06
2	II	Draw sheet for conventional representation of pipe fittings, different types of sections welding symbols and hydraulic joints.	08
3	III	Draw sheet for machine parts like wheels, pulleys**,** spokes, tool post, valves, bearings and engine parts.	08
4	IV, V	Draw sheet for representation of limits, fits & tolerances, surface finish & machining symbols.	04
5	VI	Draw sheet on Production drawing of simple machine parts.	10
6	VII	Prepare sheet on Assembly drawing using CAD.	10
7	VII	Prepare sheet on Details drawing using CAD.	10
8		Prepare production drawing sheet for Assembly or Detail drawing using 3D software.	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Make paper model of intersection of surfaces.
2. Practices to create their drawing.
3. Communicate a simple mechanical engineering drawing through the use of drawing instruments.
4. Use proper symbols on the machine parts.
5. Select and use particular tolerances.
6. Accurately measure the design drawing

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to Mechanical Engineering drawing.
2. Arrange a visit to industry, workshop for observing various machine parts, works.
3. Arrange expert seminar of industry person in the area of Mechanical Engineering drawing.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering Drawing	N D Bhatt	Charotar Publishing House
2	Machine Drawing	N D Bhatt	Charotar Publishing House
3	Engineering Graphics	Siddheshwar Shastri	TMH
4	Production Drawing	K L Narayana	PHI
5	Engineering Drawing & Graphics	K Venugopal	New Age Publication

B) Software/Learning Websites

1. http://www.engineeringdrawing.org
2. http://www.mechanical-engg.com

C) Major Equipments/ Instruments with Broad Specifications

1. Drawing instruments such as mini drafter, set square, drawing board, pencils, sheet, engineering Compass etc.

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		H		L							
CO4		H	M				L				

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

PROGRAMME : Diploma Programme in Mechanical Engineering(ME)
COURSE : Fluid Mechanics and Machinery (FMM) **COURSE CODE :** 6215

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:

Knowledge of fluid flow & related machinery is essential in all fields of engineering. Hydraulic machines have important role in power generation, water supply and irrigation and also in most of engineering segments. This course requires knowledge of basic engineering sciences, applied mechanics, mathematics etc. The fundamentals of this course are essential for the course "Industrial Fluid Power", Industrial Hydraulic and Pneumatic and other related courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the Fluid properties, fundamentals of Fluid statics and fluid flow
2. Understand the fundamental of kinematics of a fluid flow
3. Know the conservation principles of mass and energy for fluid flow
4. Understand fluid dynamics concept
5. Know the concepts of flow measurements and flow through pipes
6. Understand the concepts of momentum principles
7. Know basics of hydraulic machines dedicated

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 basic fluid properties
2. Measure fluid pressure using different pressure measuring instruments
3. Explain the conservation principles of mass and energy, linear momentum to fluid flow systems.
4. Measure the rate of flow using various flow measuring devices
5. Compute loss of head in flow through pipe
6. Calculate power and efficiency of hydraulic turbines and hydraulic pumps
7. Draw characteristics of turbines and pumps

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fluid Properties and Fluid Static**	1a. List the Fluid properties 1b. Classify fluids based on the physical properties 1c. Explain different type of pressure measuring devices. 1d. Explain Cconcept of total pressure and centre of pressure 1e. Calculate fluid pressure, total pressure and centre of pressure	1.1 Review of fluid properties 1.2 Classification of fluids 1.3 Atmospheric pressure, Absolute Pressure, Gauge pressure, Vacuum pressure 1.4 Pressure head 1.5 Pascal's law 1.6 Type of pressure measuring device 1.7 Numerical on various Manometers 1.8 Total pressure and centre of pressure • Plane surface • Inclined surface	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		• Curved surface 1.9 Numerical on Total pressure and centre of pressure-plain and inclined surface.	
Unit-II **Fluid Flow and Fluid Dynamics**	2a. Identify the fundamental kinematics of a fluid element 2b. Define various fluid flow 2c. Write Bernoulli's theorem 2d. Describe working of venturimeter, orifice meter Pitot tube. 2e. Calculate of flow using Venturimeter and Orifice meter	2.1 Classification of fluid flow 2.2 Stream-lines, Path-lines and streak lines 2.3 Continuity equation 2.4 Numericals on Continuity equation 2.5 Bernoulli's theorem 2.6 Bernoulli's equation and modified Bernoulli's equation 2.7 Venturimeter 2.8 Orifice meter 2.9 Pitot tube 2.10 Numericals on Bernoulli's equation, Venturimeter, orifice meter, pitot tube	10
Unit-III **Flow Through Pipes**	3a. State law of fluid friction 3b. Describe basic concepts of energy losses in pipes. 3c. Write equation for major and minor losses 3d. Calculate major and minor losses	3.1 Reynolds number 3.2 Laws of fluid friction (Laminar and turbulent). 3.3 Types of energy losses: • Major energy losses • Minor energy losses • Loss of head due to Friction in pipe Flow 3.4 Darcy Equation 3.5 Chezy's equation (No derivation) 3.6 Different minor losses in pipes 3.7 Hydraulic gradient and total energy line. (HGL & TEL) 3.8 Hydraulic power transmission through pipe 3.9 Water hammer & its effect. 3.10 Equivalent size of pipe. 3.11 Numericals on major, minor energy losses, power transmission through pipes	10
Unit-IV **Impact Of Jet**	4a. Describe basic concepts of impact of jet 4b. Calculate force exerted and work done and efficiency for various cases 4c. Draw velocity diagram for curve vane	4.1 Force exerted and work done by jet on stationary and moving plate: • Normal • Inclined • Curved 4.2 Velocity diagram for curved vane 4.3 Simple Numerical on work done power required and efficiency	10
Unit-V **Hydraulic Turbines**	5a. Classify hydraulic turbines. 5b. Explain constructional details and working principles of water turbines 5c. Calculate work done, power, specific speed and	5.1 Layout of hydroelectric power plant. 5.2 Advantage and disadvantages of Hydroelectric power plant. 5.3 Classification of hydraulic turbines 5.4 Construction and working of Pelton wheel, Frances Turbine, Kaplan Turbine 5.5 Draft tube:	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	efficiency of turbine 5d. Draw characteristics of turbines	• Types • Function 5.6 Cavitations in Turbine 5.7 Selection of turbine 5.8 Governing of turbine 5.9 Numerical on turbine to calculate work done, power, specific speed and efficiency of turbine	
Unit-VI **Centrifugal Pumps**	6a. Classify hydraulic pump. 6b. Describe construction, working of centrifugal and reciprocating pumps 6c. Identify common troubles/problems in pump and list possible remedial measures. 5e. Calculate work require and efficiency of hydraulic pumps 5f. Draw characteristics of pumps	6.1 Principle, construction, working and applications of Centrifugal Pumps 6.2 Types of casings and impellers 6.3 Concept of multistage of Centrifugal pump 6.4 Priming and its methods 6.5 Cavitation and NPSH 6.6 Numerical on pump to calculate Manometric head, Work done, Manometric efficiency, Overall efficiency, 6.7 Performance Characteristics of Centrifugal pumps 6.8 Trouble Shooting and its remedies	10
Unit-VII **Reciprocating Pump**	7a. Classify reciprocating pumps 7b. Describe construction, working and applications of reciprocating pumps. 7c. Compare between centrifugal pump and reciprocating pump. 7d. Calculate slip, efficiencies, power required to drive reciprocating pump	7.1 Construction, working principle and applications of single and double acting reciprocating pump 7.2 Concept of Slip, Negative slip, Cavitation and separation 7.3 Use of Air Vessel 7.4 Indicator diagram • ideal diagram • Effect of acceleration head & frictional head 7.5 Comparison between Reciprocating pump and centrifugal pump. 7.6 Simple numericals on slip, efficiencies, power required to drive reciprocating pump**.**	06
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (Practical)

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fluid static	06	04	02	12
II	Fluid Flow and Fluid Dynamics	04	04	04	12
III	Flow through Pipes	04	04	04	12
IV	Impact of jet	04	02	04	10
V	Hydraulic Turbines	04	06	04	14
VI	Centrifugal Pumps	04	04	04	12
VII	Reciprocating Pump	04	02	02	08
	TOTAL	**30**	**26**	**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/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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Calculate pressure using manometers and Burdon tube pressure gauge	04
2	II	Verify Bernoulli's Theorem.	04
3	II	Determination of Coefficient of Discharge of Venturimeter.	04
4	II	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of orifice meter.	04
5	III	Determination of coefficient of friction of flow through pipes.	04
6	III	To determine minor losses for flow through pipes.	04
7	IV	Impact of jet for determination of force for fixed vertical plate and fixed incline plate	06
8	VI	Trial on Pelton wheel Turbine to determine overall efficiency.	06
9	VI	Trial on Francis Turbine to determine overall efficiency.	
10	VII	Conduct trial on centrifugal pump to determine overall efficiency and plot operating characteristics.	06
11	VIII	Conduct trial on reciprocating pumps and determines overall efficiency of pump.	06
12	VI/VII/VIII	Visit to hydraulic power plant.	12
13	VII	Troubleshooting of centrifugal pump and its remedies	04
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like
Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/ library/ internet/lab based mini-projects, Demonstration, Industrial Visits, Video collection, Chart or Model preparation by students etc. These could be individual or group-based.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Case studies of typical maintenance/installation problems in Hydraulic pump and Turbine.
2. Arrange expert lectures of executives.
3. Visit of hydraulic power plant.
4. Collection of animation or video clips and presentation using same
5. Internet based assignments, teacher guided self learning activities,
6. Course/library/internet/lab based mini-projects etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Hydraulic, fluid mechanics & fluid machines	Ramamrutham S.	Dhanpat Rai and Sons New Delhi
2	Hydraulics and fluid mechanics including Hydraulic machines	Modi P.N. and Seth S. M.	Standard Book House. New Delhi
3	Fluid Mechanics & Hydraulic m/c	Dr. R.K. Bansal	Laxmi Publication Pvt. Ltd.
4	Fluid Mechanics and Fluid Power Engineering	Kumar D.S, S.K. Kataria & Sons.	S.K. Kataria & Sons.
5	Fluid Mechanics and Hydraulic Machines	Rajput R. K,	S. Chand & Company Ltd.
6	Fluid Mechanics	Yunus A. Cengel,	Tata McGraw Hill
7	Fluid Mechanics	Streeter V. L.	McGraw Hill International Edition.
8	Fluid Mechanics and Machinery	Agrawal S. K,	Tata McGraw Hill.
9	Pump manufactures' catalogs such as Kirloskar Brothers	Kirloskar Brothers, KSB, Kishor pumps etc.	

B) Software/Learning Websites

1. www.nptel.ac.in/courses
2. www.learnerstv.com

C) Major Equipments/ Instruments with Broad Specifications

1. Bernoulli's theorem Apparatus.
2. Flow measuring devices (Venturimeter/ orifice meter) Apparatus.
3. Determination of major losses /minor losses in pipe fittings Apparatus.
4. Reynolds number Apparatus.
5. Impact of jet Apparatus.
6. Pelton wheel test rig.
7. Francis Turbine test rig.
8. Centrifugal pump test rig.
9. Reciprocating pumps test rig.

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	L								
CO2	L	H	H	M				M	M		
CO3		H	M	H			L	M	M		L
CO4	M	H	H					H			
CO5	H	M	M	H				M	H		M
CO6	H	H		H			M		M		M
CO7		H	H	M	L	M		H	H		H

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

PROGRAMME : Diploma Programme in Mechanical Engineering ME / AE
COURSE : Theory of Machines and Mechanisms (TOM) **COURSE CODE :** 6216

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:

It is a core Technology course in Mechanical / Automobile Engineering Discipline. Mechanical / Automobile Engineering Diploma Holders often come across various mechanisms in practice. He should be able to analyze, identify and interpret various mechanisms and machines in day-to-day life. In maintaining various machines, a diploma technician should have sound knowledge of fundamentals of machine and mechanism. It will be helpful to technician to understand the mechanisms from operational point of view

In better way, this course imparts the facts, concepts, principles, procedure, kinematics and dynamics involved in different machine elements and mechanisms like lever, gear, cam, follower, belt, flywheel, brake, dynamometer, clutch etc.

Detail knowledge of above-mentioned aspect with deep insight to the practical applications develops a professional confidence in them to become successful Engineer.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Understand selection criteria of drive for specific application.
4. Appreciate concept of balancing and Vibration.
5. Develop ability to come up with innovative ideas

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 and analyze given mechanism for velocity and acceleration
2. Draw and design cam profile for given application
3. Select a drive for given application
4. Analyze balancing of rotating masses in a single plane.
5. Interpret interrelationship between components of various braking mechanisms
6. Assemble and dismantle clutches

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals and Mechanisms**	1a. Define various terms related to mechanisms 1b. Explain different Inversions of Mechanism 1c. Explain construction and working of	1.1 Kinematics of Machines: Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. 1.2 Inversions of four bar chain, Single Slider Crank chain and Double Slider Crank Chain 1.3 Some common mechanism, Geneva	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	various mechanisms.	Mechanism, mini drafter, Bicycle free wheel Sprocket mechanism	
Unit-II **Velocity and Acceleration in Mechanism**	2a. Define various terms related to velocity and acceleration 2b. Draw and analyse simple mechanisms 2c. Draw and interpret velocity and acceleration diagrams	2.1 Concept of relative velocity and acceleration of a point on link, angular velocity and angular acceleration, inter-relation between linear and angular velocity and acceleration. 2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding Coriollis components of acceleration]. 2.3 Analytical method [no derivation] and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism.	12
Unit-III **Cams and Followers**	3a. Define the terms related to Cam and followers. 3b. Classify Cams and Followers 3c. Draw cam profile as per the given applications	3.1 Concept, definition and application of Cams and Followers. 3.2 Classification of Cams and Followers. 3.3 Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation. 3.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).	06
Unit-IV **Power Transmission**	4a. State broad classification of Drives. 4b. Calculate velocity ratio, belt tensions, slip, angle of contact, power transmitted in belt drives 4c. Select suitable drives and Mechanisms for a particular application.	4.1 Types of Drives-Belt, Chain, Rope, Gear and their comparison with applications, advantages & limitations 4.2 Belt Drives-flat belt, V-belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical, no derivation) 4.3 Gear Drives-Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for simple, compound, reverted and epicyclic gear train, Law of gearing (No numerical).	10
Unit-V **Clutches & Bearings**	5a. Differentiate between uniform pressure and uniform wear theories 5b. Explain construction and working of	5.1 Clutches-Uniform pressure and Uniform Wear theories. 5.2 Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multi plate clutch, iii) Centrifugal Clutch iv)Cone clutch v) Diaphragm clutch. (Simple numerical on single and Multi plate clutch).	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	various clutch 5c. Calculate torque and power lost in friction	5.3 Bearings-i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.	
Unit-VI **Brakes, Dynamometers**	6a. Differentiate between brakes and dynamometers 6b. Construction and working of various brakes and dynamometers	6.1 Function of brakes and dynamometer, types of brakes and dynamometers, comparison between brakes and dynamometer. 6.2 Construction and working of i) Shoe brake, ii) Band brake, iii) Internal expanding shoe brake iv) Disc brake. 6.3 Construction and working of Dynamometers i) Rope Brake, ii) prony brake iii) Torsion	08
Unit-VII **Flywheel, Governors and Balancing**	7a. Understand function of flywheel and governor. 7b. Classify and compare governors. 7c. Appreciate necessity of balancing 7d. Calculate balancing mass analytically and graphically 7e. Understand causes and effects of vibrations	7.1 Flywheel-Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I. C. Engine (No Numerical). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. 7.2 Governors-Types, concept, function and application & Terminology of Governors. 7.3 Comparison between Flywheel and Governor. 7.4 Concept of Balancing. Balancing of single rotating mass. Analytical and graphical method for balancing of several masses revolving in same plane. 7.5 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.	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	Fundamentals and Mechanisms	06	06	--	12
II	Velocity and Acceleration in Mechanism	04	04	06	14
III	Cams and Followers	02	04	04	10
IV	Power Transmission	04	06	06	16
V	Clutches & Bearings	02	04	02	08
VI	Brakes, Dynamometers	04	04	--	08
VII	Flywheel, Governors and Balancing	04	04	04	12
	TOTAL	**26**	**32**	**22**	**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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Sketch and describe working of quick return mechanism for a shaper. Find the ratio of time of cutting stroke to the return stroke to understand quick return motion in shaping operation	02
2	I	Sketch and describe the working of the following mechanisms with its application, a) Bicycle free wheel sprocket mechanism b) Geneva mechanism c) Ackerman's steering gear mechanism d) Foot operated air pump mechanism	04
3	II	Determine velocity and acceleration of various links of the given mechanism, by relative velocity method (minimum two mechanisms)	04
4	II	Determine velocity and acceleration in an I. C. engine's slider crank mechanism by Klein's construction	04
5	III	Draw the profile of a radial cam for the given follower type to obtain the desired follower motion (minimum 4 problems)	04
6	IV	Determine slip, length of belt, angle of contact in an open belt drive to understand its performance	02
7	VII	Draw a schematic diagram of centrifugal governor and describe its working. Draw a graph between radius of rotation versus speed of governor	02
8	VI	Sketch, Dismantle and assemble mechanically operated braking mechanism of an automobile.	04
9	V	Dismantle and assemble multi-plate clutch of two wheeler. Draw neat sketch and state the functions of various components	04
10	VII	Determine graphically counterbalance mass and its direction for complete balancing of a system of several masses rotating in same plane and verify it analytically.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect real life examples of various mechanisms in various areas like automobiles, toys, actuators, material handling equipments.
2. Develop different ideas of mechanisms in the form of mini project by a group of students and its presentation
3. Visit automobile workshop and study various mechanisms

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to mechanisms
2. Arrange a visit to S.T. workshop/ Industry to have basic idea about TMM.
3. Arrange expert lecture of industry person in the area of TMM

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Theory of Machine	S. S. Rattan	TATA McGraw Hill companies, II Edition
2	Theory of machines	R. S, Khurmi Gupta	Eurasia publishing House Pvt. Ltd. 2006 edition
3	Theory of machines	P. L. Ballaney	Khanna Publication
4	Theory of machines	Timo Shenko	Wiley Eastern
5	Theory of machines	Jagdishlal	Bombay Metro-Politan book ltd.
6	Theory of machines	Ghosh-Mallik	Affilated East west press
7	Theory of machines	Thomas Bevan.	CBS Publication
8	Theory of machines	J. E. Shigley	Tata McGraw Hill

B) Software/Learning websites

1. http://www.howthingswork.com
2. http://www.mechanisms.co/index.html
3. http://www.technologystudent.com/
4. http://www.creativemechanisms.com
5. http://youtube.com

C) Major Equipments/ Instruments with Broad Specifications

1. Models of various mechanisms for demonstration
2. Working model of Universal governor
3. Models of automobile brakes, clutches and cam-followers

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	M		L						
CO2	L	H	M	M	H						
CO3			M	H	H		M				
CO4		L	H	M	M	L					
CO5		M	L	M	H	M					
CO6		M	L	M	H	L		L			M

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

PROGRAMME : Diploma Programme in Mechanical Engineering(ME)
COURSE : Manufacturing Processes (MPR) **COURSE CODE** : 6217

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	--	04	07	03	Max.	80	20	100	--	--	25*	125
					Min.	32	--	40	--	--	10	--

* Indicates TW to be assessed by external & internal examiners.

1.0 RATIONALE:

Manufacturing Processes is a core technology course for mechanical Engineering programme. Diploma technician often comes across various types of basic manufacturing processes. Technician is required to select, operate and control the appropriate processes for specific applications. It is also required to know about various cutting tools, latest improvements in manufacturing processes. The diploma technician should know how the raw material gets processed through various processes and ultimately results into finished goods. Hence it is essential that, he has understanding of basic manufacturing processes, machines, tools and equipments. As a technician the knowledge and practical skills in different manufacturing processes are essential and hence emphasis is also given in this course towards skills development. Further the technician should be able to handle machine, equipment, tools and accessories in the recommended manner and also follow safety precautions.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the basic manufacturing processes for manufacturing different Components.
2. Operate & control different machines and equipments.
3. Inspect the job for specified dimensions.
4. Produce job for specified dimensions.
5. Select the specific manufacturing process for getting the desired type of output.
6. Adopt safety practices while working on various machines.

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 apply appropriate manufacturing process like casting, metal working, welding, sheet metal working and turning.
2. Explain mechanics of cutting.
3. Observe and conclude effect of varying cutting parameters and work piece material.
4. Identify the machine tool and select optimum process parameter for a given job.
5. Manufacture/Prepare the job as per given product drawing.
6. Adopt safety precautions and safe working procedures.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
A	**Non chip forming processes**		
Unit-I **Metal Casting Processes**	1a. Appreciate the need of casting process. 1b. Calculate pattern allowances. 1c. Interpret the standard color coding on pattern as	1.1 **Pattern Making** • Introduction • Pattern making materials • Types of patterns • Patterns allowances • Pattern colour codes	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	well as core.	• Cores and core making	
	1d. Suggest appropriate casting method suitable for a given industrial component. 1e. Identify casting defects, their causes and suggest remedies.	• Application 1.2 **Moulding** • Introduction • Types of moulding sands, • Properties of moulding sands, • Moulding tools and their uses, • Moulding machines & their applications o Jolt machines, o Sand slinger machine, • Moulding processes o Hand moulding and Machine moulding o Green sand moulding, o Dry sand moulding, o Sweep moulding, o Plate moulding 1.3 **Casting** • Introduction • Melting furnaces Pit, Tilting, Cupola furnaces, • Special casting processes o Die casting, o centrifugal casting, o Investment casting, • Casting defects-causes and remedies, • Inspection and testing of casting 1.4 **Safety precaution in foundry**	06 06
Unit-II **Metal working processes**	2a. Compare the principles of hot and cold working Process. 2b. Identify and explain various metal working processes. 2c. Suggest appropriate metal working process and basic parameters for a given industrial component.	2.1 **Rolling and Extrusion** • Introduction, • Principles of rolling and extrusion • Hot and cold rolling. • Types of rolling mills. • Different sections of rolled parts. • Methods of extrusion- • Direct, Indirect, Backward & Impact Extrusion, Hot extrusion, Cold extrusion • Process parameters • Advantages, disadvantages • Applications. 2.2 **Forging** • Introduction • Forging Processes-Drop forging, Upset forging, Die/press forging. • Types of dies-Open Die, Closed Die(Single and Multi-impression) • Closed die Forging operations-Fullering Edging, Bending, Blocking, Finishing • Forgeable material and forgeability,	04 04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		Forging temperature, Grain flow in forged parts, • Types of Presses and hammers • Process parameters. • Applications.	
Unit-III **Metal joining processes (Welding)**	3a. Appreciate the need of joining process to reduce cost and time. 3b. Explain different welding processes. 3c. Identify the area of applications of a particular joining process. 3d. Suggest appropriate process and process parameters based on given joining situation. 3e. Practice standard safety norms during any joining process.	3.1 Introduction & Classification. 3.2 Gas welding techniques. 3.3 Types of welding flames. 3.4 Arc Welding-Principle, Equipment, Applications 3.5 Shielded metal arc welding. 3.6 Submerged arc welding. 3.7 TIG / MIG welding. 3.8 Resistance welding-Principle Spot, Seam and Projection welding 3.9 Welding defects causes effect & remedies 3.10 Brazing and soldering: Types, Principles, Applications & safety precautions.	06
Unit-IV **Press working**	4a. Identify and explain various sheet metal working processes. 4b. Suggest appropriate sheet metal working process and basic parameters for a given industrial component.	4.1 Press working • Introduction • Types of presses and Specifications. ▪ Press working operations-a)Cutting, b)Bending, c)Drawing, d)Punching, e)Blanking, f)Notching, g)Lancing • Die set components.- 4.2 Punch and Die shoe, Guide pin, Bolster plate, Stripper, Stock guide, Feed stock, pilot. • Punch and die Clearances for blanking and piercing, effect of clearance.	04
B	**Chip Forming Processes**		
Unit-V **Introduction and mechanics of cutting**	5a. Explain mechanics of cutting. 5b. Explain the effect of varying cutting parameters.	5.1 Need, scope & importance of manufacturing processes in industries. 5.2 Need of attitude, knowledge & skill required for shop floor supervisor in machine tools based industries. 5.3 Mechanics of cutting action, orthogonal and oblique cutting. (Without derivation). 5.4 Tool signature, tool geometry (three views) single point tool. 5.5 Chip formation, types of chips. 5.6 Concept and definition of cutting speed, feed and depth of cut. 5.7 Cutting fluid-basic need, types, properties and its applications. 5.8 Influence of cutting variables on surface finish, tool life, economy and mass production.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		5.9 Follow safety precautions while working on machine tools & shop floor.	
Unit-VI **Basic machine tools I (Lathe Machine)** **and** **Basic machine tools II (Drilling Machine)**	6a. Explain classification, working principles, construction and operation of lathe machines. 6b. Describe mechanism & motion transmission in lathe machines. 6c. Explain work holding devices for lathe machines. 6d. Explain classification, working principles, construction and operation of drilling machines. 6e. Describe mechanism & motion transmission in drilling machines. 6f. Explain work holding devices for drilling machines.	6.1 **Lathe Machine** • Introduction • Working Principle • Types of lathes-light duty, Medium duty and heavy duty lathe and CNC lathe. • Centre Lathe Specifications. • Basic parts and their functions. • Operations and tools-Turning, parting off, Knurling, Facing, Boring, drilling, Threading, Step turning, Taper turning. 6.2 **Drilling Machine** • Introduction • Working principle • Classifications • Radial drilling machine-Basic parts and their functions • Drilling operations performed. • Tool holding devices. • Work holding devices. • Specifications of drilling machine.	06 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	Metal casting processes (a) Pattern making (06) (b) Molding (06) (c) Casting (08)	04	06	10	20
II	Metal working processes (a) Rolling & Extrusion (08) (b) Forging (06)	04	04	06	14
III	Metal joining processes (Welding)	02	04	04	10
IV	Press working	02	04	04	10
V	Introduction and mechanics of cutting	02	04	04	10
VI	Basic machine tools I (Lathe Machine) and Basic machine tools II (Drilling Machine)	04	04	08	16
	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 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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	One job. Prepare a pattern drawing, pattern and core from the given component/drawing and specifications.	08
2	I	Prepare a mould using prepared pattern, core and moulding sand. Also pour molten metal and get the casting.	08
3	I	Demonstration of metal melting, metal pouring, metal casting and casting finishing. Also demonstrate and prepare a report on casting defects. (Use wax in place of molten metal for the purpose of demonstration.)	04
4	I	Demonstration of spinning process, forging/hot smithy process. This includes cutting of raw material and preparation of pre forged parts.	04
5	I	Visit a nearby foundry and prepare a two page report comprises of details (type, material, process etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used and consumables.	--
2	II	Visit a nearby Rolling mill/Hot-Cold material processes, allied manufacturing processes industry and prepare a two page report comprises of details(type, material, process etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used and consumables.	--
7	III	One job. Prepare a utility article job as per drawing and specifications using arc welding. This includes cutting of raw material and preparation of pre-weld parts and use tacks and continuous welding in each job. Group of 2 to 4 students depending upon volume of work.	16
8	III	One job. Prepare a job using gas cutting and gas welding. This includes cutting of raw material and preparation of pre-weld parts. Minimum 3 parts for each job should be taken and should include tacks and continuous welding.	04
9	III	One job. Prepare a job using spot/seam resistance welding. This also includes cutting of raw material and preparation of pre-weld parts.	04
10	III	Visit a nearby fabrication industry and prepare a two page report comprises of types of item produced, quantities, different sections, equipments used with specification and consumables.	---
	III	Demonstration and Visit to manufacturing industry to demonstration TIG / MIG welding setup and write specifications and report.	--
	IV	Demonstration of press working. (Type, materials, process etc.)	--
11	V	Effect of Varying Cutting Parameters: Demonstrate type of chips, surface finishes and tool life for varying	02

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
		cutting parameters for same work piece material and tool material. Tabulate the observations.	
12	V	Effect of Varying Work Piece Materials: Demonstrate type of chips, surface finishes and tool life for varying work piece material with same cutting parameters. Tabulate the observations.	02
13	VI	One Job: Prepare a composite turning job on centre lathe as per the given drawing. (Including plain turning, taper turning, boring, knurling, threading, grooving etc). Student will also prepare report including: a. Drawing of the job. b. Operation sequences including details of cutting parameters used. c. Sketch of cutting tools used. d. Specification of machines used. e. Machine settings for threading. f. Costing of job.	12
		TOTAL	**64**

Notes:

1. It is compulsory to prepare workshop book of exercises. It is also required to get each exercise recorded in workshop book, checked and duly dated signed by teacher.
2. Student activities are compulsory and are also required to be performed and noted in workshop book.
3. Students are to be continuously assessed for competencies achieved.
4. Each student is required to submit the following term work

Sr.No.	Practical task
1	One job Prepare pattern drawing and pattern from given component/component drawing and specifications.
2	One job Prepare a utility article job as per drawing and specifications using arc welding. This includes cutting of raw material and preparation of pre-weld parts and use tacks and continuous welding in each job. Group of 2 to 4 students depending upon volume of work.
3	Any one job from following a. Prepare a job using gas cutting and gas welding. This includes cutting of raw material and preparation of pre-weld parts. Minimum 3 parts for each job should be taken and should include tacks and continuous welding. b. Prepare a job using spot/seam resistance welding. This also includes cutting of raw material and preparation of pre-weld parts.
4	One Job. One composite turning job on lathe containing the operations like plain turning, step turning, taper turning, boring, internal and external threading, grooving, knurling, chamfering.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1 Select four industrial components (approved by teacher) and list various methods of manufacturing used to produce these components.

2 Select at least two components which are made by casting only. Also state the type of casting method used.

3 Prepare a list of household items which are prepared by joining processes.
4 Prepare a list of plastic items which are produced using different types of molding methods. Also name the process used.
5 Prepare a list of industries/workshops in the nearby area which are producing components by machining, casting and forming.
6 Identify the type of manufacturing process used in making main component of a car engine.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Sr.No.	Unit	Unit Title	Strategies
1	I	Metal casting processes	Demonstration. Video clips. Live examples with suitable components. Industrial visits. Show effect of process parameters.
2	II	Metal working processes	
3	III	Metal joining processes (Welding)	
4	IV	Press working	
5	V	Introduction and mechanics of cutting	
6	VI	Basic machine tools I, (Lathe Machine)	

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1.	Workshop Technology I & II	J. A. Schey	Tata McGraw Hill Education
2	Workshop Technology-I & II.	Hazra and Chaudhary Media.	promoters & Publisher private limited
3	Workshop Technology-I & II.	W.A. J. Chapman	Taylor & Francis.
4	Manufacturing Processes	M. L. Begman	Wiley India
5	Production Technology	R.K. Jain and S.C. Gupta	Khanna publication
6	Welding Engineering	B.E. Rossi	Jefferson Publications
7	Audles Welding Guide	F.D. Graham	Wiley India
8	Foundry Engineering	P.L. Jain	Tata McGraw Hill Education
9	Principle of Foundry	Jain & Gupta	National Book Trust, India
10	Manufacturing Processes	S.E. Rusinoft	Times of India Press
11	Production Technology	H.H. Marshall	Machinery Publishing Company
12	Workshop Technology-I & II.	B. S. Raghuwanshi	Dhanpat Rai and Sons, New Delhi
13	Workshop Technology	H. S. Bawa	Tata McGraw Hill Publishers, New Delhi
14	Production Technology Hand Book HMT	--	Tata McGraw Hill Publishers, New Delhi

B) Software/Learning Websites

1. www.youtube.com/watch?v=k6iODHla6qY.
2. http://web.iitd.ac.in/~pmpandey/MEL120_html/Metal%20Forming%20Processes.pdf.
3. http://thelibraryofmanufacturing.com/forming_basics.html.
4. http://www3.nd.edu/~manufact/MPEM%20pdf_files/Ch07.pdf.
5. www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/3_forming.pdf.
6. www.youtube.com/watch?v=HkjdMdp9KVU.
7. http://www-old.me.gatech.edu/jonathan.colton/me4210/casting.pdf.
8. http://www.mccannsales.com/book/sandcasting.pdf.
9. http://me.emu.edu.tr/me364/2.pdf.
10. http://www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/8_joining.pdf.
11. http://www.tech.plym.ac.uk/sme/mats116/Materialsjoiningprocesseslecturenotes_docx.pdf.
12. http://www.aws.org/w/a/.
13. www.youtube.com/watch?v=H3Qb9I03FCk.

14. www.youtube.com/watch?v=JqFp5kCeTA0.
15. www.nptel.in
16. www.howstuffworks.com
17. http://www.youtube.com/watch?v=SDJdiNeDXto.(Introduction to Welding).
18. http://www.youtube.com/watch?v=CJ42scaWFnw.(Brazing video).
19. http://www.flamingfurnace.com/.
20. http://www.sme.org.
21. http://www.youtube.com/watch?v=IrcNSgLZuFs.(Metal Casting).
22. http://www.youtube.com/watch?v=Yk1JOYzwRP4.(Loose piece Pattern).
23. http://www.youtube.com/watch?v=khEvhjlh_SM.(Foundry Pattern making).
24. http://www.youtube.com/watch?v=f7FXtnXVqzY.(Aluminium Casting).
25. http://www.youtube.com/watch?v=dOw624I9FDQ.(Investment Casting).
26. http://www.youtube.com/watch?v=bzSSfBgkWfc&NR=1&feature=endscreen.(Hot Chamber Die Casting Process).
27. http://www.youtube.com/watch?v=Ul00-KoC1Oc.(Shell Moulding).
28. http://www.youtube.com/watch?v=pTTap4WiEAU.(Gravity Die Casting).
29. http://www.youtube.com/watch?v=6xnKmt_gsLs.(Hot Rolling).
30. http://www.youtube.com/watch?v=9MU0vSN_w-A.(Cold roll forming).
31. http://www.youtube.com/user/IGEJohannesen?feature=watch.(Channel For welding videos).

C) Major Equipments/ Instruments with Broad Specifications

Sr. No	Name Of Equipments/ Instruments	Qty
	Pattern Making Shop	1
1	Heavy Duty 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	Pattern making Hand Tools Kit	20 Sets
8	Carpentry Bench Vice	20
9	Wood Turning Lathe	5
10	Pattern making 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	Various type of wood working files	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
	Foundry Shop	
1	Moulding boxes (Cope and Drag)	6 Sets
2	Furnace or Oven	1
3	Measuring Instruments, moulding Tools	5 Sets
4	Ladles and Crusibles	5 Sets
5	Bench Drilling Machine	1
6	Bench Grinder	1
7	Fitting Shop Vice Size-100/150 mm.	2

Sr. No	Name Of Equipments/ Instruments	Qty
8	Electrically operated Hand Drilling Machine (pistol Type)	2
9	Induction Hardening equipment	1
10	Pedestal Grinder	1
11	Hand Grinder	1
	Forging 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
	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
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 and safety equipments.	1
8	Abrasive Cut off machine with vice.	1
9	MIG Welding Equipment Set.	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
17	Gas welding set with Oxy acetylene gas cylinder and regulators	1
18	Welding torch and cutting torch with safety equipments.	5 Set
	Sheet Metal Shop	
1	Shearing Machine	1
2	Sheet Bending Machine	1
3	Gauges.	LS
4	Measuring tools, Sheet metal working Hand Tools and other Equipment	5 set
5	Portable Drilling Machine	1
6	Stoving Oven	1
7	Stake with Work Bench Size-1800 x 1200 x 750 mm	2
8	Swaging Machine	1
9	Universal sheet Folding Machine	1
10	Double Column Power Press	1
11	Hydraulic Press	1
12	Circle Cutting Machines	1
13	Nibbling machine with standard, optional accessories and attachments.	1 Set
	Turning Shop	
1	Centre lathe with standard, Optional and Special Accessories.	20
2	Turning shop measuring Tools. Like Vernier Calliper, Micrometer, Screw pitch gauge, inside outside callipers, Dial gauges etc.	20
3	Power Hacksaw	1
4	Special attachments. e.g. spherical turning, taper turning etc.	5
5	Required cutting tools and tool holders.	LS

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

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	M				M
CO2		H		H	L			L	M		
CO3	M	H									
CO4		H	H	M					M		
CO5	H		H	H						M	
CO6							M				M

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Mechanical Engineering Materials (MEM) **COURSE CODE** : 6218

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	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

Mechanical Engineering Materials is a basic technology course in Mechanical Engineering Discipline. A Mechanical Engineering diploma holder deals with various materials required for cutting tools, Dies, Gears, Bearings and many other applications. Knowledge of selection of proper tool materials, heat treatments for specific materials, ferrous and non-ferrous materials and their alloys for various engineering application, as well as insulating, refractory and plastic materials as per the requirements is essential.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understands about basics of engineering materials as regards classification, structure and properties.
2. Understand basics of structure-property relationships of heat treatments.
3. Analyze various types of steels and cast irons along with their specifications.
4. Understand about types, composition and field of application of various non ferrous metals and alloys and non metallic materials
5. Understand about types, composition and field of application of various Non metallic materials.
6. Understand about basic process of powder metallurgy and applications.
7. Understand about various Nondestructive testing methods and their 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. Draw the phase and TTT diagram
2. Identify the ferrous and non ferrous metals and alloys and their applications.
3. Conduct different non-destructive testing methods.
4. Select Engineering materials based on properties, behaviour and environmental effect for given engineering application.
5. Explain the various heat treatments of material and powder metallurgy for enhancing the required properties in the material.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Engineering Materials- Structure and Properties**	1a. List basic types and crystal structure of material 1b. Compare properties of material 1c. Define steel and cast iron	1.1 Introduction, Classification of materials as amorphous and crystalline, ferrous and non ferrous, Crystal structure Properties of metals Physical Properties, Mechanical Properties, unit cell and space lattice, Concept of packing efficiency 1.2 Introduction to steels and Cast irons as alloys of iron and carbon.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Equilibrium Diagrams**	2a. Define pure metal, alloy, solid solutions 2b. Learn different equilibrium Diagrams 2c. Draw Iron carbon phase equilibrium diagram, locate fields of steels and cast iron on diagram	2.1 Definitions of phase, pure metal, alloy and solid solutions. 2.2 Types of solid solutions-substitutional and interstitial, Solid solubility 2.3 Solidification of pure metal and Alloys: Cooling curves equilibrium diagrams for isomorphous, Eutectic, Eutectoid systems, **Iron Carbon Equilibrium diagram** 2.4 Study of various phases 2.5 Critical temperatures & significance 2.6 Reactions on Iron carbon equilibrium diagram 2.7 Introduction of steels and cast irons 2.8 Classification of steels on various basis as low, medium, high carbon 2.9 Steels, Hypo, Hyper eutectoid steels	10
Unit-III **Heat Treatment Of Steels**	3a. Represent various heat treatment processes on TTT diagram 3b. Suggest different heat treatment processes 3c. Compare surface heat treatment processes for different steels	**Transformation in steel on heating under equilibrium conditions** 3.1 Transformation of pearlite to austenite 3.2 Transformation of Austenite to Pearlite 3.3 T T T diagrams/isothermal diagram for plain carbon and alloy steels **Annealing:** 3.4 Purposes of annealing, Annealing temperature range 3.5 Types of annealing like conventional / full annealing, isothermal annealing, spheroidizing annealing, process annealing **Normalizing:** 3.6 Purposes of Normalizing, Temperature range, 3.7 Broad applications of Normalizing **Hardening:** 3.8 Purposes of hardening, Hardening temperature range 3.9 Conventional hardening process, Structure of martensite and properties 3.10 Quenching mediums, hardening defects. **Tempering:** 3.11 Purpose of tempering 3.12 Variations of properties of hardened steel with tempering temperatures 3.13 Types of tempering as low, medium and high temperature tempering. 3.14 Martempering, Austempering and patenting processes **Surface Heat Treatment** 3.14 Need of Surface heat treatment, 3.15 Types of Surface heat treatments like Surface hardening and case 3.16 Hardening.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		3.17 Surface hardening methods like Flame Hardening, Induction Hardening 3.14 Case hardening methods like Carburizing, Nitriding, Cyaniding	
Unit-IV **Steels and Cast Irons**	4a. List different types of steels and cast irons 4b. Know manufacturing processes of steels & cast irons 4c. Refer to specifications systems of steels and cast irons 4d. Suggest suitable steels/ cast irons in specifications for particular applications	4.1 Broad Classification of steels, Plain carbon steels 4.2 Definition, Types &Properties 4.3 Compositions and applications of low, medium and high carbon steels. **Alloy Steels:** 4.1 Definition & Effects of alloying elements on properties of alloy steels. 4.2 Tool steels: Cold work tool steels, Hot work tool steels, High speed • steels(HSS), HCHC and OHNS • Stainless Steels • Spring Steels **Cast Irons:** 4.4 Classification of cast irons and applications. 4.5 Types of cast irons as white, gray, nodular, malleable, Specifications of steels and cast Irons**:** 4.6 Bureau Of Indian Standards BIS, AISI / SAE, British Standard B.S. specifications of steels & their equivalents Specifications of cast irons Selection of appropriate steels and cast irons for engineering applications like Shafts, axles, Nuts, bolts, Levers, crank shafts, camshafts, Shear blades, agricultural equipments, House hold utensils, machine tool beds, car bodies	10
Unit-V **Non ferrous Metals and Alloys**	5a. Select various non ferrous metals/alloys in view of their composition, properties for applications	5.1 Chemical compositions, properties and applications of Copper alloys-brasses, bronzes 5.2 Aluminium alloys--Y-alloy, Hindalium, duralium with their composition and applications. 5.3 Bearing materials like white metals (Sn based), aluminium bronzes. Porous self lubricating bearings.	08
Unit-VI **Non Metallic Materials**	6a. Select non metallic materials in view of their composition, properties and applications	**Polymeric Materials** 6.1 Polymers-types, characteristics, 6.2 Properties and uses of Thermoplastics, Thermosetting Plastics & Rubbers. Thermoplastic and Thermosetting Plastic materials 6.3 Characteristics and uses of ABS, Acrylics. Nylons and Vinyls, 6.4 Epoxides, Melamines & Bakelites Rubbers**:** 6.5 Neoprene, Butadiene, Buna & Silicons-	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		Properties & applications. 6.6 Other Engineering Materials of importance-Properties and applications- 6.7 Ceramics, glasses, Glass Wool. Introduction to Composite Materials like, Laminated & Fibre reinforced materials 6.8 Nano materials-nature, properties and applications	
Unit-VII **Powder Metallurgy & Nondestructive Testing**	7a. Know concepts of powder metallurgy process with their applications 7b. Compare Different Non destructive testing processes	**Powder Metallurgy:** 7.1 Advantages, limitations and applications of Powder Metallurgy for engineering products. 7.2 Brief Description of Process of Powder Metallurgy-Powder making, blending, compacting, sintering, infiltration & impregnation. 7.3 Applications of Powder metallurgy for tungsten carbide tip tools & porous bearing. **Non destructive Testing:** 7.4 Importance of Non-destructive testing. Difference between Destructive and Nondestructive testing. 7.5 Nondestructive testing methods-Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrant test, Magnaflux test-Comparison & applications	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	Engineering Materials-Structure and Properties	04	04	00	08
II	Equilibrium Diagrams	04	04	04	12
III	Heat Treatment Of Steels	10	04	04	18
IV	Steels and Cast Irons	08	04	02	14
V	Non ferrous Metals and Alloys	04	04	02	10
VI	Non Metallic Materials	04	04	02	10
VII	Powder Metallurgy & Nondestructive Testing	02	02	04	08
	TOTAL	**36**	**26**	**18**	**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.	Tutorials/ Assignments	Hours
1	I, II	Group of 4-5 students will identify and collect five machine / product components which are made from different engineering materials and which are also failed in their applications. Students will measure and sketch the components (free hand-orthographic views) with dimensions. Students in group will also discuss the reasons of failure and will note down the discussion and outcome	08
2.	II	Each student will explain at least one diagram (assigned by teacher-may be part of iron-carbon diagram, TTT curve for specific material etc.) to all batch colleagues.	08
3.	II	Study various heat treatment furnaces.	04
4.	IV	Perform hardening process on ferrous material. Measure the hardness before and after hardening.	04
5.	VI	State the criteria to identify any five (3 metallic and 2 non metallic) materials from the selected set of material	04
6.	IV	List properties of each identified materials (Identified by Teacher). Also identify main alloying elements and reasons to add them.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Select any five objects (3 metallic and 2 non metallic) which will be used in laboratory and list the material of selected objects.
2. Prepare the material list of given tools and commonly used items such as razor blade, knife, scissor, hacksaw blade, carpentry chisel, fix spanner etc. Also give reason(s) for using such material and discuss your answers with the teacher.
3. Group of 3-5 students will visit institute's workshop and will identify at least 5 nonmetallic components for a given machine / assembly. Also list the material of identified machine / assembly components
4. List at least three questions individually which you would like to ask for followings:
    a. Comparison of iron and fiber reinforced plastic.
    b. Comparison for strength of wood and cast iron.
    c. Annealing-heat treatment process.
    d. Materials used for construction of any bike.
    e. Materials used for construction of any home appliance, like mixer, washing machine, iron etc.
5. Any other relevant activity added by teacher including preparing industrial visit report.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

10.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A Text Book of Material Science and Metallurgy	O.P. Khanna	Dhanpat Rai and Sons [1999]
2	Material Science And Metallurgy	Dr. V.D. Kodgire	Everest Publishing House [1990]
3	Material Science and Engineering	R.K. Rajput	S.K. Katari and Sons [2002 reprint 2003]
4	Material Science and Processes	S.K. Hazra and Choudhari	Indian Book Distribution Co. [1982]
5	Engineering Materials Properties and Selection	Kenneth G. Budinski and Micheal K. Budinski	Pearson Education, New Delhi
6	Introduction to Physical metallurgy	Sidney H. Avner	Tata McGraw Hill edition (2nd)

B) Software/Learning Websites

1. http://vimeo.com/32224002
2. http://www.substech.com/dokuwiki/doku.php?id=iron-carbon_phase_diagram
3. http://www-g.eng.cam.ac.uk/mmg/teaching/typd/
4. http://www.ironcarbondiagram.com/
5. http://uk.ask.com/web?q=Who+Discovered+Carbon%3F&qsrc=14097&o=41647924&l=dir
6. http://www.youtube.com/watch?v=fHt0bOfj3T0&feature=related
7. http://www.youtube.com/watch?v=cN5YH0iEvTo
8. http://www.youtube.com/watch?v=m9l1tVXyFp8
9. http://www.youtube.com/watch?v=98lh5Q0M0cg
10. http://www.youtube.com/watch?v=KIyGr-1snMY
11. http://en.wikipedia.org/wiki/Materials_science
12. http://www.studyvilla.com/electrochem.aspx

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

11.0 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		L				M		
CO2		H		M	M						L
CO3			H	M			M	L			M
CO4		H			H	H			L	L	
CO5	M		H	H	L						H

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

PROGRAMME : Diploma Programme in Mechanical Engineering(ME)/Automobile Engineering(AE)
COURSE : Computer Aided Drawing and Drafting(CDR) **COURSE CODE :** 6219

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	--	04	05	--	Max.	--	--	--	--	--	25	25
					Min.	--	--	--	--	--	10	--

1.0 RATIONALE:

Computer has become inevitable in today era and finds their application in various stages of production. This course has been introduced at diploma level in order to develop the skills in student so that they can generate various digital production drawings as required in industry using various CAD softwares.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Interpret the drawing and understand the graphical user interface for drafting.
2. Know the different draw and modify commands used for computer aided drawing.
3. Know the display and zoom commands and pan and dimension the object.
4. Know drafting using ISO snap for isometric drawing.
5. Understand the use of layout for plotting 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. Select proper software for drafting.
2. Draw and dimension the drawing of machine parts using software like AutoCAD.
3. Draw, edit and modify the new machine parts and assembly drawing.
4. Make a block, array, rotate, offset using necessary commands.
5. Plot the assembly and production drawing using CAD software.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to Computer Aided Drafting**	1a. Understand and use basics of CAD systems.	1.1 Introduction to Computer Aided Drafting (CAD)-Applications, Various commercial Softwares. 1.2 Co-ordinate system-Cartesian & Polar-Absolute, Relative mode. 1.3 Initial settings commands snap, grid, ortho, osnap, limits, units, scale, ltscale. 1.4 Object Selection methods picking, window, crossing, fence, last, previous etc.	02
Unit-II **Zoom and Display Commands**	2a. View drawing. 2b. Format drawing entities.	2.1 Zoom Commands: all, previous, out, in, extent, real time, dynamic, window and pan. 2.2 Formatting commands: Layers, block, line type, line weight, colour.	03
Unit-III	3a. Draw 2-D drawings 3b. Measure length and	3.1 Draw Command-Line, arc, circle, rectangle, polygon, ellipse, spline,	03

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Draw object commands	area	block, hatch 3.2 Enquiry commands-distance, area	
Unit-IV **Edit and Modify commands**	4a. Edit 2 D drawings. 4b. Modify 2 D drawings	4.1 Modify Command**:** Erase, oops, break, trim, copy, move, mirror, offset, fillet, chamfer, array, extend, rotate, scale, lengthen, stretch, measure, divide, explode and align. 4.2 Edit commands: Move, Copy and Stretch.	03
Unit-V **Isometric and 3D Drawings**	5a. Draw and modify 3 D drawings. 5b. Find materials mass property. 5c. Draw isometric drawings.	5.1. 3D Edit Commands-Pline, 3Dpoly, pedit, join splinedit commands. 5.2. View Commands-View ports, UCS, WCS commands 5.3. 3D Object and 3D operations: 3 D Object-Cube, Cylinder, Cone, Sphere and Wedge. 5.4. Three D operations-extrude, revolve. Command for drawing isometric object.	03
Unit-VI **Dimensioning and Plot Commands**	6a. Apply dimensions. 6b. Write text or remarks. 6c. Plot a drawing.	6.1 Dimensioning commands: Dimension styles, Dimensional Tolerances and Geometrical Tolerances. 6.2 Text commands: dtext, mtext command. 6.3 Plotting a drawing: paper space, model space, creating table and plot commands.	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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I, II	Setting the initial drawing setup.	04
2	III, IV	Use of Draw, Edit & Modify commands by giving some suitable objects.	08
3	III	Redraw figures (at least 2) (One sheet)	04
4	III, IV	Orthographic projections (One sheet)	08
5	III, IV	Sectional views (One sheet)	04
6	IV, V	Details of production drawing with dimensions, tolerances, geometrical tolerances,	08
7	VI	Machining, welding and surface finish symbols (One sheet)	08

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
8	VI	Assembly drawing with dimensions, geometrical tolerances, fits. (One sheet)	08
9	VI	Isometric drawing of at least 2 components. (One sheet)	08
10	V, VI	Draw 3 D primitives and do 3 D operations on it.	04
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the drawings of different machine parts.
2. Collect the production drawings of different assemblies and details of bench vice, bearings, couplings.
3. Prepare the PDF file of your drawing of assembly or detail.
4. Know the different 2 D drawing software currently used and compare it with one which you are using.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Demonstrate graphical user interface and the different commands.
2. Arrange a visit to industry for production drawing.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	AutoCAD: A Problem-Solving Approach	Sham Tickoo	Thomson Learning EMEA, Limited
2	Mastering Auto CAD	George Omura	BPB Publication

B) Software/Learning Websites

1. Beginners AutoCAD 2011 Tutorial DVD, Advanced AutoCAD 2011 Tutorial DVD, 2
2. Learning AutoCAD 2012 Tutorial DVD-Publisher-Infinite Skills Inc. Email**:** directsales@infiniteskills.com
3. EKHO Institute presents Professional AutoCAD Training Videos
4. Learning AutoCAD 2012 Tutorial DVD-Video Training.

C) Major Equipments/ Instruments with Broad Specifications

1. Computer lab with 20 PCs and CAD software.
2. LCD projector in the A. V. Hall.
3. Plotter of the A2 size or higher.

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		H		M							L
CO3				H							L
CO4				H							M
CO5		H	H	M				L	M		H

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

PROGRAMME : Diploma Programme in ME / PS / AE
COURSE : Electrical Technology (ETE) **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 & 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 & electromagnetic induction
2. Understand fundamentals of AC single phase supply
3. Understand the basic rules & 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, 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:

At the end of course the student shall

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 DC 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. 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 & apply Ohm's law to various circuits. 1c. Explain the laws of resistance. 1d. Differentiate between voltage drop and terminal Voltage	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 & voltage laws. (Simple Numericals)	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1e. Solve numerical based on Kirchhoff's current & voltage laws 1f. State the effects of electric current	1.4 Effects of electric current Heating, Magnetic & Chemical.	
Unit-II **Magnetism and Electromagnetic Induction**	2a. State various parameters for magnetism. 2b. Explain concept & laws of magnetic circuit. 2c. Differentiate between electric & magnetic circuit. 2d. Explain concept & 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 & magnetic circuit 2.3 Fleming's Right hand rule, Lenz's law 2.4 Dynamically induced EMF & statically induced EMF, Self induced EMF and Mutually induced EMF (Simple Numericals)	08
Unit-III **Single Phase & Three phase system**	3a. Define various Parameters of AC fundamentals. 3b. State current, voltage & power relationship in pure resistive, inductive & 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 & AC supply. 3.2 Equation for instantaneous value of alternating voltage & current 3.3 Definitions**:** Waveform, cycle, Time period, frequency, electrical and mechanical angle, Maximum value, average value & RMS value of sine wave, Form factor & Peak factor 3.4 Current, voltage & power relationship in pure Resistive, inductive & capacitive Circuit. 3.5 Concept of reactance, impedance, power factor for R-L-C series Circuit. 3.6 Concept of Active (kW), Reactive (kVAR) & Apparent power (kVA) 3.7 Advantages of polyphase system over single phase system 3.8 Star Connection, relation between line values & phase values of current, voltages (No derivation) (Simple Numericals) 3.9 Delta Connection, relation between line values & phase values of current, voltages (No derivation) (Simple Numericals)	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 & their function 4.3 Classification-Core type & shell	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 & its applications.	type 4.4 Derivation of EMF equation of a transformer 4.5 kVA rating of a transformer, Voltage ratio, current ratio, & transformation ratio (Simple Numericals) 4.6 Losses in transformer, Efficiency & Regulation of transformer by load test (Simple Numericals) 4.7 Three Phase transformer, winding Connections 4.8 Autotransformer-concept & 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 5.2 Principle 5.3 Classification on the basis of connection 5.4 Speed-Torque Characteristic of DC shunt motor and speed control 5.5 Applications 5.6 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 & 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 & electromagnetic induction	04	04	04	12
III	Single Phase & 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	4	06	14
V II	Single phase motors	02	0-	04	06
V III	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)	Approximate Hrs required
1	I	Verification of Ohm's Law	02
2	I	Verification Of KCL & 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 & DC voltage, resistance, continuity	02
5	V	Starting and starter and Speed control of DC shunt motor below & above normal speed	06

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Approximate Hrs required
6	VI	To plot speed torque characteristics of three phase induction motor	02
7	IV	Load test on single phase transformer for determination of Efficiency & regulation	04
8	--	Demonstration and Study of Servomotor	02
9	--	Demonstration and Study of Stepper motor	02
10	--	Demonstration & 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 & 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 & systems involving use of devices, parts working on principles of electronics engineering. For effective operation & 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. Draw 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 configuration 1.6 UJT, SCR, TRIAC, DIAC Symbol, working, characteristics.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Rectifiers & 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 & 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, Transformer coupled, Direct Coupled. Circuit Diagram, Frequency response and Function of each component 3.3 General theory of feedback: Types of feedback-negative & positive feedback. Barkhausen's criteria. 3.4 Operating principles of RC & 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. Circuit diagram and working of Astable multivibrator, monostable multivibrator using IC555	08
Unit-V **Digital**	5a. Draw block diagram of digital multimeter and explain its operation.	5.1 Digital Multi meter-Block Diagram and operation only, application 5.2 Block Diagram and working of CRO.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Instruments	5b. Draw and explain working of CRO. 5c. Draw and explain block diagram of Regulated power supply.	Working principle of CRT, applications of CRO 5.3 Function generator and working principle, block diagram, operation 5.4 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 & 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 & 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)*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
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:(SCA)

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.

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,

Sr.No.	Title of Book	Author	Publication
			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

a. Cathode ray oscilloscope
b. Function Generator
c. Regulated power supply
d. CRO Probe
e. V-I Characteristics of PN diode-Experimental kit
f. V-I Characteristics of zener diode-Experimental kit
g. Half wave rectifier-Experimental kit
h. Full wave rectifier-Experimental kit
i. Bridge Full wave rectifier with and without filter-Experimental kit
j. RC phase shift oscillator-Experimental kit
k. Colpitts oscillator-Experimental kit
l. OP-amp as adder-Experimental kit
m. Verification of logic gates-Experimental kit
n. Multiplexer(4:1)-Experimental kit
o. UJT relaxation oscillator-Experimental kit
p. 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 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	--	--	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**	5a. Apply Binomial Distribution 5b. Apply Poisson's Distribution 5c. 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):

Not Acceptable

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 over exploitation 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, over exploitation 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.
3. Describe the types of accidents and its measures.
4. Write the duties of production supervisor and store officer.
5. State the functions of HRM and Marketing departments.
6. Apply the practices like CPM, PERT, Supply Chain Management etc. in manufacturing organizations.

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.	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. 5c. Importance of	**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. **b. Human Resource Management**	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	Employee training	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	a. 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					H		M				
CO3		M					L				
CO4	L					H					
CO5				L							L
CO6				H			M			H	H

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	2a. Explain objective of planning by	2.1 Planning by supervisor, necessity, steps and objectives	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Supervisory Management	supervisory 2b. Describe the different types of budget. 2c. Explain the controlling of performance of team of worker in term of quantity & cost.	2.2 Budgeting at supervisory level, 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. 1d. Differentiate between selling and marketing.	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. 1.3 Simple marketing system, value exchange and transaction, functions of marketing.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	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.	1.4 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-V **Advertising and sales**	5a. Explain the concepts of marketing communication. 5b. Explain the different	5.1 Concept and the process of marketing communication. 5.2 Concept of Sales promotion and its types.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
management	types of sales promotions. 5c. Describe the concepts of sales management. 5d. Describe the various types of advertising media.	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.	
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. 2c. Describe selection procedure of material.	2.1 Objective, scope & Functions of purchasing department 2.2 Responsibility of purchasing section 2.3 Purchasing procedure or purchasing cycle. 2.4 Material Requisition: Material Indent form, Travelling Requisition card,	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		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 **Receiving and**	5a. State the procedure for inspection at receipt quality store 5b. Describe quality	5.1 Define inspection & their types, Goods receipt note 5.2 Inspection at vendor's work 5.3 Quality checking and Quantity	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
inspection	checking and quantity checking 5c. Importance of material handling for intricate materials	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	Gopal Krishnan	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 opportunities	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. 1.4 Trade Related opportunities 1.5 Business Idea-Methods and	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		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 • Small Scale Business Planning, Requirements. • Statutory Requirements and Agencies. • 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 Ahmadabad
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 to Beat Them.	V. G. Patel	
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	J. S. Saini	Wheeler Publisher, New Delhi

Sr.No.	Title of Book	Author	Publication
	Practice	B. S. Rathore	
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 Ahmadabad (Near Village Bhat, Via Ahmadabad 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 Mechanical Engineering(ME)
COURSE : Advanced Computer Applications (ACA) **COURSE CODE :** 6311

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:

'C' is the most widely used computer language, which is being taught as a core course. C is general-purpose structural language that is powerful, efficient and compact, which combines features of high-level language and low-level language. It is closer to Man and Machine both. Due to this inherent flexibility and tolerance it is suitable for different development environments Due to these powerful features C has not lost its importance and popularity in recently developed and advanced software industry. C can also be used for system level programming. C is still considered as first priority programming language.

This course covers from the basic concept of C to pointers in C. This course will act as "programming concept developer" for students. It will also act as "Backbone" for courses like OOPS, VB, Windows Programming, JAVA, OOMD.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Describe the concepts of constants, variables, data types and operators.
2. Develop programs using input and output operations.
3. Write programs using different looping and branching statements.
4. Write programs based on arrays and strings handling functions.
5. Write programs using user-defined functions and structures
6. Write programs using C pointers.

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 structured, modular and memory efficient programs in 'C' using arrays, functions, pointers and data files.
2. Apply the C programming for practical application

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to C**	1a. List the keywords of C 1b. explain Basic Input and output	1.1 History of C, Basics of Algorithm and Flowchart in C, Steps for executing a C program. 1.2 Character set, Trigraph character tokens, constants, variables, keywords C operators, C expressions, data types in C, Basic Input and output	02
Unit-II **Decision making**	2a. Develop the programme using if, if-else, else-if ladder, nested if-else statement	2.1 Decision making and branching**:** if statement (if, if-else, else-if ladder, nested if-else), Switch case statement, break statement.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-III **Control loop**	3a. Develop the programme using control loop function	3.1 Concept of control looping-type of looping conditional and unconditional while, do-while and for loop statements, break and continue statement, got statement	04
Unit-IV **Arrays**	4a. list types of arrays and array function	4.1 Definition and initialization of Arrays Syntax and types of array. Examples of array	04
Unit-V **Functions**	5a. Defined Syntax of Function, categories of Function.	5.1 Definition of function, Types of Function, Syntax of Function, categories of Function.	02
		TOTAL	**16**

5.0 ASSIGNMENTS/PRACTICALS/TASKS:

Sr. No	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Implementation and concepts of Turbo C Editor	04
2	I	To find given days to month and day.	02
3	II	To find given year is leap year or not.	02
4	II	To find greatest and smallest of 3 numbers using branching statement.	04
5	III	To find whether given number is 1) odd, 2) even, 3) Positive, 4) Negative, 5) Prime using menu driven with switch-case-default.	04
6	III	To display all odd numbers from 1-50 nos. using while loop.	02
7	III	To perform addition of 100 to 1 numbers using do-while loop.	02
8	III	To display 1 to 10 numbers their square and cube in tabular form using for loop	02
9	IV	To find smallest / largest number from array elements.	04
10	IV	To enter elements for two 3X3 matrix and display them in matrix form and perform addition of 2 matrices.	02
11	V	To calculate area of circle using function.	02
12	V	To calculate factorial of any given number using recursion.	02
		TOTAL	**32**

6.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare presentation and deliver seminar on various topics covered like String functions, Pointers, Arrays, File Functions.
2. Students are expected to develop minimum one program of particular topic as an example to exhibit real life application.

7.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Lecture Method, Use of teaching aids, Demonstration.

8.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Programming in 'C'	Balgurusamy	Tata McGraw Hill
2	Let's 'C'	Vasant Kanetkar	BPB
3	Complete reference C	Herbert Shildt	Tata McGraw Hill

B) Software/Learning Websites

1. http://cplus.about.com/od/beqinnerctutoriali/a/blctut.htm
2. http://howstuffworks.com/c.htm
3. http://www.indiastudycenter.com/studyguides/sc/obitest/default.asp

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

9.0 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					H	L	L	H
CO2			H					H	L	L	H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Plant Maintenance and Safety (PMS) **COURSE CODE** : 6312

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:

The mechanical engineering technician deals with various types of machines used for useful task. The machine consisting of various types of mechanism & elements which are subjected to various types of stresses due to variety of forces acting on them. These machine elements have to be designed properly so that they will withstand the forces acting on them for a long time without any deformation.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand various types of failure & develop the ability to analyze the problem.
2. Diagnose faults and repair the same
3. Manage maintenance operations satisfactorily
4. Understand the importance of preventive 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. Recognize troubles in mechanical elements.
2. Assemble, dismantle and align mechanisms in sequential order.
3. Carry out plant maintenance using latest techniques like TPM, Preventive maintenance

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of maintenance engineering**	1a. Appreciate the need of maintenance in industry 1b. Describe functions of maintenance department	1.1 Definition and aim of maintenance engineering 1.2 Primary and secondary functions and responsibility of maintenance department 1.3 Types of maintenance. 1.4 Types and applications of tools used for maintenance. 1.5 Types of repair Cycles	04
Unit-II **Methods of Lubrications**	2a. Select appropriate lubricants and lubrication method.	2.1 Lubricants-types and applications. 2.2 Lubrication methods- • Screw down grease cup. • Pressure grease gun. • Splash lubrication. • Gravity lubrication. • Wick feed lubrication. • Side feed lubrication. • Ring lubrication.	04
Unit-III	3a. Develop decision trees to diagnose	3.1 Fault tracing-concept and importance. 3.2 Decision tree-concept, need and	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Fault tracing	faults in equipment.	applications. 3.3 Sequence of fault finding activities, show as decision tree. 3.4 Draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipments like: • Any one machine tool. • Pump • Air compressor. • Internal Combustion engine. • Boiler. • Electrical motors. 3.5 Types of faults in machine tools and their general causes.	
Unit-IV **Periodic and preventive maintenance**	4a. Carry out periodic inspection in mechanical systems. 4b. Plan preventive maintenance of major mechanical systems.	4.1 Definition, need, steps and advantages of preventive maintenance. 4.2 Steps/procedure for periodic and preventive maintenance of: • Machine tools. • Pumps. • Air compressors. • Diesel generating (DG) sets. 4.3 Program and schedule of preventive maintenance of mechanical and electrical equipments. 4.4 Advantages of Preventive maintenance.	04
		TOTAL	**16**

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 **(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	**Preparatory Activity:** Study and demonstrate use of various types of tools. (Fix spanners, box spanners, ring spanners, allen keys, types of pliers, screw drivers, bearing puller etc.).	02
2	I -IV	Analysis of manual of newly installed machine,	02
3	I-IV	Preparation of Chart & history sheet for a machine.	02
4	II	Use of lubrication equipment likes oiling gun, greasing gun etc., Familiarization with different grades of lubricants. Joining a flexible pipe & Checking its leakages in any hydraulic circuit.	04
5	III	Assignment on Newer maintenance technique-TPM its importance	02

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
6	III	**Maintenance of Mechanical Based Equipment/Device/Machine.** Maintenance of **any two** from following. Batch may be divided in to two groups and each group may be given one case. a. Head stock. b. Tail stock. c. Feed box. d. Indexing head. e. Internal combustion (IC) engine. f. Pump. (Dismantle of given case, observe rules, follow sequence of dismantling operations, cleaning, inspection, measuring deviations and recovery methods, testing and assembling).	06
7	IV	**Preventive Maintenance:** Prepare a preventive maintenance schedule of any workshop having-air compressors, Lathe machine, Milling Machine Drilling machine etc.	04
8	IV	**Safety:** Demonstrate use of fire fighting and safety related equipments.	04
9	I-IV	**Mini Project And Presentation:** a. Identify mechanical based any one equipment / device / machine at institute level which requires maintenance. b. Prepare general sketch. c. Perform fault tracing and prepare the decision tree. d. Dismantle. Write the sequence of dismantling. Also describe the steps. List the tools used for this activity. e. Attend necessary maintenance tasks. Write the tasks performed. f. Assemble, test and if necessary, modify. Write the steps. g. Prepare power point presentation. Present the project. This must include photographs / movies of group working on project.	06
		TOTAL	**32**

6.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Monitor functionality of machine element and try to judge fault in it.
2. Visit nearby Industry/plant/workshop/hospital and collect samples of periodic & preventive maintenance format.

7.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Fundamentals of maintenance engineering-Demonstrate and explain use of tools.
2. Fault tracing-Show movie. Demonstrate the steps.
3. Periodic and preventive maintenance-Show movie. Demonstrate the steps. Show some sample formats.
4. Industrial safety-Demonstrate and explain use of safety equipments.

8.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Maintenance Engineering Handbook	Higgins & Morrow	DA Information Services
2	Maintenance Engineering	H.P. Garg	S. Chand and Company
3	Foundation Engineering Handbook	Winterkorn, Hans.	Chapman & Hall London

B) Software/Learning Websites

1. www.mt-online.com
2. www.pmxpert.com
3. www.nptel.iitm.ac.in
4. en.wikipedia.org
5. webstore.ansi.org/preventive-maintenance
6. www.mapcon.com

C) Major Equipments/ Instruments with Broad Specifications

1. Tool kit.
2. Fire extinguishers.
3. Lubricants
4. Cotton wastes
5. Kerosene
6. Measuring instruments.

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	L	M	H		M	M			L		M
CO2	M		H	M	M		L	H	M	L	M
CO3	M		M	H		H					

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
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, attitude and 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. Write report on expert lecture.
4. Develop problem solving techniques through case studies.

4.0 COURSE DETAILS:

Note: 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 **Information search and data collection**	1a. List different software used in Mechanical Engineering field 1b. List out various solar energy equipments 1c. Procedure for pump installation & maintenance 1d. Prepare proposal for starting small scale industry 1e. Prepare data base for manufacturing product 1f. List out successful entrepreneurs in near-by areas 1g. Prepare list of various material handling devices	1.1 Collection of information regarding different software's user in mechanical engineering and detailed study of any one of them 1.2 Market survey for solar energy equipment's or non-conventional energy sources. 1.3 Pumps installation and maintenance. 1.4 Preparing a proposal of starting a small scale industry and collecting information regarding different schemes. 1.5 Collection of information to manufacture a product and calculating its market value. 1.6 Survey & interviews of successful entrepreneurs in nearby areas. 1.7 Preparing manuals regarding maintenance of machinery & equipment's in mechanical

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	1h. List out various industrial accidents	department.
		1.8 Collecting of information regarding different types of material handling devices & plant layout used in industry. 1.9 Machine installation & maintenance. 1.10 Information regarding industrial accidents & its prevention techniques.
Unit-II **Industrial visit.**	2a. Develop technical report writing skills on industrial visits 2b. Understand culture of industry	2.1 Industrial visits and report writing of**: (Any Two)** ▪ Manufacturing organizations for observing various manufacturing processes including heat treatment ▪ Material testing laboratories in industries or reputed organizations ▪ Auto workshop / Garage ▪ Plastic material processing unit ▪ ST workshop / City transport workshop ▪ Machine shop having CNC machines. ▪ City water supply pumping station ▪ Manufacturing unit to observe finishing and super finishing processes
Unit-III **Expert lectures**	3a. Write report on the expert lecture to obtain the professional knowledge.	3.1 Expert lectures from professionals/ industries on. (Any Two) ▪ Environmental Pollution control ▪ Software for Mechanical Engineering. ▪ Green technology. ▪ Advances in refrigeration & Air conditioning. ▪ Advances in manufacturing techniques. ▪ Nano technology. ▪ Industrial safety. ▪ Use of plastics in automobiles.
Unit-IV **Case Study**	4a. Explain case study techniques 4b. Solve Mechanical engineering problems by case study technique. 4c. Suggest solution for problems by case study techniques	4.1 Case Study ▪ Observe the Space utilization in workshop & identify the problems regarding area. Suggest suitable solution. ▪ Measures to reduce the consumption of energy in department. ▪ Identify the location for installing non-conventional energy sources. ▪ Select a proper tool required for different manufacturing operations. ▪ Repair and maintenance of various instruments and machineries in mechanical engineering.

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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	**Information search, data collection and writing a report on the topic (Any Five)** a. Collection of documents, certificates and its market value required for manufacturer of product. b. Preparing a proposal of starting a small scale industry and collecting information regarding different schemes. c. Market survey for advanced engineering materials w.r.t. quality, rate and applications. d. Market survey for pumps, pipes and peripherals required for machinery. e. Collection of information regarding different software's used in Mechanical Engineering and detailed study of any one of them. f. Collection of market information including rates and specifications for non-conventional energy products like solar water heater. Solar lamp, wind turbine. g. Survey & interviews of successful entrepreneurs in nearby areas. h. Collecting of information regarding different types of material handling devices & plant layout used in nearby industry.	24
2	II	**Industrial visits (Any two)** a. Manufacturing Industries. b. Visit to cold storage plant c. Visit to calibration laboratory. d. Visit to Thermal/Hydraulic power station. e. Visit to Automobile workshop.	16
3	III	**Expert Lectures (Any Two)** The lectures from professionals/ industry expert to be organized (2 hrs. duration) on any 2 topics of following suggested areas or any other suitable topics. a. Environmental Pollution control b. Software for Mechanical Engineering. c. Industrial Safety. d. Green technology. e. Advanced Manufacturing techniques f. Nano Technology. The brief report to be submitted on the expert lecture by each student as a part of term work.	08
4	IV	**Case study (Any Two)** a. Study of different types of plant layout in workshop and suggest suitable layout. b. Study the various energy saving techniques and suggestion regarding reduction of consumption. c. Identify the location for installing non-conventional energy devices.	16

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
		d. Study different types of tools and select for particular manufacturing process. e. Repair and maintenance of various equipments in mechanical engineering department.	
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect specifications and rates of various machines and instruments.
2. Collect set of working drawings for Mechanical engineering machines and products.
3. Observe a video on expert lectures from internet on Mechanical engineering topic and draft a report on it.
4. Collect specifications of general and cutting tools.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software; arrange industrial visits, expert lectures, case studies related to Mechanical engineering.

9.0 LEARNING RESOURCES:

A) National and international Journals and Magazine. Production technology handbook, Mechanical Engineering Review, handbook of Refrigeration, SAE Handbook.

B) Software/Learning Websites

1. http://www.howstuffworks.com
2. www.Slideshare.com.
3. www.ishare.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				H
CO4	H	H	H	H	M			M			H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Seminar (SEM) **COURSE CODE :** 6411

TEACHING & 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 & 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 & 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:

Sr.No.	Areas For Selection
1	Green Technology
2	Alternative fuels
3	Emerging technologies
4	Ergonomics and Aesthetics
5	Technology Forecasting
6	Business Entrepreneurship
7	Industrial Automation
8	Work study
9	Material Technology
10	Safety
11	Latest vehicle controls and systems
12	Robotics and artificial intelligence
13	Design for Excellence (DFX)
14	Advanced Manufacturing Process
15	Mechatronics
16	Supply Chain Management
17	Lean Manufacturing
18	Operation Research

6.0 SUGGESTED INSTRUCTIONAL STRATEGIES:

Classroom Teaching, Library Assignment, Group Discussion, Case Studies

7.0 LEARNING RESOURCES:

Magazines, Journals, Papers: National & 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 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 & 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	L	H			L			H	M		M
CO2		M			M			M	M	H	M
CO3		H						M			
CO4			H		M					L	
CO5									H	M	
CO6				H				M			H
CO7	L	M		M		H	H	H	M		H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
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	--

* Indicates TW to be assessed by external & internal examiners.

1.0 RATIONALE:

An Engineer or technician has to work on various projects in profession or 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 & 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 & 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
12	Design of Components, preparation of drawing, estimates wherever required,

Activity No	Activities
	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 & 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 Mechanical Engineering depending upon the availability of projects may be included. Preference should be given to practical oriented projects according to the local needs.

Sr.No.	Areas For Selection
1	Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/demonstration models etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.
2	Design & fabrication of mechanisms, machines, Devices etc.
3	Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modelling, pick & place robots etc.
4	Industry sponsored projects-project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co-guide along with guide from institution.
5	Topic selected must be related with latest technological developments in mechanical or Mechatronics field and should not be a part of diploma curriculum.
6	Investigative projects-Project related with investigations of causes for change in Performance or structure of machine or component under different constraints through experimentation and data analysis.
7	Maintenance based projects: The institute may have some machine/ equipment/ system which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity are submitted.
8	Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken.
9	Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.
10	Innovative/ Creative projects-Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM, Mechatronics etc.
11	Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene etc, Working model or case study should be undertaken.
12	Market research/ survey based projects: Projected related with identification of extent of demand, sales forecasting, comparative study of marketing strategies, comparative study

Sr.No.	Areas For Selection
	of channels of distribution, Impact of variables on sales volume etc. The project involves extensive survey & market research activities information to be collected through various mechanisms/tools & report be prepared.
13	Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.

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 & figures (optional), Introduction, Objectives of the Project, Methodology used, Design, Drawing of the part and assembly, Testing, Costing, Result, Conclusions & 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 & 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.
   a. For textbooks-Dr. V.L. Shah & Veena Gore, Limit State Design of Steel Structures, Structures Publications, 1 Edition, 2009.
   b. For papers-David, Insulation design to combat pollution problem, Proc of IEEE, PAS, Volume 71, Aug 1981, pp 1901-1907.
   c. Only SI units are to be used in the report. Important equations must be numbered in decimal form.
   d. 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										H
CO2		H	M								
CO3							M				M
CO4	M					L		M	H		M
CO5		H		L	M		M		H	L	M
CO6		M	H			M	H			H	M
CO7		M	H		H			H	H		H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME) / Automobile Engineering(AE)
COURSE : Metrology and Quality Control(MQC) **COURSE CODE :** 6413

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:

The diploma mechanical Engineer often come across measuring different parameters of machined components and the appropriate fitment of interchangeable components in the assemblies. For the above purpose he/she is also required to analyze the quantitative determination of physical magnitude and ensure the control of quality.

During previous semesters different systems of measurement and their units etc have been introduced in the course, basic physics. The different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like surface finish, Squareness, Parallelism, Roundness etc) and the use of gauges and system of limits, Fits, Tolerances etc. are often required to be dealt in detail by diploma engineer on the shop floor. He/she is also required to analyze, Interpret and present the data collected, graphically and statistically for ensuring the quality.

The knowledge of the course also forms the basis for the design of mechanical measurements systems, design & drawing of mechanical components.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand and calculate the least count of all basic measuring instruments.
2. Acquaint with operation of precision measurement tools and equipments.
3. Select appropriate instruments for specific measurement.
4. Analyze and interpret the data obtained from the different measurement processes and present it in the statistical form.
5. Construct and draw the control chart and represent the data in graphical form.
6. Understand ISO certification procedure and quality system.
7. Understand the modern quality concepts and statistical 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. Acquire knowledge of traditional and modern measuring methodology used in industry to measure actual product dimensions, shape and surface texture.
2. Illustrate working principle of measuring instruments, comparators and gauges for inspection purpose.
3. Identify and select proper measuring instrument for specific application.
4. Inculcate habits of handling the instruments and interpret measurement data, to estimate uncertainties.
5. Measure and compare dimensions of components by using various comparators.
6. Apply knowledge of various tools and techniques used to determine geometry and dimensions of machine tools in engineering applications.
7. Apply the recent quality control tools to obtain the process control.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to Metrology**	1a. Describe the basis of metrology. 1b. Explain various standards and comparators. 1c. State the different types of gauges. 1d. Explain the basics of angular measurement and measure angle using different instruments.	1.1 **Metrology:** Definition, Categories, Need of inspection, Precision and Accuracy, Sensitivity, Readability, Calibration, Traceability, Reproducibility, Sources of errors, Factors affecting on accuracy, Selection of instruments, Precautions while using instruments for getting higher precision and accuracy. 1.2 Introduction of CMM. 1.3 Standards: Definition, line and end standard, Wavelength standard. Slip gauges and its accessories, Length bars. 1.4 Comparators: Definition, Requirement of good comparator, Classification, uses, working principles. Relative advantages and disadvantages. 1.5 Interchangeability, Design of Plug and Ring Gauges, Taylor's Principle, IS919-1993 (Gauges IS 3477-1973) Concept of multi gauging and inspection. 1.6 Concept, Instruments for Angular Measurements, Working and use of Universal Bevel Protractor, Angle Gauges (With Numerical on Setting of Angle Gauges), Sine Bar, Spirit Level, Principle of Working of Autocollimator, Angle dekkor and Clinometers.	03 06 04 04
Unit-II **Threads and Gear Metrology**	2a. Explain the various methods of calculating thread elements and gear tooth elements. 2b. State the various types of errors in threads and gears. 2c. Discuss the terminology of thread and gear.	2.1 ISO grade and types of thread, Errors in threads, Pitch errors, Measurement of different elements such as major diameter, minor diameter, pitch,, Thread angle, effective diameter: One, Two and Three wire method, Working principle of floating carriage micrometer, profile projector and tool makers microscope. Interferometry. 2.2 Analytical and functional inspection, Rolling test bench, Errors in gears. Measurement of tooth thickness, (Constant chord method), gear tooth vernier calliper,	03 04
Unit-III **Testing Techniques**	3a. Explain the techniques to measure surface finish of various components. 3b. Discuss the various machine tool test and alignment test. 3c. Understand the terminology of surface finish.	3.1 Primary and secondary texture, terminology of surface texture as per IS 3073-1967, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis, Working principle of stylus probe type instruments 3.2 Parallelism, Straightness, Squareness, roundness, run out, alignment tests of Lathe and Drilling, machine tools as per	04 04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		IS.	
Unit-IV **Quality Control**	4a. Explain the concept of Quality. 4b. Differentiate between quality and inspection. 4c. Discuss the principles of TQM. 4d. Explain the concept of quality audit. 4e. Describe the six sigma methodology. 4f. Explain the procedure of ISO certification.	4.1 Definitions, meaning of quality, Quality characteristics, Quality of design, conformance, performance, Concept of reliability, maintainability, Cost, Quality assurance, Quality and Inspection, Inspection stages. 4.2 Principles of Total Quantity Management. Continuous improvement-PDCA, Quality Circles, Employee empowerment (JIDOKA). 4.3 Quality Audit: Concept of audit practices, lead assessor certification. 4.4 Six sigma: Meaning, methodology of system Improvement. 4.5 Concept, ISO 9000 series quality standards, QS14000, necessity and procedure of ISO certification, TS 16949.	04 08 04
Unit-V **Elementary Statistics & it's application in quality control**	5a. State the various types of data. 5b. Explain the various types of control charts. 5c. Discuss process capability of machine. 5d. Differentiate between acceptance sampling and 100% inspection. 5e. Explain various sampling plans. 5f. Describe OC curve.	5.1 Meaning and importance of SQC, Variable and attribute Measurement, inherent and assignable sources of variation, control charts for variables: X, σ and R charts, control charts for attributes: p, c, np charts, process capability, 5.2 Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits, OC curve.	10 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	Metrology Basics	02	02	--	04
	Standards and comparators	02	02	04	08
	Gauges	02	--	04	06
	Angular Measurement	--	02	04	06
II	Screw thread Measurements	02	02	--	04
	Gear Measurement and Testing	02	02	--	04
III	Measurement of surface finish	--	02	02	04
	Machine tool testing	02	02	04	08
IV	Quality	02	02	--	04
	Total Quality Management	04	04	02	10
	ISO 9000 Series & Other standards	02	02	--	04
V	Statistical quality control	02	02	08	12
	Acceptance Sampling	02	02	02	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/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	Measurement of all parameters of given part using linear measuring instruments.	04
2	I	Measurement of unknown angle of component using sine bar and angle dekkor.	02
3	I	Measurement of run-out, roundness using dial indicator.	02
4	II	Measurement of various screw thread elements.	04
5	II	Measurement of gear tooth elements by using gear tooth vernier calliper and verification of gear tooth profile using profile projector.	04
6	III	Interpretation of fringes using optical flat.	02
7	III	Machine tool alignment test for any machine tool like lathe, drilling.	04
8	V	Draw the frequency histogram, frequency polygon, normal distribution curve and ogive curve for given samples and find mean, mode, median, standard deviation, variance and range.	04
9	V	To draw and interpret the control limit for variable measurement (X and R chart). Or (P and C chart)	04
10		Industrial visit concerned with Metrology and Quality Control. Measurement of various products by using CMM	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Identify actual machine parts/products/components in labs of mechanical department and workshop for measurements purpose.
2. Understand the quality characteristics of the products available in the market.
3. Visit the industries to collect the data for P, C, X and R chart.
4. Selection of comparators for the given dimensional data.
5. Study the quality management system tools by visiting different manufacturing industries.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to MQC.
2. Arrange an Industrial visit to understand the uses of various measuring instruments.
3. Arrange expert seminar of industry person in the area of metrology and quality control.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering metrology	R. K. Jain	Khanna Publisher, Delhi.
2	Metrology for Engineers	J. F. W. Galyer and C.R. Shotbolt	ELBS
3	Engineering Metrology	K. J. Hume	Kalyani publishers
4	A text book of Engineering metrology	I. C. Gupta	Dhanpat Rai and Sons,
5	Metrology Lab. Manual	M. Adithan and R. Bahn	NITTTR Chandigarh.
6	Statistical Quality Control	M. Mahajan	Dhanpat Rai and Sons
7	Quality control	NITTTR Chennai	Tata McGraw Hill,
8	Quality planning and analysis	Juran U. M. and Gryna	Tata McGraw Hill,
9	Inspection and quality control	National productivity council	N. P. C., New Delhi.
10	Managing for Total Quality	N. Logothetis	Prentice-Hall, Delhi.
11	Statistical Process analysis	Lauth Alwan	Tata McGraw Hill.

B) Software/Learning Websites

1. http://www.creaform-metrology.com
2. www.en.wikipedia.org
3. www.jenoptik.com

C) Major Equipments/ Instruments with Broad Specifications

1. Vernier Calliper-0-200mm.
2. Micrometer-0-25mm, 25-50mm.
3. Surface Plate-Granite.
4. Vernier Height Gauge and Depth Gauge.
5. Micrometer Depth Gauge.
6. Sine Bar with slip gauge box.
7. Angle gauges box.
8. Universal bevel protractor.
9. Angle dekkor.
10. Optical profile projector.
11. Screw pitch gauge.
12. Combination set box.
13. Floating Carriage Micrometer,
14. Monochromatic light unit.
15. Optical flat.
16. Gauges-plug, ring, snap.
17. Dial Indicator.
18. Gear tooth vernier caliper.
19. Spirit Level.
20. Coordinate Measuring 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	M						L			
CO2		H	M								
CO3	H		M					L			
CO4				H		M					
CO5			H								
CO6				H							
CO7	H										H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Design of Machine Elements (DME) **COURSE CODE** : 6414

TEACHING & 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	01	02	07	04	Max.	80	20	100	--	25	50	175
					Min.	32	--	40	--	10	20	--

1.0 RATIONALE:

A diploma holder is expected to design and draw simple machine components used in small and medium scale industries. Fundamental knowledge of Applied Mechanics, Strength of Materials and Theory of Machines is essential. Course aims at developing analytical abilities to give solutions to engineering design problems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Apply the knowledge of basic science and engineering.
2. Analyze the problem.
3. Understand material properties and processes.
4. Use design data books, handbooks, ISI reference books etc. to get standard information.
5. Understand various modes of failures.

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 appropriate mechanism and make load calculations.
2. Identify weaker sections and find out the failure loads.
3. Select appropriate material.
4. Design the machine element for the given application.
5. Select standard dimensions and parts from design data books, handbooks and ISI reference books.
6. Prepare production drawings as per the needs of manufacturing processes in industries.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topic/ Sub topic	Hours
Unit-I **Fundamentals of Design**	1a. List parameters 1b. Apply basic concepts	1.1 Machine design philosophy and phases in design, design considerations, Aesthetic and Ergonomic consideration in design. 1.2 Types of loads, concept of stresses, bearing pressure, bending and torsion stresses, principal stresses, strain, stress-strain diagram. 1.3 Concept of creep, Fatigue, S-N curve, Endurance limit. 1.4 Maximum principal stress theory and Maximum shear stress theory. 1.5 Designation of materials as per IS, Selection of' materials and manufacturing processes. (To be covered in practical with practical examples) Use of design data books, Standardizations.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topic/ Sub topic	Hours
		1.6 Factor of Safety, conditions for selection of F.S. 1.7 Stress concentration meaning, causes and remedies	
Unit-II **Force consideration**	2a. Design a joint 2b. Calculate dimensions of lever/link	2.1 Forces resulting in direct tension, compression and shear. Design of simple machine parts such as knuckle joint, turn buckle, cotter joint. 2.2 Forces resulting in bending. Design of bell crank lever, hand lever and lever for safety valve. 2.3 Forces resulting in combined, direct and bending. Design of C-frame and offset link.	10
Unit-III **Design of Shaft, Keys and Couplings**	3a. Design shaft 3b. Design key 3c. Design coupling	3.1 Types of shafts, Shaft materials, Standard sizes, Design of solid and hollow shafts based on strength and rigidity criteria. 3.2 Design of hollow and solid shaft for combined bending and twisting moments and considering the effect of shock and fatigue. ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley. 3.3 Types of keys, effect of keyway on the strength of shaft, design of rectangular and square keys. 3.4 Types of couplings, Design of muff coupling, flanged couplings (protected and unprotected) and bushed pin type flexible coupling.	14
Unit-IV **Design of Fasteners and Power screws**	4a. Draw thread profiles 4b. State applications of fasteners 4c. Design screwed/ welded joint 4d. Design power screw	4.1 Stresses in screwed fasteners, bolts of uniform strength. Design of bolted joints subjected to eccentric loading (about one axis only), Merits and demerits of joint. 4.2 Design of transverse and parallel fillet welds, axially loaded symmetrical section, merits and demerits of joint. 4.3 Thread profiles used for power screw. 4.4 Torque required for raising and lowering the load, Efficiency, self locking and overhauling conditions. Stresses in power screws 4.5 Design of screw jack and screw clamp. (Numerical problems limited to square threads only)	14
Unit-V **Design of Springs**	5a. Classify springs 5b. Design helical spring	5.1 Classification, application and functions of springs. 5.2 Selection of material for springs and specifications of spring. 5.3 Wahl's correction factor and its application, 5.4 Design of helical springs with circular cross section wire for I.C. engine valves, weighing balance, railway buffers etc.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topic/ Sub topic	Hours
		5.5 Design of multiple leaf springs.	
Unit-VI **Bearings and Mountings**	6a. Classify bearings 6b. Select bearings	6.1 Types of bearings, common bearings used in practice, Types of ball and roller bearings, 6.2 Life load relationship, basic Static load capacity, basic dynamic load capacity, limiting speed, bearing life. Designation of bearings. 6.3 Selection of bearings from manufacturer's catalogue. Mounting methods.	06
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS

Unit	Unit Title	Distribution of Theory Marks			
		Remembrance (Knowledge)	**Understanding (Comprehension)**	**Application**	**Total**
I	Fundamentals of Design	06	06	--	12
II	Force consideration	06	--	08	14
III	Design of Shaft, Keys and Couplings	02	06	10	18
IV	Design of Fasteners and Power screws	04	08	06	18
V	Design of Springs	04	04	02	10
VI	Bearings and Mountings	04	02	02	08
	TOTAL	**26**	**26**	**28**	**80**

6.0 ASSIGNMENTS/ PRACTICALS/TASKS

Sr.No.	Unit No.	Practical Exercise (Outcomes in Psychomotor Domain)	Approximate Hrs Required
1	I	Assignment based on the topic Fundamentals of Design (min. 2 questions per sub-topic-Students are expected to solve questions using Design data book, hand books, reference books)	06
2	II	Design and draw mechanical joint.	04
3		Design and draw mechanical lever.	
4	III	Mini Project 1-Design and prepare the drawing of transmission system by observing transmission of power through shaft, keys, coupling, pulley and belt drive etc.	06
4	IV	Mini Project 2-Design and prepare CAD Drawing of power screw	04
5	IV	Design of fasteners	04
6	V	Design of springs (Helical spring and leaf spring)	04
7	VI	Selection of bearings	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Refer design data book and note down mechanical properties of mild steel, cast iron, phosphor bronze, cast steel, brass and aluminum.
2. Visit internet sites and list out and draw at least 10 practical examples of stress concentration.
3. Study the power transmission system of flour mill and suggest improvements if any.
4. Visit the showroom of a truck spring supplier, observe various leaf springs and prepare a report.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Text Book:

Sr.No	Title of Book	Author	Publication
1	Design of Machine Elements	R. S. Khurmi and Gupta	S. Chand
2	Machine Design	Pandya and Shah	Charotar Publications Anand
3	Machine Design	V B Bhandari	Tata McGraw Hill Publications
4	Machine Design	U C Jindal	Pearson Education India
5	Design Data book	PSG	PSG college of Technology Coimbatore
6	Mechanical Engineering Design	Shigley	Tata McGraw Hill Publications
7	Machine Design	Spott M F	Prentice Hall Publications

B) Software/Learning Websites

1. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_home.html
2. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod4.html
3. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod7.html.
4. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod4.html
5. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod5.html
6. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod8.html
7. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod11.html
8. http://www.machinedesignonline.com/MDO_Portal/design_component.html

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10. MAPPING MATRIX OF PO'S AND CO'S:

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

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Mechanical Measurements (MMS) **COURSE CODE** : 6415

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:

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the working principle and characteristics of measuring instruments
2. Understand construction and working of various measuring devices for different application
3. Understand the significance of control system in automation.
4. Understand the use of measuring instrument for specific application.
5. Understand construction and working of instruments for miscellaneous measurement.

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 working of generalised measurement system.
2. Select the transducer for measurement of parameter for specific application.
3. Monitor and control the parameters as per requirement of process.
4. Compare the performance of a displacement, temperature measuring instrument with standard.
5. Select and operate the instrument for measurement of different parameters like flow, stress, force.
6. Measure sound, liquid level, speed, humidity etc. using various instruments.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Significance of measurement**	1a. Explain the working of generalised measurement system. 1b. Understanding static and dynamic characteristics 1c. Select the transducer for specific application.	1.1 Functional elements of measurement system, Classification of instruments, Types of errors, static performance parameters (simple numerical). 1.2 Dynamic terms and characteristics 1.3 Transducers and its Classification: analog and digital, active and passive, resistive, inductive, capacitive, piezo-electric, thermo resistive 1.4 Specification, selection and application of transducers 1.5 Mechanical, hydraulic, pneumatic and	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		optical amplifying elements	
Unit-II **Control systems**	2a. Explain working of control systems 2b. Monitor and control the parameters in real time application	2.1 Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed Forward control system, 2.2 Servomotor mechanism, hydraulic, pneumatic, electronic, proportional, integral, derivative control systems and their comparison. 2.3 Control system Applications for boilers, air conditioners, motor speed control etc.	08
Unit-III **Displacement speed and strain measurement**	3a. Explain the working of displacement and speed measuring instruments. 3b. Select the transducer for measurement of displacement, speed and strain for various applications.	3.1 Potentiometer, LVDT and RVDT, 3.2 Speed measurement-Mechanical and electrical Tachometers, 3.3 Inductive Pick Up, Capacitive Pick Up, Stroboscope. 3.4 Strain measurement-Stress-strain relation, types of strain gauges, strain gauge materials, Gauge Factor (Simple Numerical), classification of strain gauges 3.5 Selection and installation of strain gauges, load cells, rosettes	16
Unit-IV **Temperature measurement**	4a. Explain the working of various temperature measuring instruments 4b. Compare the performance of a temperature measuring instrument with standard.	4.1 **Non-electrical methods**-bimetal and liquid in glass thermometer, pressure thermometer 4.2 **Electrical methods**-RTD, platinum resistance thermometer, thermistor 4.3 **Thermoelectric methods**-Elements of thermocouple, law of intermediate temperature, law of intermediate metals, quartz thermometer 4.4 **Radiation methods**-Radiation and Optical pyrometers. 4.5 Calibration of temperature measuring instruments.	12
Unit-V **Flow measurement**	5a. Know the working of various flow measuring instruments 5b. Select and operate the instrument for measurement of flow.	5.1 Positive displacement meters, 5.2 Variable head flow meters, Variable area meter-rotameter, Pitot tube, Turbine meter, Vortex flow meter, 5.3 Hot wire/film anemometer, Electromagnetic flow meter, Ultrasonic flow meter	08
Unit-VI **Miscellaneous Measurement**	6a. Explain the working of various miscellaneous measuring instruments 6b. Measure sound, liquid level, speed, humidity etc. using various instruments.	6.1 Acoustics measurement-sound characteristics, Sound level meter, Microphones, 6.2 Humidity measurement-Sling hygrometer, hair hygrometer, Humistor hygrometer. 6.3 Liquid level measurement-direct and indirect methods 6.4 Force measurement-Tool	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		6.5 Dynamometer (Mechanical Type) Shaft Power Measurement-Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer.	
		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	Significance of measurement	04	08	04	16
II	Control systems	--	04	08	12
III	Displacement speed and strain Measurement	04	08	08	20
IV	Temperature measurement	--	08	04	12
V	Flow measurement	--	04	04	08
VI	Miscellaneous Measurement	04	04	08	12
	TOTAL	**12**	**32**	**20**	**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, II	Measurement of strain of cantilever beam for increasing and decreasing load using strain gauge	04
2	III	Speed Measurement of machine shaft using photo magnetic and Electromagnetic pickup.	02
3	V	Flow Measurement through pipe using Rotameter.	04
4	III	Verify Displacement of screw micrometer by inductive transducer (LVDT).	04
5	IV	Calibration of thermometer with Thermocouple.	04
6	IV	Verification of characteristics of the thermistor.	02
7	VI	Verify Force and weight using a load cell.	04
8	VI	Measurement of Liquid Level in tank by using Capacitive Transducer.	02
9	VI	Humidity measurement using sling hygrometer	04
10	I	Verify characteristics of Light Dependant Resistor (LDR)	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Identify different functional elements of any temperature control system
2. Measure speed of lathe spindle, peloton wheel using tachometer.
3. Understand the humidity control in air conditioning system.
4. Understand the water level control in residential apartments.
5. Study the construction and working of weighing bridge.
6. Suggest suitable flow measuring device for municipal water distribution system.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Introduction to recent trends in flow, temperature, force, strain measurement by audio visuals.
2. Arrange a visit to process industry
3. Arrange expert seminar of industry person in the area of measurement and control.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Instrument, Measurement and Analysis 2nd Edition	B. C. Nakra K. K. Chaudhary	TATA McGraw Hill
2	Mechanical Measurement and Instrumentation	A. K. Sawhney	Dhanpatrai and Sons, New Delhi
3	Measurement System	E. O. Doebelin	TATA McGraw Hill
4	Mechanical and Industrial Measurement	R. K. Jain	Khanna Publications New Delhi

B) Software/Learning Websites

1. Audio visual videos for different experiments on You tube

C) Major Equipments/ Instruments with Broad Specifications

1. Experimental set up for measurement of strain
2. Experimental set up for measurement of speed with photo, inductive transducer
3. Experimental set up for measurement of temperature using RTD, Thermostat, Thermocouple
4. Experimental set up for measurement of flow with Rotameter
5. Experimental set up for measurement of humidity with sling hygrometer.
6. Experimental set up for liquid level measurement
7. Experimental set up for measurement of force with load cell
8. Experimental set up for measurement light dependant resistor

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			H				M				
CO3			H					L			
CO4			H								
CO5			H								
CO6			H								

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Power Engineering (PEG) **COURSE CODE** : 6416

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:

I.C. Engines find applications in almost all sectors of industry and in automobiles. Diploma technicians deal with working, testing and maintenance of I.C. Engines. I.C. Engines are one of the major contributors of air pollution. Hence I.C. Engine pollution control plays a vital role in protecting the environment. Use of air compressors is increasing. There is large scope for energy saving in air compressors. Hence it is necessary to understand thermodynamic aspect of air compressor. Gas turbine is used for power generation and for jet propulsion. Diploma engineer should understand the power engineering there is scope for entrepreneurship in this field.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand construction, working of different types of I.C. Engines & their cycle.
2. Understand testing procedure of I.C. Engines and pollutants.
3. Know the I.S. specifications for I.C. Engine.
4. Understand working of gas turbines and jet propulsion.
5. Understand working principles of refrigeration & air conditioning.

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 different types of parts of I.C. engine.
2. Measure different parameters for preparing heat balance sheet and pollutants for petrol/diesel engine.
3. Conduct the trial on I.C. engine for Morse test.
4. List various applications of Gas turbine and jet propulsion.
5. Calculate the COP of refrigerator
6. Calculate the power required and volumetric efficiency of air compressor

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **I. C. Engine**	1a. Draw P-V &T-S diagram for Otto & Diesel cycle. 1b. Classify I.C engine. 1c. Differentiate between two stroke & four stroke petrol engine. 1d. Compare S.I & C.I engine. 1e. Explain detonation & supercharging. 1f. Discuss fuels &	1.1 Power Cycles-Carnot, Otto, Diesel, Dual and Brayton Cycle, representation on P-V, T-S diagram and Simple numerical on Otto cycle only. 1.2 Classification of I.C. Engines**:** Two stroke and four stroke Engines-Construction and working, comparison, valve timing Diagram. 1.3 Brief description of I.C. Engine combustion (SI & CI), scavenging, pre-ignition, detonation, supercharging. Turbo charging, simple Carburettor,	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	lubricant additives used I.C engine.	M.P.F.I., fuel injection pump 1.4 List of fuel, lubricant additives and their advantages.	
Unit-II **I.C Engine Testing and Pollution Control**	2a. Explain mechanical efficiency. 2b. Describe the various parameter for heat balance sheet 2c. Explain Morse test. 2d. Describe exhaust gas analyser. 2e. Explain Bharat & Euro norms.	2.1 Engine Testing-I.P., B.P. Mechanical, Thermal relative and volumetric efficiency, BSFC, Heat Balance sheet. 2.2 Morse Test, Motoring test 2.3 Pollution Control**:** Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, exhaust gas analysis for petrol and diesel engine, Catalytic Converter, Euro standards Bharat stage IV norms.	14
Unit-III **Air Compressor**	3a. Classify Air compressor 3b. Explain construction & working of single stage air compressor. 3c. Explain screw compressor with neat sketch. 3d. Compare reciprocating and rotary compressor. 3e. Describe methods of energy saving in air compressor.	3.1 Introduction 3.2 uses of compressed air ▪ Classification of air compressors ▪ Definition: Compression ratio ▪ Compressor capacity ▪ Free Air Delivered ▪ Swept volume 3.3 Reciprocating air compressor ▪ Construction and working of single stage and two stage compressor ▪ Efficiency: Volumetric, Isothermal & Mechanical (only simple numerical), effect of intercooling, ▪ Advantages of multi staging. 3.4 Rotary Compressor Introduction ▪ Construction and working of screw, lobe, vane, ▪ centrifugal compressors (No numerical) ▪ Comparison and applications of reciprocating and rotary compressors ▪ Applications of Pneumatic Tools, drills, hammer etc. 3.5 Methods of energy saving in air compressors.	12
Unit-IV **Gas turbine and Jet Propulsion**	4a. Classify the gas turbine 4b. Differentiate between closed cycle & open cycle gas turbine. 4c. Describe methods to improve thermal efficiency of gas turbine. 4d. Explain the principle of turbojet. 4e. Describe liquid propellant & its components.	4.1 Classification and applications of gas turbine 4.2 Constant volume and constant pressure gas turbines. • Closed cycle and open cycle gas turbines and their comparison. 4.3 Methods to improve thermal efficiency of gas turbine-Regeneration, inter-cooling, reheating using T-S diagram (no analytical treatment) 4.4 Jet Propulsion • Principles of turbojet, turbo prop, Ram jet 4.5 Rocket propulsion	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		• Solid propellants and liquid propellants, components of liquid propellants rocket engine.	
Unit-V **Refrigeration and Air-Conditioning**	5a. Explain COP of heat pump & refrigerator. 5b. Describe vapour compression refrigeration cycle. 5c. Explain properties of air and show on psychrometric chart. 5d. Describe psychrometric process by using psychrometric chart. 5e. Classify air conditioning systems.	5.1 Introduction ▪ COP of Heat Pump and refrigerator, Tonnes of refrigeration. 5.2 Vapour compression system ▪ Vapour compression refrigeration cycle, components of Vapour Compression Cycle. ▪ Applications-Water cooler Domestic refrigerator, Ice plant & cold storage. 5.3 Psychrometry ▪ Properties of air, psychometric chart & processes: sensible heating and cooling, humidification and dehumidification, heating and humidification, cooling and dehumidification. (No Numerical) 5.4 Air conditioning systems ▪ Definition of Air conditioning and classification of Air conditioning Systems.	12
			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	I.C. Engine	04	08	08	20
II	I.C Engine Testing and Pollution Control	04	04	08	16
III	Air Compressor	06	04	06	16
IV	Gas Turbine and Jet Propulsion	04	08	00	12
V	Refrigeration and Air conditioning	06	06	04	16
	TOTAL	**26**	**22**	**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/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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Dismantling/ assembly of petrol/diesel engine	04
2	II	Trial on single/multicylinder petrol and diesel engine with heat balance sheet.	04
3	II	Prepare a procedure report to conduct Morse Test on Multicylinder Diesel/Petrol engine.	02
4	II	Measurement of I.C. pollutants with the help of Exhaust gas Analyzer for petrol / diesel engine.	02
5	III	Trial on two-stage Reciprocating compressor.	04
6	III	Collection and analysis of manufacturer's catalogue for Reciprocating/Screw compressor	04
7	IV	Visit website-www.nasa.gov and prepare a brief report on gas turbine and jet propulsion.	04
8	V	Trial on Refrigeration Test Rig for calculation of C.O.P, power required, refrigerating effect.	04
9	V	Write a report by identifying the components and tracing the flow of refrigerant through various components in window air conditioner/split a/c.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect technical specification of four stroke petrol/diesel engine for two/four wheeler.
2. Identify various parts of petrol/diesel engine.
3. Operate exhaust gas analyser.
4. Collect technical specification of air compressor.
5. Collect technical specification of refrigerator.
6. Collect technical specification of window/split a/c.
7. Measure C.O.P. of refrigerator.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video clips of working of four stroke petrol /diesel engine.
2. Arrange visit to ST workshop/Automobile industry/garage/service station.
3. Arrange expert lecture of industry expert.
4. Arrange a visit to repairing shop of refrigerator /window/split a/c.

9.0 LEARNING RESOURCES:

A) Text Books:

Sr.No.	Title of Book	Author	Publication
1	Course in Thermal Engineering	V. M. Domkundwar	Dhanpat Rai & Co
2	Thermal Engineering	P.L. Ballaney	Khanna Publishers
3	Text Book of Thermal Engineering	R.S. Khurmi	S. Chand & Co. Ltd
4	Heat Engine Vol.-I and Vol.-II, Vol-III	Patel. Karamchandani	Acharya Publication
5	Automobile Engineering	R. k. Jain	Tata McGraw hill

B) Software/Learning Websites

1. http://crankit/petrol engine/
2. www.britanica.com
3. http://crankit/diesel engine/
4. www.youtube.com/watch.v
5. www.popular mechanics.com//how-air-compressor
6. www.slide share.net//refrigeration-and air conditioning

C) Major Equipments/ Instruments with Broad Specifications

1. Test rig-Diesel engine, Kirloskar make, 7.4KW.
2. Test rig Morse Test, petrol engine, 4 cylinders, 1200 cc.
3. Test rig two stage Air compressor, make-CEC, Coimbatore, 3HP, cap-250 lit/min.
4. Test rig window/split a/c cap-1.5 TOR.

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	M	H	H			M	L				L
CO3	M	H	H	H		L					L
CO4	M	H				L					
CO5	M	H	H								
CO6		H	M								

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Production Processes (PPS) **COURSE CODE** : 6417

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	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

Diploma technician often comes across various types of basic production processes. Quality of these processes and parts depends on parameters aspects such as accuracy of profile, dimension & surface finish controls. These parameters are specified on the product drawing and require suitable machines & cutting tools for its manufacturing. Correct selection of process and its parameters on such machines; plays a vital role in obtaining required quality product at optimum cost. This course will make students familiar with fundamentals of such production processes on various machines like drilling and milling, grinding, gear cutting, super finishing, CNC lathe. And to select, operate and control the appropriate processes for specific applications. Also provide the knowledge of various cutting tools, latest improvements in production processes, surface finishing processes and plastic processes.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the different types of basic production processes.
2. Select, operate and control appropriate processes for specific application.
3. Know about different types of cutting tools used in production processes.
4. Understand the different surface finishing processes.
5. Know latest developments in production processes.

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 working of machine tools like drilling and milling, grinding, gear cutting, CNC lathe along with their applications.
2. Interpret designation system of grinding wheels and cutting tools.
3. State importance of surface finish and related surface finishing methods.
4. Prepare the CNC Program using ISO format for turning operation and test it on CNC machine.
5. Select and apply appropriate heat treatment process for specific application.
6. Prepare the job on CNC lathe as per manufacturing drawing.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basic machine tools-II (Drilling)**	1a. Explain classification, working principles, construction and operation of drilling machines. 1b. Describe mechanism & motion transmission in drilling machines. 1c. Explain work holding devices for drilling machines.	1.1 Drilling machine. i. Introduction ii. Types/ Classification. iii. Working principle (using block diagram). 1.2 Redial drilling machining. i. Constructional features. ii. Kinematics (drive, spindle speeds, feed mechanism,	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		radial movement etc.) constructional sketch, working and use. iii. Detailed specifications. 1.3 Accessories- i. Types, constructional sketch, working and applications. ii. Tool holding and setting methods. iii. Operations performed, deep hole drilling**.** iv. Work holding devices-constructional sketch, working and applications. v. Twist drill nomenclature, Types and forms of drills and Reamers vi. Cutting parameters, machining time calculation.	
Unit-II **Milling and gear manufacturing**	2a. Explain classification, working principles, construction and operation of milling machine. 2b. Describe mechanism & motion transmission in milling machine. 2c. Select appropriate milling cutter for required milling 2d. Calculate number of revolutions of indexing head for given requirements using appropriate indexing method. 2e. Assimilate the Gear manufacturing & finishing processes. 2f. Describe constructional features and working of various gear manufacturing machines. 2g. Select appropriate gear manufacturing machine as per the given situation. 2h. Select gear cutting parameters for given materials and work-piece	**Milling Machine** 2.1 Milling machine. i. Introduction ii. Classification: Basic parts and their functions, column and knee type, Horizontal and plain milling machine, Universal milling machine. 2.2 Size and specifications. 2.3 Types of operations i. e. plain, milling, face milling, T-slot milling, straddle milling, Gang milling, angular milling slitting or saw milling, Helical or spiral milling up milling, down milling. 2.4 Milling cutters-types and applications. 2.5 Dividing head and Indexing methods. i. Indexing-dividing head-constructional sketch, working and use. ii. Simple, differential and compound indexing methods with simple numerical. 2.6 Work holding devices-constructional sketch, working and applications. 2.7 Cutting parameters, machining time calculations.	06
	2i. Explain procedural steps for producing accurate gears using gear milling, gear hobbing and gear	**Gear manufacturing** 2.8 Introduction 2.9 Methods of gear manufacturing i. Gear hobbing-principle of	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	shaping machines.	operation advantages and limitations/disadvantages ii. Gear shaping-principle of operation, advantages and limitations/disadvantages iii. Tool mounting methods on gear milling, gear shaping and gear hobbing machines. iv. Nomenclature and sketch of gear hob and gear shaping cutter. 2.10 Gear finishing process: Gear shaving, Gear grinding, Gear burnishing, Gear lapping.	
Unit-III **Grinding and super finishing process**	3a. Classify grinding machines 3b. Describe constructional features and working of various grinding and super-finishing machines. Gear manufacturing, 3c. Explain Cutting action of grinding wheel. 3d. Define Terms associated with grinding wheel operations including loading, glazing, dressing and truing. 3e. Select grinding wheel. 3f. Maintain grinding wheel for effective grinding. 3g. Select appropriate finishing operation and grinding machine as per production drawing of the component. 3h. Explain Honing, lapping, buffing & super-finishing processes with their applications.	3.1 Introduction 3.2 Classification, Constructional features including coolant and lubrication systems, motion and power transmission path, working, application and cutting parameters of following grinding machines with "commonly used grinding wheels and work piece materials"**:** 3.3 Cylindrical (centre less, internal and external) grinding machines. 3.4 Bench and portable grinder. 3.5 Tool and cutter grinding machine. 3.6 Profile grinding machine. 3.7 Methods of mounting work piece on cylindrical grinding machines (Including chuck and mandrel). 3.8 Cutting action of grinding wheel. 3.9 Terms associated with grinding wheel operations including loading, glazing, dressing and truing. 3.10 Grinding wheels: 3.11 Nomenclature. 3.12 Types and shapes. 3.13 Designation system and its interpretation. 3.14 Selection criteria and applications. 3.15 Static and dynamic balancing of grinding wheels-need and methods. 3.16 Methods of mounting grinding wheel.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		3.17 Super finishing processes i. Honing, lapping, buffing, burnishing and polishing their applications.	
Unit-IV **Plastic Moulding Processes**	4a. Suggest appropriate plastic moulding method suitable for a given non metal industrial component.	4.1 Introduction 4.2 Concept, basic principle, major parts, working and their materials of construction, process parameters and applications of: i. Injection moulding. ii. Blow moulding. iii. Extrusion process. iv. Compression moulding v. Vacuum forming vi. Transfer moulding vii. Calendaring 4.3 Safety precautions.	06
Unit-V **Heat Treatments of metals.**	5a. Suggest appropriate Heat Treatment method suitable for a given metal industrial component.	5.1 Introduction 5.2 Necessity of heat treatments 5.3 Common heat treatment processes Annealing, Normalizing, hardening, tempering applications and selection of these processes. 5.4 Surface hardening methods (Carburizing, induction, flame hardening and their applications.)	06
Unit-VI **CNC Lathe**	6a. Identify CNC Turning Centre Machine Elements & CNC control panel keys and Menu structure. 6b. Start the CNC Machine and Reference it and move the Machine Slides (Axes) in JOG/INC/MPG Modes. 6c. Start Spindle ON/OFF, Coolant On/Off, Tool Changing and do axes positioning in JOG/MDI Modes. 6d. Load Parts in Work holding devices and Tools in tools Turret. 6e. Input/edit Part Programs in the CNC Control and do Graphic Simulation to Verify & Check Part Programs. 6f. Do Machining operations like Turning, Facing, Contour Turning with Roughing/Finish Turning	6.1 **CNC Lathe** i. Introduction to CNC Machine ii. classification, iii. Advantages and disadvantages. iv. positioning system, v. Constructional features of CNC lathe. 6.2 **Part programming**: i. Programming format ii. NC word, statement and block. iii. co-ordinate system (absolute & incremental) iv. Preparatory and miscellaneous codes, (M codes and G codes) 6.3 Fixed cycles in programming-canned cycle, do-loop, threading cycle.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	using Stock Removal Cycles, Sub programming. 6g. Grooving, Thread Cutting, Drilling, Boring and Tapping using Automatic/Memory Modes with block search and Repositioning/Restart procedure.		
		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	Basic machine tools-II : (Drilling)	02	04	06	12
II	Milling and Gear manufacturing	02 04	02 04	04 04	22
III	Grinding (08) and Super finishing process (06)	02 --	02 02	04 04	14
IV	Plastic Molding Processes	02	02	06	10
V	Heat Treatments of metals.	--	02	04	06
VI	CNC Lathe	04	04	08	16
	TOTAL	**16**	**22**	**42**	**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 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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
1	I	**Preparatory activity:-** Calculate revolution per minute (RPM) for drill spindle based on given data. Demonstration of drilling machine and various types of drill forms.	04
2	II	**One composite job on Milling and drilling:** Prepare a job using milling operations including use of indexing head (Including gear tooth cutting). Student will also prepare report including: a. Drawing of the job. b. Operation sequences including details of cutting parameters used. c. Sketch of cutting tools used. d. Specification of machines used. e. Machine settings for indexing. f. Costing of job.	08

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours.
3	I, II & III	**One job** containing surface grinding/cylindrical grinding / tool & cutter grinding for tolerances + 30 microns (for the job already made on milling machine/ preparation of single point cutting tools.) **Kinematics and motion transmission systems:** Demonstrate motion and power transmission path, transmission systems, work mounting systems, tool mounting systems and tool holders/holding systems of cylindrical/surface grinding, tool and cutter grinding, gear hobbing, gear milling, gear shaping and broaching machines. Student will prepare the machine wise report on all machines included here. a. Sketch and label main elements of machine kinematics. b. Demonstrate and explain machining process with position/motion of work piece and tool. Video may also be used. c. Sketch cutting tools with nomenclature. d. Sketch tool holders. e. Explain methods of work and tool mounting systems. f. Tabulate cutting parameters for commonly used tool materials and work piece materials.	10
4	IV	Demonstration & visit to industry.	
5	V	Demonstration & visit to industry.	
6	VI	**One job** Programming on CNC lathe containing operations like, plain turning, taper turning (Group of 2 students.) Demonstration & visit to industry. i. Writing Part program. ii. By using Preparatory and miscellaneous codes, iii. (M codes and G codes), iv. Co-ordinate system (absolute & incremental). v. NC word, statement and block. vi. Programming format. vii. Loading a part program on machine controller. viii. Checking for syntax error. ix. Editing part program. x. Simulation and dry run. xi. Machine zero and work zero setting. xii. Tool offset setting xiii. Machining. Demonstrate various types of CNC controllers and DNC concept.	10
		TOTAL	**32**

Notes:

a. It is compulsory to prepare workshop book of exercises. It is also required to get each exercise recorded in workshop book, checked and duly dated signed by teacher.
b. Student activities are compulsory and are also required to be performed and noted in workshop book.
c. Students are to be continuously assessed for competencies achieved.

Each student is required to submit the following term work.

Sr.No.	Practical task
1	**One job** i. Containing drilling, milling, Gear cutting on milling machine (spur gear) ii. Costing of job.
2	**One job** i. Containing surface grinding/cylindrical grinding for tolerances + 30 microns (for the

Sr.No.	Practical task
	job already made on milling machine.) Or ii. Preparation of single cutting tool on tool and cutter grinder providing various angles on it. iii. Costing of job.
3	**One job** i. Programming on CNC lathe containing operations like, plain turning, taper turning (Group of 2 students.) ii. Costing of job.
4	Assignments on **One assignment** on cutting tool nomenclature and tool signature of single point cutting tool. 4.1. One assignment on multipoint cutting tool i. e milling cutters, broaching tools, drills, 4.2. One assignment on grinding wheels, shapes & types. 4.3. One assignment on accessories and attachments-work holding and tools holding devices used on milling machine. 4.4. One assignment on shapers, planer, boring machine, broaching machine.

Note: Practical examination of all students is to be conducted on simulation software/ virtual CNC machine (CNC lathe)/trainer.

Guidelines for Practical Examination

- An examiner must prepare 6 practical tasks on turning operations. Students can pick up one task /assignment randomly. The students should write part programme, enter into machine, dry run and manufacture the component.
- Evaluation of students based on their contribution in activities like programming, setting of machine and tools, job shall be done by the internal as well as external examiner.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

Sr. No	Student Activity
1	Select two industrial components (approved by teacher) and list various machine tools and operations used to produce these components. Use one component for mini project and presentation.
2	Prepare a list of plastic items which are produced using different types of molding methods. Also name the process used.
3	Collect/download at least four different above machine tool catalogues including at least one plastic, grinding, milling & CNC
4	Collect/download at least one catalogue each of cutting tool, work holding device and tool holder on CNC lathe machine.
5	Identify type of electric motor used in each type of machine tools in your Polytechnic workshop.
6	Identify type of CNC controllers of CNC machines in your Polytechnic workshop.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Sr.No.	Unit	Unit Title	Strategies
1	I	Basic machine tools-II **(Drilling)**	PPT Demonstration. Video clips. Live examples with suitable components. Industrial visits. Show effect of process parameters.
2	II	Milling and Gear manufacturing	
3	III	Grinding and Super finishing process	
4	IV	Plastic Molding Processes	
5	V	Heat Treatments of metals.	
6	VI	CNC Lathe	

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1.	Workshop Technology I & II	J. A. Schey	Tata McGraw Hill Education
2	Workshop Technology-I & II.	Hazra and Chaudhary Media.	promoters & Publisher private limited
3	Workshop Technology-I & II.	W.A. J. Chapman	Taylor & Francis.
4	Manufacturing Processes	M. L. Begman	Wiley India
5	Production Technology	R.K. Jain and S.C. Gupta	Khanna publication
6	Welding Engineering	B.E. Rossi	Jefferson Publications
7	Audles Welding Guide	F.D. Graham	Wiley India
8	Foundry Engineering	P.L. Jain	Tata McGraw Hill Education
9	Principle of Foundry	Jain & Gupta	National Book Trust, India
10	Manufacturing Processes	S.E. Rusinoft	Times of India Press
11	Production Technology	H.H. Marshall	Machinery Publishing Company
12	Workshop Technology-I & II.	B. S. Raghuwanshi	Dhanpat Rai and Sons, New Delhi
13	Workshop Technology	H. S. Bawa	Tata McGraw Hill Publishers, New Delhi
14	Production Technology Hand Book HMT	-	Tata McGraw Hill Publishers, New Delhi

B) Software/Learning Websites

1. http://nptel.ac.in/video.php?subjectId=112105126
2. http://nptel.ac.in/courses.php?disciplineId=112
3. http://nptel.ac.in/courses/112104028/
4. http://nptel.ac.in/courses/112105126/27
5. http://www.youtube.com/watch?v=eUthHS3MTdA (Plastic Injection Moulding)
6. http://www.howstuffworks.com
7. http://www.youtube.com
8. http://www.swansoft.com
9. http://www.cnc.com

C) Major Equipments/ Instruments with Broad Specifications

Sr.No.	Name Of Equipments/ Instruments	Qty
	Machine Shop	
1	Radial drilling machine with standard attachments & accessories.	1
2	Column drilling machine with standard attachments & accessories.	1
3	Bench drilling machine with standard attachments & accessories.	1
4	Required cutting tools i.e. drills.	1 Set Each
5	Milling Machine (Vertical & horizontal) machine with standard attachments & accessories and indexing/ dividing heads.	1 each
6	Required cutting tools i.e. milling cutters.	1 set each
7	Hacksaw machine.	1
8	Shaper, slotter, planner machine with standard attachments & accessories.	1 each
9	Required cutting tools HSS & carbides.	1 set each
10	Polishing and buffing machine	1
11	Cylindrical grinding machine with standard attachments & accessories.	1
12	Surface grinding machine with standard attachments & accessories.	1
13	Tool & cutter grinder with standard attachments & accessories.	1
14	Center Less grinding machine with standard attachments & accessories.	1

Sr.No.	Name Of Equipments/ Instruments	Qty
15	Various types (shapes) of grinding wheels	1 Set
16	Required tool holders	1 Set each
17	CNC lathe machine with standard attachments & accessories.	1
18	CNC simulator software for turning operations 20 users	1
19	CNC simulator hardware with display & control panel	5
20	Virtual CNC turning machine	1
21	CNC tooling	1 set
22	Desktop computers	25

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

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	M	L	L	M			L	L
CO2	M	H	H	L							
CO3			H	H	M	L			L		
CO4		H	H							L	M
CO5		H	H	H						M	M
CO6		H	H	M		M	M				
CO7	H	H	H	H						M	M

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

PROGRAMME : Diploma Programme in Mechanical Engineering(ME)
COURSE : Advance Manufacturing Processes (AMP) **COURSE CODE** : 6418

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	--	50	175
					Min.	32	--	40	10	--	20	--

1.0 RATIONALE:

This is manufacturing technology course which has relevance with the courses taught earlier namely-manufacturing processes and production processes. After getting conversant with the basic manufacturing and production processes, it is necessary for a technician to know about the advancements in the area of manufacturing. The course will impart knowledge and skills necessary for working in modern manufacturing environment.

This course will help the student to get familiarized with working principles and operations performed on non-traditional machines, advance methods of machining, machining center (CNC milling), SPM, automated machines which imparts knowledge, skills and competencies of modern machining tools. Also provide technical knowhow of maintenance practices of machine tools.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know different non-traditional machining processes, CNC milling machines,
2. Understand the working of Special Purpose Machines.
3. Know maintenance practices of machine tools.
4. Know the Operation and control of different advanced machine tools and equipment's.
5. Manufacture jobs as per specified requirements by selecting the specific machining process.
6. Adopt safety practices while working on various machines and shop floor.
7. Develop the mind-set to adopt modern trends in manufacturing and automation.

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 working of Non conventional and advance machining methods with kinematics and stating their applications.
2. Explain need, working principles and applications of special purpose machines and transfer lines.
3. Differentiate automation switches and classify automation systems.
4. Outline the process and prepare a tool layout of a given component as per drawing.
5. Prepare a CNC part programming using ISO format for milling operations and operate CNC milling machine.
6. Select, mount and set cutting tool and tool holder on machine tool.
7. Select and apply appropriate maintenance practices for machine tool.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Non conventional Methods of**	1a. Appreciate use of Non-conventional machining methods.	1.1 Need of nonconventional machining and comparison between conventional & non-conventional machining methods.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
machining	1b. Explain working principles and working parameters of non-conventional machining methods. 1c. Select a non-conventional machine as per requirement 1d. Explain and select appropriate powder metallurgy methods for specific application.	1.2 Classification, working principles, application and working parameters of following non-conventional machining methods: ▪ **Electro discharge machining (EDM):** Principle of working, Setup of EDM, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, Applications e. g. micro hole drilling, curve hole drilling. ▪ **Wire cut EDM**: Principle of working, Setup of WEDM, controlling Parameters, Applications. ▪ **Laser Beam Machining (LBM):** Physical principle of Laser, Laser action in ruby rod, Types of Lasers. Set-up for LBM. Characteristics, controlling Parameters, Applications: Application of Laser Beam for Welding (LBW) ▪ **Other non-traditional machines such as ECM**: Principle of working, Applications. Water jet machining. 1.3 Criterion for selection of non-conventional machining methods. 1.4 Powder metallurgy: Introduction, Process steps, methods of manufacturing powders-blending, compacting mechanical disintegration, atomisation, chemical method electrolytic, decomposition, pre sintering & sintering. Advantages & disadvantages of powder metallurgy. Applications-self lubricating bearings, filters, permanent magnets, cemented carbide (cermets carbides) etc.	08 05 03
Unit-II **CNC milling machines**	2a. Identify CNC Machining Centre Machine Elements. 2b. Know the CNC control panel keys and Menu structure. 2c. Identify axes of CNC machining center. 2d. Start the CNC Machine and Reference it and move the Machine Slides (Axes) in JOG/INC/MPG Modes.	2.1 Vertical and horizontal machining center: Constructional features of VMC, Axis identification. Automatic tool changer and tool magazine. 2.2 Part programming on VMC: ISO G and M codes for milling-meaning and applications of important codes. Use of G41 and G42, 2.3 Machine zero, home position, work piece zero, programme zero. 2.4 Canned cycle and subroutine.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2e. Start Spindle ON/OFF, Coolant On/Off, Tool Changing and do axes positioning in JOG/MDI Modes. 2f. Load Parts in Work holding devices and Tools in tools Magazine/ATC & Spindle. 2g. Develop part programs for given component on milling machine. 2h. Input/edit Part Programs in the CNC Control and do Graphic Simulation to Verify /Check Part Programs. 2i. Do Machining operations like Face Milling, End Milling, Pocket Milling, Drilling, Boring and Tapping using Automatic / Memory Modes with block search and Repositioning/Restart procedure. 2j. Interface software application for auto part programming.	2.5 Importance of Computer Aided Part Programming 2.6 Principles of computer aided part programming 2.7 CAD CAM integration: Concept Steps involved in CAD/CAM integration, CAM software.	
Unit-III **Machine Tool Automation**	3a. Explain classification, working principles, construction and operation automats and Transfer lines. 3b. Differentiate automation switches and systems. 3c. Sketch and describe Programmable Logic Controller.	3.1 Single spindle Automats: ▪ Need. ▪ Constructional features. ▪ Working principle ▪ Applications. 3.2 Introduction to multi spindle automates and special purpose automates. 3.3 Transfer lines. ▪ In line and rotary. 3.4 Automation ▪ Elements of control system, ▪ Limit switches, Proximity switches, ▪ Block diagram for feedback and servo control system, 3.5 PLC ▪ Introduction to PLC, ▪ Block diagram of PLC. ▪ Application	08
Unit-IV **Special Purpose Machines (SPM)**	4a. Explain classification, working principles, construction and operation of capstan lathe, turret lathe automats and Transfer lines.	4.1 Capstan and turret lathe: ▪ Constructional features and working principle. ▪ Functions and applications. ▪ Difference between capstan and turret lathe.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	4b. Outline the tool layout for Capstan & Turret Lathe 4c. Explain construction, Principles of design of SPM. 4d. Describe the productivity improvement by using SPM	▪ Preparation of tool layout. ▪ Merits and demerits. ▪ Turret lathe in comparison with basic centre lathe. ▪ Work holding devices. 4.2 SPM ▪ Concept, ▪ General elements of SPM, ▪ Productivity improvement by SPM, ▪ Principles of SPM design, ▪ Applications of SPM.	
Unit-V **Maintenance of Machine Tools**	5a. Explain different types of maintenance, need and their importance. 5b. Describe repair cycle complexity and analysis. 5c. Plan and schedule the maintenance activities and keep its records. 5d. Discuss the new trends of maintenance i.e. TPM	5.1 Introduction. ▪ Types of maintenance, ▪ Repair cycle analysis, ▪ Repair complexity, ▪ Maintenance manual, Maintenance records, Housekeeping. ▪ Introduction to Total Productive Maintenance (TPM).	06
Unit-VI **Advanced methods of machining**	6a. Describe Micromachining methods and their applications. 6b. Explain additive manufacturing methods, i.e. rapid prototyping working principles, construction, operation and their applications.	6.1 Micro Machining ▪ Introduction. ▪ Definition. ▪ Micro drilling, micro turning, micro milling, micro welding, ▪ Application of micro machining. 6.2 Rapid proto typing. ▪ Process. ▪ Materials. ▪ Applications. ▪ Advantages. ○ Fused Deposition Method (FDM) ○ Stereolithography (SLA) ○ Selective Laser Sintering (SLS & DMLS) ○ 3 D Printing.	06
		TOTAL	**64**

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	**Unit-I** **Non conventional Methods of machining**	--	--	--	26
	i. Electrical discharge Machining (6)	--	02	04	
	ii. Wire cut EDM (4)	--	--	04	
	iii. Laser Beam Machining (LBM) (8)	02	02	04	
	iv. Other non-traditional machines such as ECM (4)	02	02	--	
	v. Powder metallurgy (4)	--	--	04	

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
II	**Unit-II** **CNC milling machines**	04	04	06	14
III	**Unit-III** **Machine Tool Automation**	--	--	--	12
	Automats (4)	--	--	04	
	Automation system (8)	--	02	06	
IV	**Unit-IV** **Special Purpose Machines (SPM)**	02	02	06	10
V	**Unit-V** **Maintenance of Machine Tools**	02	02	02	06
VI	**Unit-VI** **Advanced methods of machining**	--	--	--	12
	Micro machining (4)	02	02	--	
	Rapid Prototyping (8)	02	04	02	
	TOTAL	**16**	**22**	**42**	**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 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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Demonstration, industrial visit.	--
2	II	Two job Programming on CNC milling machine containing operations like, face milling, slotting, Contour machining, Pocket milling-one job (Group of 2 students.) a. Writing Part program by using Preparatory and miscellaneous codes, (M codes and G codes), Co-ordinate system (absolute & incremental), NC word, statement and block, Programming format. b. Loading a part program on machine controller. c. Checking for syntax error. d. Editing part program. e. Simulation and dry run. f. Machine zero and work zero setting. g. Tool offset setting h. Machining. i. Costing of job. Demonstration & visit to industry.	20

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
3	III	Demonstration & visit to industry to observe the automation.	--
4	IV	a. Tool Layout b. Prepare a tool lay-out of a given component for capstan and turret lathe c. Demonstration & visit to industry.	04
5	V	a. Report on Dismantling, assembly and maintenance practice of simple machine element of following (any One) 1. Bearing and coupling 2. Shaft and pulley 3. Lathe Chuck and Tailstock on lathe 4. Tapping attachment on drilling machine b. Report on mounting and Dismounting procedure of following (any one)- 1. Milling machine arbour, 2. Vertical milling head 3. iii. Tool post	08
6	VI	Demonstration & visit to industry.	--
		TOTAL	**32**

Notes:

a. It is compulsory to prepare workshop book of exercises. It is also required to get each exercise recorded in workshop book, checked and duly dated signed by teacher.
b. Student activities are compulsory and are also required to be performed and noted in workshop book.
c. Students are to be continuously assessed for competencies achieved.

Each student is required to submit the following term work

Sr.No.	Practical task
1	**Two job** 1a. Job on CNC milling contains face milling, slotting, Contour machining, Pocket milling. Group of two students-one job 1b. One job on simulator and one job on machine. 1c. Costing of job.
2	Assignments on 2a. One assignment on USM, CHM, EBM, AJM, WJM, PAM. 2b. Report on the tools, fixtures and cams used on automats observed during industrial visit. 2c. Report on mounting and Dismounting procedure of following (any two)-(a)Milling machine arbor, (b) Vertical milling head (c) Tool post. 2d. Assignment on micromachining processes. 2e. Assignment on rapid prototyping.

Note: Practical examination of all students is to be conduct on simulation software/ virtual CNC machine (CNC milling)/trainer.

Guidelines for Practical Examination

An examiner must prepare 6 practical tasks on milling operations. Students can pick up **one** task /assignment randomly. The students should write part programme, enter into machine, dry run and manufacture the component.

Evaluation of students based on their contribution in activities like programming, setting of machine and tools, job shall be done by the internal as well as external examiner.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Download free simulation software and check part programme on it.
2. Visit or participate in the technical events, exhibition, conference, seminar etc.
3. Collect/download at least four different machine tool catalogues including at least one special purpose, Automat, non-conventional, CNC machine or advance machine i.e. prototyping machine, micro machining.
4. Collect/download at least one catalogue each of cutting tool, work holding device and tool holder on CNC milling machine.
5. Collect/Down load information of various CNC manufacturing software's CAD CAM software and write report on their features.
6. Identify type of CNC controllers of CNC machines in your Polytechnic workshop.
7. Prepare a report on maintenance practices of CNC machines. It should include types of CNC machine tools maintenance, Tools required, Daily checklist, Problems related to mechanical systems, Backlash, Causes and precautions of electronics system.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Sr.No.	Unit	Unit Title	Strategies
1	I	Non conventional Methods of machining	PPT Demonstration. Video clips. Live examples with suitable components. Industrial visits. Show effect of process parameters.
2	II	CNC milling machines	
3	III	Machine Tool Automation	
4	IV	Special Purpose Machines (SPM)	
5	V	Maintenance of Machine Tools	
6	VI	Advanced methods of machining	

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1.	Manufacturing Science	Amitabh Ghosh, Mallik	East-West Press Pvt. Ltd.
2	Production Technology	HMT, Banglore	Tata McGraw Hill
3	CNC machines	Pabla B. S. M. Adithan	New Age int. limited.
4	Industrial maintenance	H. P. Garg	S. Chand & Co. Ltd.
5	Non-conventional Machining	P. K. Mistra	Narvasa Publishing House
6	Maintenance Engineering Handbook	Lindley R. Higgins	McGraw Hill
7	Manufacturing Processes	Begman, Amsted	John Willey and Sons.
8	Fundamental of metal cutting and machine tools	B. L. Juneja	New age international limited.
9	Technology of Machine Tools.	Steve Krar, Albert Check	McGraw-Hill International.
10	CAD/CAM Principles and Applications	P. N. Rao	Tata McGraw-Hill
11	Manufacturing Technology Metal Cutting & Machine tools	P. N. Rao	Tata McGraw-Hill
12	Workshop Technology	Hajara Chaudhari	Dhanpat Rai
13	Production Technology	R. K. Jain	Khanna Publication
14	Hand book of machine Tool's	H. M. T.	H. M. T.
15	Workshop Technology Vol. II	H. S. Bava	Tata McGraw-Hill
16	CNC Programming Hand Book	Peter Smid	Industrial Press, Inc. New York
17	Micromachining	V. K Jain	Allied publisher
18	Manufacturing technology	Kalpak Jain	-
19	Computer Numerical Control	Quesada, Robert	PHI Learning, New

Sr.No.	Title of Book	Author	Publication
	turning and machining centers		Delhi.
20	Computer Aided Manufacturing	Rao P.N. Tiwari, N.K. Kundra T	Tata McGraw Hill, New Delhi.

B) Software/Learning Websites

1. http://nptel.ac.in/video.php?subjectId=112105126
2. http://nptel.ac.in/courses.php?disciplineId=112
3. http://nptel.ac.in/courses/name
4. http://nptel.ac.in/courses/lecture
5. http://www.howstuffworks.com
6. http://www.youtube.com
7. http://www.swansoft.com
8. http://www.cnc.com
9. http://www. nonconvationalmachiningmethods.com
10. http://www.iid.ac.in/
11. http://www.nptl/CSE/web/112107077/models/
12. http://www.stratasys.com.in
13. http://www.3Dprinting.com
14. http://www.//en.wikipedia.org/wiki/fuseddepositionmodel
15. http://www.additively.com
16. http://www.livescience.com
17. http://www.zcorp.com
18. www.mastercam.com
19. www.mtabindia.com
20. www.swansoftcncsimulator.com
21. www.cncsimulator.info

C) Major Equipments/ Instruments with Broad Specifications

Sr. No	Name Of Equipments/ Instruments	Qty
	Machine Shop	
1	Electro Discharge machine with standard attachments & accessories.	1
2	Turret and Capstan lathe machine with standard attachments & accessories.	1
3	Automat with standard attachments & accessories.	1
4	Required cutting tools HSS	1 Set Each
5	CNC Milling Machine with standard attachments & accessories (Trainer / Production)	1
6	Required CNC cutting tools i.e. CNC milling cutters.	1 set each
7	Hacksaw machine.	1
8	Required Measuring and Setting tools.	1 set each
9	Required tool holders	LS
10	CNC simulator software for milling operations 20 users	1
11	CNC simulator hardware with display & control panel	5
12	Virtual CNC Milling machine	1
13	Desktop computers	25
14	CNC technology teach ware	1 set
15	LCD projector with screen	1 set

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

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							
CO2	M	H	H								
CO3	M		H		L		M	M			
CO4	H	H	H							L	M
CO5	M	H	H	M							
CO6	M	H	H	M	M	L					

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Industrial Hydraulics and Pneumatics (IHP) **COURSE CODE :** 6512

TEACHING & 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:

Oil Hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids. Diploma engineers come across such systems in all segments of industries. Hence the course will give the students basic skills and knowledge, which will be directly needed in the industrial environment.

2.0 COURSE OBJECTIVES:-

The student will be able to

1. Understand different hydraulic & pneumatic systems component.
2. Understand working of hydraulic & pneumatic systems.
3. Understand and interpret hydraulic & pneumatic systems.
4. Understand working hydraulic and pneumatic systems.
5. Understand faults of hydraulic and pneumatic systems.

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 properties of oil
2. Identify and draw symbol of hydraulic & pneumatic components.
3. Select hydraulic & pneumatic components.
4. Draw hydraulic & pneumatic components.
5. Interpret hydraulic & pneumatic circuits.
6. Draw hydraulic & pneumatic system for particular application.
7. Identify faults and suggest remedial action.

4.0 COURSE DETAILS:-

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of hydraulic and Pneumatic systems**	1a. Identify components 1b. list components 1c. Draw layout of components	1.1 General layout, applications, merits and limitations of hydraulic and Pneumatic systems 1.2 Essential Properties of oils	06
Unit-II **Oil Hydraulic system components**	2.a. Identify Pumps, valves, Actuators 2.b. State functions of Pumps, valves**,** Actuators	2.1 **Pumps**-Construction, working, symbol and applications of vane, gear, gerotor, screw and piston pump	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2.c. Draw sketch of Pumps, valves**,** Actuators 2.d. Describe Hydraulic system components 2.e. Compare components of Hydraulic system	2.2 **Valves**-Construction, working, symbols and applications of ▪ Direction control**-**Poppet and spool type, check valve, 3/2, 4/2, 4/3, 5/2, 5/3, standard centre position, method of actuation (lever, push button, cam, solenoid and Pilot), rotary spool ▪ Pressure control-relief, reducing, sequence, counterbalance, unloading ▪ Flow control-pressure and temperature compensated and non compensated ▪ Servo valves, Modular valves, Cartridge valves 2.3 **Actuators**-Construction, working, symbols and applications ▪ rotary actuators-hydraulic motors ▪ Linear actuators-cylinders-single acting and double acting and their subtypes, different mounting methods 2.4 **Accessories-**Construction, working and symbols of Oils and filters, accumulators, cooler/ heat exchangers, pipes, tubes, hoses, seals and gaskets	06 06 04
Unit-III **Oil Hydraulic circuits**	3a. Select components 3b. Draw circuit with components 3c. Develop hydraulic circuit for machine 3d. Compare different hydraulic circuit for machine.	3.1 **Simple circuits**-Direct/Indirect triggering of SA and DA cylinders, Sequencing circuit, counterbalance, meter in, meter out, bleed off, regenerative, synchronising 3.2 **Industrial circuits**-shaper, drilling, grinding, milling two pump unloading, time dependant reversals, piston continuous back and forth.	08
Unit-IV **Pneumatic system Components**	4a. Identify valves**,** actuators and accessories 4b. State functions of**,** valves**,** Actuators, accessories	4.1 **Valves-**Construction, working, symbols and applications of pressure control valves, Direction control valves, Flow control valves	06
	4c. Draw sketch**,** valves**,** Actuators and Accessories 4d. Describe Hydraulic system components	4.2 **Actuators-**Construction, working, symbols and applications of rotary and linear actuators	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	4e. Compare components of Pneumatic system	4.3 **Accessories**-Construction, working, symbols and applications of Pipes, Hoses, Fittings, FRL unit	04
Unit-V **Pneumatic circuits**	5a. Select components 5b. Draw circuits with components 5c. Develop Pneumatic circuits for machine 5d. Compare different Pneumatic circuit for machine.	5.1 Speed control circuit for single acting, double acting cylinders and air motors 5.2 Sequencing circuits-position based and time delay circuit 5.3 Two hand control, logic AND OR circuit	08
Unit-VI **Hydropneumatics**	6a. Understand Hydropneumatics 6b. Compare Hydropneumatics 6c. Explain Hydropneumatics	6.1 applications, merits and limitations of hydropneumatic systems 6.2 Types of Hydropneumatic systems 6.3 Comparison of Hydropneumatic, hydraulic and Pneumatic system	06
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS

Unit	Unit Title	Distribution of Theory Marks			
		Remembrance (Knowledge)	**Understanding (Comprehension)**	**Application**	**Total**
I	Basics of hydraulic and Pneumatic systems	06	06	--	12
II	Oil Hydraulic system components	06	--	08	14
III	Oil Hydraulic circuits	02	06	10	18
IV	Pneumatic system Components	04	08	06	18
V	Pneumatic circuits	04	04	02	10
VI	Hydropneumatics	04	02	02	08
	TOTAL	**26**	**26**	**28**	**80**

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.*

S. No.	Unit No.	Exercises	Approx. Hrs. Required
1	All	Drawing of various ISO symbols used in hydraulic and pneumatic system components.	04
2	III	Assemble meter in, meter out circuit and sequencing circuit. Describe and compare circuits.	04
3	III	Observe any one stationary hydraulic system, like in any machine/ machine tool. Draw circuit diagram.(write a report)	04
4	V	Assemble pneumatic circuit for speed control of double acting cylinders/air motors.	04
5	VI	Demonstration of hydro pneumatic circuit. Draw circuits.	04
6	II & V	Select components for given applications. (hydraulic and pneumatic circuits-one each)	04
7	V	Fault finding and taking remedial/corrective action for hydraulic/pneumatic system.	04
8	III	Observe any one mobile hydraulic system like in earth moving equipments. Identify components (write a report)	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1 Survey of oil used for hydraulic systems-specifications, manufacturer's names, costs, packing sizes etc.
2 Survey of air filters and oil filters used in hydraulic and pneumatic systems.
3 Prepare cutout/model/chart of pumps and motors. (any one)
4 Prepare cutout/model/chart of pressure, direction and flow control valves.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange expert lecture on automation of hydraulic pneumatic system
2. Arrange industrial visit

9.0 LEARNING RESOURCES:

A) Reference Books:

Sr.No.	Title of Book	Author	Publication
1	Hydraulics & Pneumatics	Andrew Parr	Jaico Publication house
2	Pneumatic system-Principle and maintenance	Majumdar S R	Tata McGraw HILL
3	Oil Hydraulic system-Principle and maintenance	Majumdar S. R	Tata McGraw HILL
4	Industrial Hydraulics manual	Vickers Perry	
5	Maintenance engineering handbook	L. R. Higgins	Tata McGraw HILL
6	Hydraulics and Pneumatics	Stewart	Tata McGraw HILL
7	Industrial Hydraulics	John Pippenger Tyler Hicks	Tata McGraw HILL
8	Industrial Hydraulics	D. D. Bank & D. S. Bank	Himalaya

B) Software/Learning Websites

1. H-simulator, P-simulator, Hydraulics, hydro motion, pneumomotion
2. **CD's:** CDs developed by various system components' manufacturers.
3. Manufacturers catalogue

C) Major Equipments/ Instruments with Broad Specifications

1. Pneumatic Trainer
2. Hydraulic Trainer
3. Cut section, transparent models of Hydraulic and Pneumatic system components.

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

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

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Automobile Engineering (AEG) **COURSE CODE :** 6513

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:

Diploma engineer may have to work in Automobile industry, garage, as a vehicle inspector in RTO. Diploma engineer must know the maintenance work of automobile, parts of automobile, pollution control of automobiles & how automobile works.

This course imparts knowledge of maintenance work of automobile, parts of automobile, pollution control of automobiles & how automobile works.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know the different parts of automobile.
2. Understand the different system components of automobile with their functions.
3. Know steering system with its components.
4. Understand the braking system of automobiles.
5. Compare and select the automobile vehicles based on their features.

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 parts of automobiles.
2. Identify different automobile system components with their functions.
3. Identify different components of steering system, braking system.
4. Locate the suspension system, transmission system components.
5. Identify various components of air conditioning system in vehicle.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to Automobiles.**	1a. Draw vehicle layouts. 1b. Draw chassis layouts. 1c. Explain the concept of aerodynamic shape of vehicle.	1.1 Classification of automobile vehicles, Two and four wheeler chassis layout of an automobile vehicle, Layout of vehicle such as front engine rear wheel drive, front engine front wheel drive, rear engine rear wheel drive, four wheels drive etc. their advantages, comparisons. 1.2 Types of chassis-frame, frameless, unitary (combination of frame & frameless) construction, Chassis layout, Forces acting on chassis, Functions of chassis. 1.3 Body construction-Types of bodies, functions of body, Aerodynamic Shape of car body & advantages.	10
Unit-II	2a. Describe transmission	2.1 Need and Requirements of	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Transmission system	system of automobiles and their components. 2b. Explain construction and working of gear box.	transmission system. Its components and their functions. 2.2 **Clutch**: Function and purpose of clutch, types and construction of clutches such as single plate and multiplate type. Faults & remedies in clutch. 2.3 **Gear box**-Constant mesh and synchromesh gear box with their construction and operation. 2.4 **Propeller shaft-**construction and functions. 2.5 **Differential-**need, construction and working, differential action and operation 2.6 **Axle-**Hotchkiss and torque tube drives, Rear axle-full floating axle, semi-floating and three quarter floating axle. Front axle.	
Unit-III **Control Systems**	3a. Explain different components of steering system. 3b. Describe steering geometry and requirements. 3c. Explain Braking system of automobiles. 3d. Differentiate between disc brakes and drum brakes.	3.1 **Steering System** ▪ Purpose of steering system, functions & types of steering system. ▪ Construction and working of- recirculating ball type and rack and pinion type. ▪ Wheel Geometry-caster, camber, king pin inclination, Toe In and Toe Out. ▪ Power steering (introductory). 3.2 **Braking System** ▪ Need of braking system, types of automotive braking systems for four wheels vehicles- mechanical, hydraulic and air operated. ▪ Hydraulic braking systems: Layout & components of hydraulic braking Systems. ▪ Construction and working of master cylinder and wheel cylinder, Tandem cylinder. ▪ Drum braking system, Disc Braking Systems ▪ Air braking system: layout and working.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-IV **Suspension System, wheel and tyres**	4a. Explain necessity of suspension system. 4b. Describe components of suspension system. 4c. Explain different types of wheels & tyres.	4.1 **Suspension System** ▪ Necessity and Classification of Suspension System ▪ Front and rear suspension system construction and working of Wishbone type, Mac Pherson type, Trailing link type, coiled springs, leaf spring and shock absorbers, air suspension system. 4.2 **Wheels and Tyres:** ▪ Types of wheel-spoked, disc, light alloy cast. ▪ Types of rims. ▪ Tyres-Desirable properties, types-redial ply, cross ply, tubeless. Factors affecting tyre life.	12
Unit-V **Electrical Systems**	5a. Describe battery constructional details with sketch. 5b. Explain charging system. 5c. Explain starting system.	5.1 **Battery:** ▪ Automotive battery construction and operation, battery capacity, Battery ratings, Battery tests. ▪ Charging System**:** Need of charging system, Construction and operation of charging system, Dynamo, Alternator principle, construction and working 5.2 **Starting System:** ▪ Need of starting system layout, Bendix and solenoid drive 5.3 **Ignition System and their Components:** ▪ Battery, magneto, electronic ignition system.	08
Unit-VI **Automobile Air conditioning System.**	6a. Explain concept of air conditioning system. 6b. Describe the various parameters of air-conditioning. 6c. Identify various components of air conditioning systems in a vehicle	6.1 Locate various components of air conditioning systems in a vehicle. 6.2 Introduction, layout of car air conditioning system, components of a system, working of a system, parameter control (Humidity, temperature, purity of air) required. 6.3 Important precautions while using AC system.	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	Introduction to Automobiles	04	04	04	12
II	Transmission system	04	06	08	18
III	Control Systems	04	06	06	16
IV	Suspension System, wheel and tyres	04	08	04	16

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
V	Electrical Systems	04	04	04	12
VI	Automobile Air conditioning System	02	04	--	06
	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/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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Demonstration of all parts of automobile (4 wheeler)	02
2	II	Dismantle and assemble synchromesh gear box or constant mesh gear box.	04
3	II	Demonstration of Differential of automobile.	02
4	III	Demonstration of steering system by dismantling necessary parts.	04
5	III	Dismantle brake system and observe various components of it. Write function of important components.	04
6	IV	Demonstration of leaf spring, torsion bar, dependent & independent suspension.	04
7	V	Inspection of battery like Ah rating, type of battery, no. of cells, vents, charge status by using hydrometer and voltmeter.	04
8	V	Demonstrate battery and magneto ignition system.	04
9	VI	Demonstration of car air-conditioning system.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect information about Automobile manufacturers in India-Two or four wheeler vehicles.
2. Collect and interpret technical specification of automobiles from market and internet.
3. Locate and identify different components of various systems of automobiles.
4. Observe the chassis of following vehicle like LCV or HCV or jeep. Draw and describe various components mounted on it.
5. Visit to automobile service centre and observe various systems.
6. Collect information about advance systems in automobiles like ABS, Safety Air Bag etc.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to automobile service centre.
2. Arrange a visit to automobile manufacturing company.
3. Arrange expert seminar of industry person in the area of resent developments in automobiles.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Automobile Engineering	William Crouse	Tata-McGraw Hill
2	Automobile Engineering	Dr. Kirpal Singh vol. I & II	Standard Publishers
3	Automobile Engineering	H. M. Sethi	Tata-McGraw Hill
4	Automotive Mechanics	S Shrinivasan	Tata-McGraw Hill
5	Automobile Engineering	T. R. Banga, Nathu Singh	Khanna publishers

B) Software/Learning Websites

1. www.tatamotors.com
2. www.marutisuzuki.com
3. www.auto.howstuffworks.com
4. You tube videos for automobile systems

C) Major Equipments/ Instruments with Broad Specifications

1. Chassis of four wheeler automobile.
2. Using model/charts/PPTs/ video clips for automobile systems and components.

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			M			
CO2			M						M		L
CO3				H					M		
CO4		H								H	M
CO5				H		M					M

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Industrial Engineering (IEN) **COURSE CODE** : 6514

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 industry at various levels and mostly on shop level. While delivering duty on shop level as a supervisor, one has to perform management functions. One must have knowledge of management and its various functions, scientific management. Also, he must know work-study techniques, CPM and PERT for better delivery of his / her duty. One must acquire smartness required for moving up in organization. This course is introduced for imparting such qualities in diploma engineer.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the concept and role of industrial engineering in industry.
2. Understand the concept of work study and role of it in improving the productivity.
3. Understand technique of method study.
4. Apply technique of work measurement.
5. Understand the concept of value engineering.
6. Know the plant layout and material handling system.

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 work study tool to improve the productivity in industry.
2. Draw the various charts, diagrams etc. to improve the methods.
3. Calculate the standard time for real time process.
4. Apply the value engineering for product design.
5. Design the factory layout for given application.
6. Select the proper material handling equipment for particular operation.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (In cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Concept of Industrial Engineering**	1a. Describe history and development of IE dept. 1b. Explain role of industrial engineer in industry. 1c. Explain future of industrial engineering.	1.1 History and development of Industrial Engineering. 1.2 Roles of Industrial Engineer. Application of Industrial Engineering. 1.3 Future of Industrial Engineering. 1.4 Production management, difference between production management and industrial engineering	04
Unit-II **Work Study**	2a. Explain the objective and basic steps of work study. 2b. Differentiate between production	2.1 Definition, Importance and Advantages of work-study. 2.2 Objectives and basic steps of work study. 2.3 Productivity, productivity and	08

Unit	Major Learning Outcomes (In cognitive domain)	Topics and Sub-topics	Hours
	and productivity. 2c. Describe role of government and employers to increase productivity. 2d. Relate the productivity with work study, standard of living, management and workers.	Production, importance of productivity, means of increasing productivity, productivity improvement procedure, roles of government, employers and workers in productivity improvement. 2.4 Relationship of productivity with work study, standard of living, management and workers.	
Unit-III **Method Study**	3a. Explain the concept of method study. 3b. Describe basic procedure and steps for method study. 3c. Describe various recording techniques for method study. 3d. Explain various charts and diagrams for method study. 3e. Explain micro motion study. 3f. Describe principles of motion economy. 3g. Describe the procedure for develop, install and maintain improved method.	3.1 Definition, objectives, advantages and limitations of method study. 3.2 Pre-requisite, basic procedure and steps of method study. 3.3 Economic, technical, human consideration for selection of work. 3.4 Various recording techniques and their objectives. (Various charts, diagrams etc. with examples). 3.5 Critical examination (Primary, secondary and final questions). 3.6 Micro-motion study, its purpose, procedure and equipments, Therbligs, 3.7 SIMO chart, Cyclograph, Chrono-cyclograph, their advantages and limitations. 3.8 Principles of motion economy: Use of human body, Arrangement of work place and Design of tools and equipments. 3.9 Develop the improved method, obtaining approval, defining and installing the improved method, Training and retraining operatives, maintaining improved method.	08
Unit-IV **Time study (work measurement)**	4a. Define work measurement. 4b. Explain procedure of work measurement. 4c. Describe equipments used for time study. 4d. Describe steps for time study. 4e. Explain qualified worker, rating and different allowances. 4f. Describe the procedure to measure standard time.	4.1 Definition, objectives/ uses, basic procedure and equipments of time study. 4.2 Selection of work/job for time study. 4.3 Selection of workers for time study, Qualified workers 4.4 Steps in making time study, recording information, methods of timing. 4.5 Concept of performance rating, necessity of performance rating. 4.6 Various allowances. 4.7 Standard time computation (numericals). 4.8 Work sampling, Predetermined Motion Time and System (PMTS), Method time measurement (MTM)	08
Unit-V	5a. Explain the concept of value	5.1 Introduction, concept, definition of value engineering, types of values.	08

Unit	Major Learning Outcomes (In cognitive domain)	Topics and Sub-topics	Hours
Value Engineering and Maintenance Engineering	Engineering. 5b. Describe objectives of value analysis 5c. Describe the various types of maintenance. 5d. Explain the concept of TPM	5.2 Aim/objectives, procedure of value analysis, difference between value analysis and value engineering, when to apply value analysis. 5.3 Techniques, tests and advantages of value analysis /engineering, Resistance of change. 5.4 Introduction to maintenance engineering, types of maintenance: Scheduled, Preventive, breakdown maintenance. Introduction of TPM, Pillars of TPM	
Unit-VI **Factory layout and material handling**	6a. Describe various types of layout. 6b. Explain principles of designing plant layout. 6c. Describe materials handling equipments and their applications.	6.1 Concept, objectives, importance of plant layout, factors influencing plant layout, principles of designing plant layout. 6.2 Types of plant layouts, advantages, limitations and applications, symptoms of bad layout. 6.3 Functions and Principles of material handling, factors to be considered in material handling. 6.4 Material handling equipments and their applications. Relationship between plant layout and material handling, procedure for improving the material handling system.	06
Unit-VII **Production Planning and Control**	7a. Describe the function and objectives of PPC. 7b. Explain the steps in PPC 7c. Explain the techniques of sales forecasting. 7d. Explain the concept of line of balance	7.1 Functions and objectives of Production Planning and Control, 7.2 Steps of Production Planning and Control: Process planning, Loading, Scheduling, Dispatching and Expediting with illustrative examples, 7.3 Sales forecasting: Techniques and Applications. 7.4 Introduction to line of balance, assembly line balancing and progress control.	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	Concept of Industrial engineering	04	02	02	08
II	Work Study	04	04	04	12
III	Method Study	04	04	04	12
IV	Time study (work measurement)	02	08	04	14
V	Value Engineering and Maintenance Engineering	06	04	04	14
VI	Factory layout and material handling	02	04	04	10
VII	Production Planning and Control	02	04	04	10
	TOTAL	**24**	**30**	**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:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect different equipments and tools, for method study.
2. Measure standard time for given task.
3. Collect the Preventive Maintenance schedule of any one machine in industry.
4. Prepare a value analysis report for reducing the price of motorcycle in past ten years.
5. Collect the information of various material handling equipments.
6. Collect the video clips of various material handling equipments
7. Draw the outline process chart, flow process chart, string diagram etc. for any manufacturing process.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video clips on topic industrial engineering department.
2. Arrange a visit to Industrial Engineering department of nearby industry.
3. Arrange expert seminar of industry person in the area of industrial Engineering.
4. Show the video clips on various material handling equipments.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering and Production Management	M. Mahajan	Dhanpat Rai and Sons
3	Personnel Management	Arun Monnappa and Mirza	Tata McGraw Hill
4	Essentials of Management	Harold and L koontz	McGraw Hill, New York
5	Work Study	ILO	McGraw Hill, New York
6	Operation management	S. D. Sharma	Dhanpat Rai & Sons
7	Industrial engineering and management science	Banga and Sharma	Khanna

B) Software/Learning Websites

1. www.iiie-india.com
2. www.nitie.edu
3. www.iienet2.org
4. www.siue.edu/ENGINEERING/IE/index.html

C) Major Equipments/ Instruments with Broad Specifications

1. Equipments required for times study: Board, Watch, wink counter, video camera, pencil etc.

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	
CO2		H	M	H						M	
CO3		M	H	H						H	
CO4		L	H	H						M	H
CO5	M	M	M	L							
CO6		L	M	H						H	

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Power Plant Engineering (PPE) **COURSE CODE** : 6515

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:

The consumption of electrical energy per capita is universally accepted as a scale for measuring the living standard of a country. The demand for energy is increasing day by day and existing power generation capacity is inadequate to meet this increasing demand. Industries are expected to generate their own power and supply the excess power to national grid. Alternate energy sources are also harnessed to meet the increasing demand. Diploma engineers should know the layout, components of different power plants and economic aspects of power plants.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand different types of Power Plants and site selection criteria.
2. Understand the Thermal Power Plant Operation, turbine governing, types of high pressure boilers, Fluidized bed combustion systems.
3. Understand the Design of chimney in thermal power plants, cooling tower operation.
4. Know the different types of Nuclear power plants including Pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
5. Understand Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Understand the different types environmental and safety aspects of power plant operation.

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. Write the energy resources and energy conversion methods available for the production of electric power.
2. Calculate the efficiency and output of a modern Rankin cycle steam power plant from given data, including superheat, reheat, regeneration and irreversibility.
3. Calculate the heat rate, fan power consumption, flame temperature and combustion air requirements of conventional steam generators (boilers).
4. Calculate the performance of gas turbines.
5. Explain the major types of hydro-power and wind-power turbines and estimate power generation potential.
6. Explain the basic principles of thermal-fission and fast-breeder nuclear power plants, such as pressurized-water, boiling-water and heavy-water reactors.
7. Write the control methods of major pollutants emitted from fossil-fuel power plants.
8. Explain the environmental impact of electric power production on air quality, climate change, water and land.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to power plant**	1a. Explain the different power sources, world energy scenario. 1b. Draw the PV & TS diagram for various thermal cycles. 1c. Explain the criteria for sites selection of power plants	1.1 Power scenario in India 1.2 Types of power plants-Hydro, Nuclear, Thermal and Future Trends in power sector. 1.3 Analysis of steam cycles-Carnot, Rankin, Reheat cycle, Regenerative cycle, Methods of reheating, Advantages and Disadvantages of reheat cycle. 1.4 Gas turbine cycle 1.5 Criteria for sites selection of power plants	10
Unit-II **Steam power plant**	2a. Explain the steam power plant and its components. 2b. Draw the layout of steam power plant. 2c. Compare Sub-Critical and Super-critical boilers. 2d. Explain environmental aspects of steam power plant.	2.1 Layout of steam power plant, general features of selection of site 2.2 High pressure boilers-Construction and working of Sub-Critical and Super-critical boilers. 2.3 Coal and ash handling system-equipment's for in plant handling of coal such as belt conveyor, screw conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and Pneumatic ash handling, Electrostatic precipitator. 2.4 Boiler Feed water treatment 2.5 Environmental aspects of steam power plant-water pollution, air pollution, emission standard and its control	12
Unit-III **Nuclear power plant**	3a. Explain the natural resources and the techniques of fission reaction, in power production. 3b. Write the hazards of nuclear power plant. 3c. Explain the safety precautions in nuclear power plant.	3.1 Fusion and fission reaction, 3.2 Elements of nuclear power station, layout, types of nuclear Reactors. 3.3 Nuclear fuels, coolant & moderators. 3.4 Working of PWR, BWR, CANDU, BREEDER type reactor. 3.5 Safety precautions and waste disposals.	12
Unit-IV **Gas turbine power plant**	4a. Explain the importance of Gas turbine power plant 4b. Compare Gas turbine power to Steam power plant. 4c. Explain the gas turbine energy power generation technology.	4.1 General Layout, Gas turbine power plants in India. 4.2 Components of gas turbine plants, gas turbine Fuels. 4.3 Comparison of Gas turbine plant with diesel and Steam power plant. 4.4 Environmental impact of gas turbine power plant.	08
Unit-V **Non-conventional**	5a. Explain the importance of hydel power plant 5b. Explain the low cost	5.1 Geothermal power plant-types, economical justification 5.2 Tidal power plant-factors affecting suitability of site, working of different	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
power generation plants	power production segment. 5c. Differentiate between Non-conventional power plant and conventional power plant.	tidal power plants, advantages and disadvantages 5.3 Wind power plant-different types, advantages and Disadvantages. 5.4 Solar power plant, PV, solar thermal CSP. 5.5 Magneto Hydro dynamics power plant 5.6 Small hydro power plant 5.7 Introduction to Plasma technology	
Unit-VI **Economics and operational aspects**	6a. Explain economical and operational aspects of power plants. 6b. Explain the elements used to control the cost of power plant.	6.1 Prediction of load, selection of types of generation, number of generating units. 6.2 Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical) 6.3 Major electrical equipment's in power station-generator, step-up transformer, switch gear, electrical motors.	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	Introduction to power plant	04	04	02	10
II	Steam power plant	06	06	04	16
III	Nuclear power plant	06	06	04	16
IV	Gas turbine power plant	04	04	02	10
V	Non-conventional power generation plants	04	04	04	12
VI	Economics and operational aspects	04	04	08	16
	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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1.	II, III	Visit to steam power plants/nuclear power plants & prepare a report.	05
2.	III	Collect information & Technical details of nuclear power plants.	04
3.	II	Collect information & Technical details of Steam power plants.	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
4.	V	Collect information & Technical details of Solar & Wind power plants.	05
5.	VI	Study of economic and operational aspects of power plants (simple numerical).	05
6.	VI	Assignment on Coal & Ash Handling system.	02
7.	VI	Assignment on Waste Heat recovery systems.	02
8.	V	Visit to solar power plant/ Hydro power plant/ wind power Plants & prepare a report.	05
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the detail information of different types of power plant from internet search situated in Maharashtra as well as India.
2. Collect the detail information of any power plant situated nearby your institute.
3. List out general methods of energy saving at home as well as in city.
4. Arrange a programme for awareness of energy saving in the society.
5. Carry out the energy audit of home/institute.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to National Power Training Institute, South Ambazari Road, Nagpur for advance knowledge in Power Plant Familiarization. To study following topics:
   a. Ash Handling System.
   b. Gas Turbine and combined cycle power plant.
   c. Power Station Safety.
   d. Environmental pollution & pollution control.
   e. Pulverisers and feeders.
   f. Renewable energy sources,
2. Arrange Power Plant expert person seminar on new topics related to energy production, minimize pollution etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Power plant engineering	P. K. Nag	Tata McGraw Hill
2	Power plant engineering	Fredrick T. Mosse	East-West press
3	Solar energy, Principles of Thermal Collection & Storage	S. P. Sukhatme	3rd Edition, Tata McGraw Hill
4	A text book of Power System Engineering	A. Chakrabarti and M. L. Soni	Dhanpat Rai and Co
5	A course in power plant engineering	Arora and Domkundwar	Dhanpat Rai and Co
6	Renewable energy sources	Salunki IIT BOMBAY	**----**

B) Software/Learning Websites

B.1. CD's / PPT's etc.:

1. CDs developed by Maharashtra Energy Development Agency (MEDA), Pune. (www.mahaurja.com)
2. Dr. Govind N. Kulkarni, Documentary (DVD), Solar Energy-An Awakening, Usha Solar

B.2. Websites:

1. http://www.bee-india.nic.in(Website of Bureau of Energy and Efficiency).
2. http://www.mahaurja.com(Website of Maha urja).
3. http://www.energymanagertraining.com(Energy management).

C) Major Equipments/ Instruments with Broad Specifications

1. Steam power plant model.
2. Nuclear power plant model.
3. Solar power plant model.
4. Hydro power plant model.
5. Wind power Plant model.

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	M	M	L	M	M			L		M
CO2		H		M				L			L
CO3		H		L		M					
CO4		M	M	L							L
CO5		L			M	M					L
CO6		M	L		L	L					L
CO7		L	L		M	H	L				H
CO8					M	H			M		H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Refrigeration and Air Conditioning (RAC) **COURSE CODE :** 6516

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:

Refrigeration and Air conditioning is one of the most meaningful job areas for diploma holders in Mechanical Engineering. Considering the wide and increasing use of Refrigeration and Air conditioning for domestic, commercial and industrial applications and the challenges put by the use of Refrigeration and air conditioning equipment's in existing stage, it is absolutely necessary that Diploma Engineers should learn this course. They should know the processes equipment's, systems of Refrigeration and Air conditioning with their functioning, maintenance, repairs and measures to meet the challenges of the near future in this area. The knowledge of Thermal Engineering and power engineering is a prerequisite for this course.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the principles of refrigeration and air conditioning.
2. Know the working principles and construction of Refrigeration and Air conditioning systems.
3. Understand various charts and tables used in refrigeration and Air conditioning.
4. Know Heat load cooling calculation for different applications.
5. Understand various components and controls used in refrigeration and air conditioning fields.
6. Know the application of refrigeration and air conditioning systems.
7. Know Eco friendly refrigerant for environment safety.

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. Write terminology associated with Refrigeration and Air Conditioning.
2. Describe the principles and construction of refrigeration and air conditioning.
3. Calculate various psychometric properties for psychometric processes.
4. Select various component of refrigeration and air-conditioning as per need
5. Calculate heat load for air conditioning systems.
6. Identify common troubles/ problems in Refrigeration and Air Conditioning system and list possible remedial measures.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basic of Refrigeration**	1a. Explain the principles and methods of refrigeration 1b. Explain working of conventional and nonconventional refrigeration	1.1 Review of II law of thermodynamic. 1.2 Definition of refrigeration and Necessity of refrigeration. 1.3 Concept of heat engine, heat pump and refrigerator. 1.4 Unit of refrigeration, COP and refrigerating effect.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	system 1c. Calculate COP, RE and work required.	1.5 Methods of refrigeration: 1.6 Conventional • Ice refrigeration • vapour refrigeration system • vapour absorption refrigeration • Steam jet refrigeration system. 1.7 Non Conventional • Vortex tube • Solar refrigeration • Thermoelectric Refrigeration 1.8 Low temperature system; Cryogenics. 1.9 Major application area • Domestic • Commercial • Industrial. 1.10Simple Numerical to calculate COP, RE and work required.	
Unit-II **Refrigeration cycles**	2a. Explain construction and working of Refrigeration and Air conditioning systems. 2b. Use of various charts and tables used in refrigeration a. Evaluate Performance of refrigeration system 2c. Explain method of improvement of COP	2.1 Types of Refrigeration cycle 2.2 Reversed Carnot cycle: • Working • PV and TS diagram • Limitations • Simple numerical 2.3 Air Refrigeration Cycles: Bell Coleman cycle • Construction and working • PV and TS diagram • Advantages and Limitations • Applications • Simple numerical 2.4 Air craft refrigeration • Types of air craft refrigeration • Simple air cooling system 2.5 Vapour Compression cycle: • Principle, • Components and, working • Representation on P-H and T-S diagram • Types of compression of VCR (wet compression, dry compression and superheated compression) • Calculation of COP with help of relations and charts) • Methods of improving COP: Effect of superheating, under cooling. 2.6 Actual VCR diagram 2.7 Introduction to multistage of VCR, its necessity and advantages.	10
Unit-III **Refrigerants**	3a. Classify refrigerants 3b. List the properties of refrigerants 3c. Selection of	3.1 Classification of refrigerants 3.2 Desirable properties of an ideal refrigerant 3.3 Nomenclature of refrigerants 3.4 Secondary refrigerants and its selection 3.5 Selection of refrigerant for applications:	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	refrigerant for refrigeration systems 3d. Explain the need of eco-friendly refrigerants	• Water cooler • Domestic refrigerator • Ice plant • Window air conditioner • Split air conditioner 3.6 Concept of • Greenhouse effect • Ozone depletion • Global warming potential. 3.7 Future industrial Eco-friendly refrigerants	
Unit-IV **Equipment selection**	4a. Explain the construction and working of components of Vapour Compression refrigeration system 4b. Select various component of refrigeration and air-conditioning as per need	4.1 Components of practical Vapour Compression Refrigeration System. 4.2 Compressor: • Classification, • Construction and working of open type, hermetic, centrifugal, rotary & applications. 4.3 Condensers: • Classification, • Construction and working of different types of condenser (air cooled, water cooled and evaporative condensers) • Comparison and its applications. 4.4 Expansion devices: • Types • Construction, working • Applications (Capillary tube, automatic, thermostatic expansion valve). 4.5 Evaporators: • Classification • Construction and working of bare tube, plate type-finned type, and shell and tube type. • Applications 4.6 Selection criteria for vapour compression refrigeration system components for the following applications: • Water cooler • Ice plant • Domestic refrigerator • Cold storage 4.7 Control in refrigeration and air conditioning system**:** Function • Fluid flow control • Operating controls • Safety control	12
Unit-V **Psychrometry and Comfort conditions**	5a. Explain the principles of air conditioning. 5b. Plot and interpret various air conditioning processes on	5.1 Need of air conditioning 5.2 Psychrometry- • Properties and its relations • Representation of psychrometric properties on chart • Various air conditioning Processes on psychometric charts	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	psychometric chart. 5c. Measure various air properties. 5d. Explain working of various Air conditioning equipment	5.3 Bypass Factor, ADP and concept of SHF, RSHF, ERSHF and GSHF. 5.4 Simple numerical using Psychometric chart 5.5 Comfort condition • Factors affecting human comfort • Effective temperature • Comfort chart 5.6 Equipment • Humidifier • Dehumidifier • Filter and its types • Heating and cooling coils • Temperature and humidity measuring instruments	
Unit-VI **Air conditioning systems**	6a. Explain Air Conditioning system. 6b. Calculate the cooling load for different applications.	6.1 Classification of Air conditioning systems 6.2 Construction, working and applications of • Summer air conditioning system • Winter air conditioning system • Year round air conditioning system • Central air conditioning system • Unitary air conditioning system • Central air conditioning system 6.3 Components of cooling load • Sensible heat gain sources • Latent heat gain sources	08
Unit-VII **Air distribution systems**	7a. Explain the various components of air distribution system. 7b. Explain insulation material and its types 7c. Explain the controls in refrigeration and air conditioning systems	7.1 Main component of Air distribution system 7.2 Ducts: need, types, construction, materials 7.3 Duct systems: Construction, working and applications • Closed perimeter system • Extended plenum system • Radial duct system 7.4 Air conditioning fans and blower: • Types • Construction, working • Applications 7.5 Air distribution outlets, Supply outlets return outlets, grills diffusers 7.6 Insulation: • Purpose • Properties of insulating material • Types of insulating materials	10
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (Practical)

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basic of Refrigeration	04	04	02	10
II	Refrigeration cycles	04	06	02	12
III	Refrigerants	02	04	02	08
IV	Equipment selection	04	06	06	16
V	Psychrometry and air conditioning equipment	04	06	02	12

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
VI	Air conditioning systems	04	04	02	10
VII	Air distribution systems	04	04	04	12
	TOTAL	**26**	**34**	**20**	**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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Constructional details, controls and working of vapour compression system for refrigerator, water-cooler, window AC	02
2	I	Trial on water cooler test rig and find out COP and water cooling capacity rate	02
3	II	Testing of domestic refrigerator to find out Refrigerators capacity, power required and COP	02
4	III	Trial on ice plant test rig to find out capacity, power required and COP	08
5	IV	Dismantling and assembly of hermetically sealed compressor	04
6	VI	Trial on Air Conditioning system test rig and find out capacity of system, power required and COP	02
7	V, VI, VII	Cooling load calculations for HOD cabin, classrooms, laboratory and Principal cabin and select cooling capacity of air conditioner unit (any one).	02
8	II, III	Visit to cold storage and write the visit report using following points • Organisational structure • Plant layout • Constructional details of various components • Use of refrigerant with scientific reason • Cooling load • Safety control devices • Purpose of cold storage • Constructional details of AHU • Constructional details of ducting and insulation used • Parameters to be controlled • Troubleshooting and remedies • Economy associated with cold storage	02
9	VI	Servicing of refrigeration/ air-conditioning unit using various tools	02
10	VI, VII	Visit to central AC Plant and write the visit report using following points	02

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Constructional details, controls and working of vapour compression system for refrigerator, water-cooler, window AC	02
		• Layout • Constructional details of various components • Use of refrigerant with scientific reason • Cooling load • Safety control devices • Constructional details of AHU • Constructional details of ducting and insulation used • Parameters to be controlled • Air distribution system • Troubleshooting and remedies	
11	VII	Identify the common problem occurred in following refrigeration system and their remedies: • Domestic refrigerator • Split window air conditioner • Water cooler	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/ library/ internet/lab based mini-projects, Demonstration, Industrial Visits, Video collection, Chart or Model preparation by students etc. These could be individual or group-based.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Case studies of typical maintenance/installation problems in refrigeration system for different makes.
2. Arrange expert lectures of executives of different refrigeration field companies
3. Visit of authorized workshop of service station
4. Collection of animation or video clips and presentation using same
5. Internet based assignments, teacher guided self learning activities,
6. Course/library/internet/lab based mini-projects etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Refrigeration and Air Conditioning	C.P. Arora	McGraw-Hill India Publishing Ltd.
2	Refrigeration and Air Conditioning	Arrora and Domkundwar	Dhanpat Rai and Sons
3	Refrigeration and Air Conditioning	Manohar Prasad	New Age International Publisher
4	Refrigeration and Air Conditioning	P. N. Ananthanarayanan	Tata McGraw Hill
5	Refrigeration and Air Conditioning	Jordon and Prister	Prentice Hall of India Pvt. Ltd.
6	Principles of Refrigeration	Roy J Dossat	Person Eructation
7	Refrigeration and Air Conditioning	W.F. Stocker and J. W. Jones	McGraw Hill Publications
8	Commercial Refrigeration	Edwin P. Anderson	Taraporevala Sons & Co.
9	Refrigeration and Air Conditioning	Khurmi R S	S Chand Publications

B) Software/Learning Websites

1. www.nptel.ac.in/courses
2. www.ishrae.in
3. www.ashrae.org
4. www.learnerstv.com

C) Major Equipments/ Instruments with Broad Specifications

1. Domestic refrigerator test rig
2. Water cooler test rig
3. Vapour absorption system equipment
4. Air Conditioning system test rig
5. Hermetically sealed compressor
6. Refrigeration tools

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	H									
CO2		M	H	M					H		H
CO3		M	H	H	M		M	M	H		M
CO4		H	H		M	H	M		H	L	M
CO5		H	H		M	H		H	H		H
CO6	L	H	M	H	M	H	H	M	H	L	H

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Alternate Energy Sources (AES) **COURSE CODE** : 6517

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:

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. Understand the need and importance of renewable energy
2. Know various Biomass Conversion processes.
3. Understand the Energy Saving Potential, Waste Heat Recovery, Energy Efficiency.
4. Understand the methodologies to execute preliminary energy audit.

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. Write the need and importance of renewable energy
2. Analyze various Biomass Conversion processes for its content.
3. Evaluate the Energy Saving Potential, Waste Heat Recovery, Energy Efficiency.
4. Apply the methodologies to execute preliminary energy audit.
5. Explain utilization of Wind and Geothermal Energy.
6. Explain working principle of solar devices and solar system.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Introduction to Renewable Energy**	1a. Explain need of renewable energy 1b. Explain the effect of use of fossil fuel on climate change and global warming 1c. Identify various renewable energy sources	1.1 Need of Renewable Energy Non renewable Energy sources-Fossil Fuels: Coal, Oil, Natural gas, Tar sands and Oil shale Climate Change-Green House Gases, Global Warming Sustainable growth, Present Energy Scenario: Global and Indian, Pattern of Energy Consumption, Different types of Energy and its utilization. 1.2 Renewable Energy Sources: Solar Energy-Direct Uses, Indirect Uses, Hydro-Power, Wind Power, Bio-Energy, Wave Power, Non-Solar Renewable Energy, Tidal Energy, Geothermal Energy.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		1.3 Energy Storage Management Thermal Storage-sensible and latent its comparison, Electrical Storage: Introduction to battery, super capacitor and fuel cell.	
Unit-II **Direct Uses of Solar Energy**	2a. State the concept of solar radiation 2b. List various solar thermal applications.	2.1 Solar Radiation, Sun & Earth, Solar Spectrum, Sun & Earth Movement, Solar Geometry: Concept 2.2 Solar Thermal Applications, Water Heating, Space Heating, Space Cooling and Refrigeration, Power Generation, Distillation	10
Unit-III **Solar Photovoltaic cell**	3a. Describe the working principle of solar thermal systems	3.1 Construction Details containing capacity, size and materials for Solar Flat Plate Collector, Solar Evacuated Flat plate Collector, Solar Concentrating Collector, Solar Cooker-Box and Concentrating, Solar Drying 3.2 Solar Photovoltaic Conversions: Principle of working of Solar cell Construction Details containing capacity, size & materials of Solar Photovoltaic System Applications-Solar Lantern, Solar Home System, SPV Street Light, SPV Traffic Signal, Info-display, SPV Power Pack, Stand alone SPV Power Plant, Solar Generators, Building Integrated PV Systems, SPV Pumping Systems	12
Unit-IV **Indirect Uses of Solar Energy-I**	4a. Know the site selection criteria for wind and hydro plant 4b. Classify small hydro plants 4c. Identify component of Horizontal Axis Wind Turbine	4.1 Hydro-Power Site Selection, Different Components of Small Hydroelectric Projects, Types of Turbine-Francis, Propeller, Classification of Small Hydro-electric Plants: Ultra low head, Low head, Medium/high head, Micro hydro, Mini hydro, Small hydro 4.2 Wind Power, Concepts of Wind Energy Conversion, Lift and Drag, Classification and Description, Components of Power Generating Horizontal Axis Wind Turbine, Site Selection Criteria.	10
Unit-V **Indirect Uses of Solar Energy-II**	5a. State the site selection criteria for wind and hydro plant 5b. Compare bio fuels	5.1 Bio-Energy-Photosynthesis and Carbon Cycle Concept. 5.2 Bio energy Sources-Types Such as, Energy Plantation, Agricultural Crops, Wood Residues, Animal Waste, Municipal Solid Waste, Landfill Gas, Commercial and Industrial Waste 5.3 Biomass Conversion Routes-Thermo chemical Route and Biochemical Route,	10

	5c.	5.4 Combustion, Gasification, Pyrolysis, Anaerobic digestion, Fermentation 5.5 Bio fuels from Bio-Mass 04 Marks Bio ethanol, Biodiesel, Biogas, Algae-a new biomass	
Unit-VI **Energy measurement and Conservation**	6a. Judge the energy saving potential, waste heat recovery, energy effect 6b. State the use of different energy measuring instruments	6.1 Energy Measurement and Instruments**:** Lux meters, Pyranometer, Sunshine Recorder, Pyrheliometer, Combustion analyzer. 6.2 Energy Conservation**:** Energy Efficiency-Boiler & Furnace Efficiency, Waste Heat Recovery Systems, Energy Loss Prevention-Thermal Insulation	10
		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	Introduction to Renewable Energy	04	04	04	12
II	Direct Uses of Solar Energy	04	04	04	12
III	Solar Photovoltaic cell	04	04	04	12
IV	Indirect Uses of Solar Energy-I	04	08	04	16
V	Indirect Uses of Solar Energy-II	04	08	04	16
VI	Energy measurement and Conservation	04	04	04	12
	TOTAL	**06**	**26**	**48**	**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, II	Collect information about global and Indian energy market from websites and prepare report.	04
2	I, II	Visit to a commercial or Industrial Solar water heating Installation. Write report about regarding collector layout, piping and fittings and measurement, manufacturing, cost and performance of the system.	04
3	III	Performance measurement of photovoltaic array used for an application such as pumping, home lighting etc. making use of energy instruments.	04
4	IV	Visit to or study of a Hydraulic Power plant. Write about location, capacity, efficiency, construction and working of the plant.	04
5	IV	Performance estimation and comparison of different collector technologies used for hot water generation such as evacuated tube, flat plate collector, dish collector etc. on site.	04
6	V	Collect information about construction and working of horizontal axis wind mill or to visit a nearest wind farm and write a report.	04
7	V	Writing a report on plant structural details and components by visits to a biogas plant or biomass gasification facility.	04
8	VI	Practical study of energy audit instruments used for measurement of electric energy, temperature, flow, exhaust gas analysis etc.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the logistics information of non conventional sources of energy near local area.
2. Find out the information of mentioned areas of industries by internet.
3. Collect the government policies about industries working in the area of alternate sources of energy.
4. Gather information about wind energy and its applications.
5. Collect the information about applications of tidal energy and its generation.
6. Collect the information about applications of bio gas and its generation.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to solar plant, windmill and bio gas plant.
2. Arrange expert seminar of industry person in the area of alternate sources of energy and its scope.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Non conventional energy sources	G. D. Rai	Bureau of Energy and Efficiency (BEE)
2	Solar energy, Principles of Thermal Collection & Storage	S. P. Sukhatme	3rd Edition, Tata McGraw Hill
3	Non-Conventional Energy Resources	B. H. Khan	2nd Edition, McGraw Hill Companies
4	Solar Photovoltaic Fundamentals Technologies and Applications	Chetan Singh Solanki	PHI Learning private ltd New Delhi

B) Software/Learning Websites

Not acceptable

C) Major Equipments/ Instruments with Broad Specifications

Not acceptable

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		H		H							
CO3				H							M
CO4				H							M
CO5				L							M
CO6			H								

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Mechanical Estimation and Costing (MEC) **COURSE CODE** : 6518

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:

For a mechanical engineering technician should have sound knowledge of the various methods and techniques of costing. This will equip him with the necessary know-how for undertaking any manufacturing operation in a workshop or an industry.
Diploma engineer who takes up a job in industry will be able to perform estimating and costing operations which are necessary for efficient and economical production.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Plan, use and control resources optimally and economically.
2. Understand the estimate production/operation cost for budgeting and analysis.
3. Know the estimating and costing manufactured product.
4. Understand the break even analysis.
5. Understand the calculation of labour charges.

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 the time of machined parts.
2. Identify and estimate elements of cost in various processes.
3. Perform break even analysis for economical production.
4. Calculate the fabrication cost, forging cost & foundry cost.
5. Calculate the direct and indirect labour cost.
6. Prepare detailed estimate of any mechanical product.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of Estimation and Costing**	1a. Explain the terminology of (EC) Estimating & Costing-cost elements, Overheads, selling price and catalogue price. 1b. Explain need, scope & importance of EC in industries. 1c. Compare costing and estimating.	1.1 Definition 1.2 Objective 1.3 Elements and Components of costing 1.4 Factors of Estimating 1.5 Estimating procedure 1.6 Standard Estimate form	12
Unit-II **Estimation of Machining Time**	2a. Calculate the machined part cost for lathe, drilling, milling and shaping operations. 2b. Calculate Machining Time considering all parameters	2.1 Introduction 2.2 Different Machining Operations and Time Allowances. 2.3 Concept of standard Unit Time, Cycle Time and Total Time. 2.4 General Terms 2.5 Calculation of Machining Time	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		2.6 Simple Numerical	
Unit-III **Estimation of Fabrication Cost**	3a. Calculate Fabrication Cost considering elements of Cost, joining method etc. 3b. Explain various costs of fabrication	3.1 Definition 3.2 Elements of Cost of fabrication 3.3 Joining Methods 3.4 Classification of Various Costs of fabrication 3.5 Simple Numerical	10
Unit-IV **Estimation of Forging Cost**	4a. Explain the types of Forging 4b. Calculate production cost of forging component.	4.1 Introduction 4.2 Types of Forging& their costing 4.3 Forging Operation 4.4 Forging Losses 4.5 Simple Numerical	10
Unit-V **Estimation of Foundry Cost**	5a. Calculate cost of material, pattern and production for a casting component. 5b. Calculate the cost of Cleaning and Shipping.	5.1 Casting Weight 5.2 Process for Finding the Foundry Cost 5.3 Cleaning and Shipping Costs 5.4 Foundry Tooling Cost 5.5 Simple Numerical.	10
Unit-VI **Labour Cost**	6a. Explain the Methods of Remuneration 6b. Compare Direct and Indirect Labour cost.	6.1 Direct And Indirect Labour, Workmen Classification, Definition of Wages, Methods of Remuneration	10
		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 Estimation and Costing	04	04	04	12
II	Estimation of Machining Time	04	06	08	18
III	Estimation of Fabrication Cost	04	06	04	14
IV	Estimation of Forging Cost	04	06	04	14
V	Estimation of Foundry Cost	04	06	04	14
VI	Labour Cost	02	02	04	08
	TOTAL	**22**	**30**	**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.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	II	Estimation for machining Time for representative machines-one conventional machine.	05
2	II	Estimation for machining Time for representative machines-on CNC machine.	05
3	III	Case study on estimation of overheads for a manufacturing unit.	06
4	IV	Process costing of two components-on conventional machine (Any **ONE** Process).	04
5	V	Process costing of two components-on CNC machine (Any **ONE** Process).	04
6	VI	Time estimation for machining cycle for two components involving variety of processes.	04
7	VI	Estimation for setting up a small work shop.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Calculate the cost of any 5 mechanical products.
2. Prepare a chart of Cost-capacity equations.
3. Solve 05-10 simple numerical on each chapter.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Visit to any SME/workshop/ automobile garage.
2. Expert seminar of industry person in the area of estimation and costing.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mechanical Estimating And Costing	TTTI Chennai	----
2	Estimating And Costing Mechanism	J. S. Charaya	----
3	Cost Accounting	R. R. Gupta	----
4	Cost Accounting	B. Jawaharlal	----
5	Cost accounting &mgt. accounting	S. N. Inamadar	Everest publication

B) Software/Learning Websites

1. http://calculatoredge.com/index.htm#mechanical
2. www.themetalcasting.com (casting cost estimation)
3. http://www.researchgate.net(COMPUTERIZED_COST_ESTIMATION_FOR_FORGING_INDUSTRY)
4. http://www.sanfoundry.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							
CO2	M		H						L	L	
CO3				H	M		L				L
CO4	M	M	M						L	H	
CO5	H	M								M	L
CO6	M		M	M					L	H	M

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Mechatronics (MTX) **COURSE CODE** : 6519

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:

The integration of Mechanical Engineering, Electrical Engineering, Electronics Engineering, Computer Technology and Control Engineering is increasingly forming a crucial part in the design, manufacture and maintenance of wide range of engineering products and processes. As a consequence there is a need for a diploma engineers to understand systems used in automation

2.0 COURSE OBJECTIVES:

The student will be able to

1. Identify the latest technologies of mechanical, electronics, control, software and computer engineering used in an automation system.
2. Understand various input and output devices in an automated system.
3. Know the concept of ladder diagrams used in PLC.
4. Understand the programming of PLC for simple automated systems.
5. Know the significance of operation manuals of PLC manufacturers.
6. Understand the simulations using software provided by the PLC manufacturer.

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. Design and conduct experiments to evaluate the performance of a Mechatronics system.
2. Analyze and interpret data related to components with respect to specifications of an automated system.
3. Design Mechatronics components, system or process to meet desire needs.
4. Design a system with sensing, actuating and embedded processing components, required to run the defined task autonomously.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Mechatronics Design System**	1a. Identify the need of Mechatronics 1b. Know the role of Mechatronics in various sectors	1.1 Introduction to Mechatronics 1.2 Advantages, disadvantages & applications, Integrated design issues in Mechatronics 1.3 Mechatronics key elements 1.4 Role of Mechatronics in automation with examples 1.5 Need of Mechatronics in manufacturing industries, Marine applications, aero applications and Space applications.	08
Unit-II **Sensors and Electrical**	2a. Identify the different types of sensors and actuators	2.1 Potentiometer sensor, Proximity sensor, Eddy current proximity sensor, Inductive proximity sensor, Optical encoder, Pneumatic sensor, Piezoelectric sensor,	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
actuation systems	2b. Describe the working of DC & AC motors	Tactile sensor, Light sensor 2.2 Limit switches, Thumb wheel switches, Relays, Solenoids 2.3 DC motor, Brushless DC motor, AC motor, Stepper motor and Servo motor	
Unit-III **Programmable Logic controller (PLC)**	3a. Identify the PLC type 3b. State the uses of PLC 3c. State the difference between microprocessor and microcontroller	3.1 Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, 3.2 Input/output modules (Analog, digital), concepts of sink/source, latch/unlatch, advantages and disadvantages of PLC 3.3 Installation, troubleshooting and maintenance of PLC 3.4 Networking of PLC 3.5 Online, offline, stop / run modes of operations, uploading / downloading between PLC and PC 3.6 Introduction to microprocessor and microcontroller with block diagram 3.7 Difference between microprocessor and microcontroller	10
Unit-IV **PLC Programming & Functions**	4a. Understand and draw ladder diagrams of PLC programming. 4b. Know various functions of PLC	4.1 Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions. 4.2 Simple ladder programming such as tank level control, temperature control etc. 4.3 Register basics, timer functions, counter functions 4.4 Intermediate functions-Arithmetic functions, number comparison and number conversion functions 4.5 Data handling functions-SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File arithmetic and logic function 4.6 PLC digital bit functions and applications 4.7 Sequencer functions and cascading of sequencers 4.8 PLC matrix functions	18
Unit-V **Robotics**	5a. Understand concept of robotics 5b. State applications of robots 5c. Know limitations of human in difficult operation	5.1 Introduction, Robot anatomy and structure, specification, working and basic components, Various configuration, Degree of freedom 5.2 Power sources for robotics, Actuators-Mechanical, Electrical, Hydraulic and Pneumatic 5.3 Concept of grippers-Screw and vacuum actuated gripper, end effectors 5.4 Applications of robots in various fields such as in automobiles, space etc.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-VI **DCS & SCADA**	6a. Understand the difference between DCS & SCADA 6b. Describe the need of DCS & SCADA	6.1 Introduction to DCS & SCADA 6.2 Need of DCS & SCADA 6.3 Generalised block diagram of DCS & SCADA 6.4 Applications of DCS & SCADA 6.5 Advantages of DCS & SCADA 6.6 Difference between DCS & SCADA	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	Mechatronics Design System	04	04	--	08
II	Sensors and Electrical actuation systems	04	04	04	12
III	Programmable Logic controller (PLC)	04	08	--	12
IV	PLC Programming & Functions	04	12	08	24
V	Robotics	02	08	04	14
VI	DCS & SCADA	02	08	--	10
	TOTAL	**20**	**44**	**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 PRACTICALS

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Identify different types of Mechatronics system built in automated machine tools	04
2	II	Identify different types of sensors and actuators	04
3	II	Identify different types of DC and AC motors applications	04
4	III	Development of ladder diagram for traffic light controller	04
5	III	Development of ladder diagram for Bottle filling plant	04
6	III	Development of ladder diagram for Lift elevator and control	02
7	IV	Identify various electro pneumatic systems in material handling automation module	04
8	V	Identify the different motions of robotic arm	02
9	III	Maintenance of PLC of any automation system	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the information of different types of sensors from online resources.
2. Search the information of above mentioned industries by internet.
3. Collect the information about automation modules.
4. Search information about electro pneumatic systems.
5. Draw the different types of ladders diagrams of PLC systems of CNC machines and servo motor system.

6. Search the DCS and SCADA module plants from online resources.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to automation industries located at nearby areas.
2. Arrange expert seminar/lectures by a resource person from industry in the area of manufacturing and automation.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mechatronics-Electronic control systems in Mechanical and Electrical Engineering	Bolton W	Pearson Education Ltd
2	Introduction to Mechatronics and Measurement systems	Histand B. H. & Alciatore D. G	Tata McGraw Hill Publishing
3	Programmable Logic Controllers	John W. Webb & Ronald Reis	Prentice Hall of India
4	Programmable Logic Control-Principles and Applications	NIIT	Prentice Hall of India
5	Mechatronic systems design	Kolk R. A. & Shetty D.	Vikas Publishing, New Delhi
6	Mechatronics principles, concepts and applications	Mahalik N. P.	Tata McGraw Hill Publishing
7	Robotic Engineering	Richard D. Klafter Michael Negin	Prentice Hall of India
8	Robots and Manufacturing Automation	C. Ray Asfahl	John Wiley and Sons.

B) Software/Learning Websites

1. http://www.automationworld.com/
2. http://www.rockwellautomation.com/
3. http://www.automation.com/
4. http://www.rethinkrobotics.com/
5. http://www.vexrobotics.com/
6. http://www.robotevents.com/

C) Major Equipments/ Instruments with Broad Specifications

1. Experimental set up for automated material handling module
2. Experimental set up of robot arm.
3. Experimental set up for AC/DC motors
4. Experimental set up for FMS module.
5. Experimental set up of traffic light control, bottle filling plant, lift elevator and control.

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							
CO2		M									H
CO3	H		M								
CO4		M		L							H
CO5								L			L

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

PROGRAMME : Diploma Programme in Mechanical Engineering (ME)
COURSE : Entrepreneurship Development and Management (EDM) **COURSE CODE :** 6520

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.	20	--	40	--	10	10	--

1.0 RATIONALE:

To enhance employability and Entrepreneurship amongst youth Govt. of India is taking initiative through Startup India, Make in India and Skill Development Program. Young engineers are required to train to support this mission. 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. 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.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop idea of Business planning entrepreneurial opportunity.
2. Develop entrepreneurial personality, skills, values and attitude.
3. Understand legal and human aspects of business management.
4. Understand financial and managerial aspects of enterprise management.
5. Become well acquainted with of support systems like banks, Government, DIC etc.
6. Use above information to 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. Identify business opportunity and finalize product/service
2. Collect information by Visiting to DIC and Nationalized Banks
3. Work together with similar/specific entrepreneur and seek for partnership/guidance if any
4. Familiar with Legal, ethical and environmental aspects of business.
5. Conduct various feasibility study
6. Prepare preliminary project report and detailed project report (Case Study)

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Entrepreneurship and support system**	1a. Collect Information 1b. Understand DIC 1c. Understand role of various organisations	1.1 Sources of information 1.2 Application forms 1.3 DIC and its functions 1.4 Role and functions of Commercial Banks, NSIC, SIDBI, SIDO, SIC, TCO, NABARD	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Market survey and opportunity identification**	2a. Know process of SSI 2b. Understand technique of product selection 2c. Know Govt schemes 2d. Conduct market research	2.1 Procedure for starting SSI 2.2 Agencies to be contacted for project implementation and their role 2.3 Incentive schemes by State and Central Government for establishing SSI 2.4 Process of final product selection 2.5 Market research 2.6 Case study	14
Unit-III **Project report preparation**	3a. Prepare PPR 3b. Conduct feasibility study 3c. Prepare DPR	3.1 Introduction 3.2 Preliminary Project Report, format, advantages 3.3 Techno-economic feasibility report 3.4 Detailed Project Report 3.5 Project Appraisal	12
Unit-IV **Legal aspects of business**	4a. Differentiate direct tax and indirect tax 4b. Know patent rules 4c. Understand taxation benefits to SSI	4.1 Principles of Taxation 4.2 Direct and indirect Tax 4.3 Income Tax, Sales Tax, Excise duty, deductions, computation, Tax payer's obligations 4.4 Patent rules 4.5 Taxation benefits to SSI	10
Unit-V **Environmental and safety aspects in Business**	5a. Explain pollution standards and legislation 5b. Know water act and air act 5c. Explain safety provisions 5d. Assess degree of pollution	5.1 Environmental pollution-Air, water noise pollution 5.2 Pollution standards 5.3 Pollution Legislation 5.4 The water Act 1974 5.5 The Air Act 1981 5.6 Assessment of air and water pollution from Industries 5.7 Air pollution control 5.8 Safety provisions in Factory act 1948	12
Unit-VI **Business Ethics**	6a. Explain concept of ethics 6b. Know code and provisions 6c. Discuss cases	6.1 Concept of ethics 6.2 Need of business ethics 6.3 Ethics issues-cases/examples 6.4 Code of ethics 6.5 Major provisions	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	Entrepreneurship and support system	08	8	--	16
II	Market survey and opportunity identification	04	04	04	12
III	Project report preparation	04	04	08	16
IV	Legal aspects of business	04	08	--	12
V	Environmental and safety aspects in Business	04	08	--	12
VI	Business Ethics	04	04	04	12
	TOTAL	**28**	**36**	**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:

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.*

S. No.	Unit No.	Exercises/Assignments	Approx. Hrs. Required
1	I	Opportunity identification-finalising product/service	04
2	I	Visit to DIC/Bank/MSSIDC/MIDC/MPCB/Industry	04
3	I	Prepare a preliminary project report and study its feasibility	04
4	II	Report on Legal aspects of Business	04
5	III	Case Study on Business Ethics	04
6	II	Assessment of Air and Water Pollution from Industry in prescribed format-A case Study	04
7	IV	Preparing Detailed Project Report-Case Study	08
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1 Assess yourself-are you an entrepreneur?
2 Report on
   - interview of successful entrepreneurs (minimum two)
   - Taxation systems and govt. concessions
   - visit to small scale industry
3 Product survey-select one product and collect all its related information i.e. specification, price, manufacturer.
4 List of identified opportunities with risk factors

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 expert lecture of an entrepreneur/Bank Official

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	Preferred by 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 Ahmadabad (Near Villaget, Via Ahmadabad Airport &
4	A Manual on Business Opportunity	J. B. Patel	

Sr.No.	Title of Book	Author	Publication
	Identification & Selection	S. S. Modi	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
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 to Beat Them.	V. G. Patel	
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
13	Industrial Engineering and Management	O. P. Khanna	Dhanpat Rai Publication
14	Entrepreneurship Development and Management	Dr. R.K. Singhal	S. K. Kataria and Sons New Delhi

B) Software/Learning Websites

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

C) VIDEO CASSETTES

Sr.No.	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat, Via Ahmadabad 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					M	M	H	L	M	H	H
CO2					H		M	H	H	M	M
CO3					M		M	M	H	M	H
CO4					L	H	H				M
CO5		L	M	M	M	M	M	M	M	L	H
CO6	L	M	M	M	H	M	H	H	H	H	L

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 termwork 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: Mechanical 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	**Dr. C. Y. Seemikeri** HOD., Mechanical Engg., Govt. Polytechnic, Nashik.	Chairman
2	**Dr. S. B. Ingole** HOD., Mechanical Engg. .(II nd Shift), Govt. Polytechnic, Nashik.	Member
3	**Shri. Rajesh Deshpande** Director, AR Technology, Nashik	Member
4	**Shri. Bhalchandra Varade** Manager, Technology Center, ABB, MIDC, Satpur, Nashik.	Member
5	**Shri. V. S. Kalmani** Head of the Department, KKW Polytechnic ,Nashik	Member
6	**Shri. S. P. Muley** Lecturer Mechanical Engg. Govt. Polytechnic, Nashik.	Member
7	**Shri. R. V. Rupvate** Lecturer Mechanical Engg., Govt. Polytechnic, Nashik.	Member
8	**Shri. Pramod U. Wayse** Deputy Secretary (T), MSBTE, Regional Office, Osmanpura, Aurangabad-431005.	Member
9	**Shri. S. P. Dikshit** Lect., Civil Engg. Dept., Incharge CDC, Govt. 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	Prof. D. P. Nathe	Principal, Government Polytechnic, Nashik
2	Shri. S. P. Muley	Head of Mechanical Engineering Department
3	Shri. R. V. Rupvate	Head of Mechanical Engineering Department (II Shift)
4	Shri. S. D. Sanap	Lecturer in Mechanical Engineering, Government Polytechnic, Nashik.
6	Shri. A. G. Waghulde	Lecturer in Mechanical Engineering, Government Polytechnic, Nashik.
5	Dr. S. J. Gorane	Lecturer in Mechanical 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	**Mechanical Engineering Department, Government Polytechnic Nashik**	
	Shri. S. P. Muley	Head of Department
	Shri. R. V. Rupvate	Head of Department (II Shift)
	Shri. B. Prasad	Lecturer in Mechanical Engineering
	Shri. S. D. Sanap	Lecturer in Mechanical Engineering
	Shri. S. A. Kulkarni	Lecturer in Mechanical Engineering
	Shri. A. S. Sangvikar	Lecturer in Mechanical Engineering
	Shri. P. S. Kulkarni	Lecturer in Mechanical Engineering
	Shri. A. G. Patil	Lecturer in Mechanical Engineering
	Shri. A. G. Waghulde	Lecturer in Mechanical Engineering
	Shri. S. J. Gorane	Lecturer in Mechanical Engineering
	Shri. S. S. Vaditake	Lecturer in Mechanical Engineering
	Shri. K. A. Jagtap	Lecturer in Mechanical Engineering
	Shri. Y. S. Kokate	Lecturer in Mechanical Engineering
	Shri. V. H. Chaudhari	Lecturer in Mechanical Engineering
	Shri. A. A. Maske	Lecturer in Mechanical Engineering
3	**Applied Mechanics Department, Government Polytechnic Nashik**	
	Shri. R. G. Sonone	Co-ordinator and Lecturer in Applied Mechanics
	Shri. V. R. Gaikwad	Lecturer in Applied Mechanics
4	**Other Departments, Government Polytechnic Nashik**	
	Shri. P. G. Kochure	Workshop Superintendent
	Shri. S. B. Bhusare	Lecturer in Electrical Engineering
	Mrs. S. S. Chaudhari	Lecturer in Electronics and Telecommunication Engineering
	Dr. S. S. Pathak	Lecturer in Civil Engineering
5	**Science and Humanities Department, Government Polytechnic Nashik**	
	Shri. S. M. Shinde	Lecturer in Mathematics
	Mrs. A. S. Salunkhe	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
	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 Mechanical Engineering programme**, which shall be implemented from academic year 2016-17.

Verified by

Department Level CDC Representative
Government Polytechnic, Nashik

Head of Department
Mechanical Engineering
Government Polytechnic, Nashik

Incharge, Curriculum Development Cell
Government Polytechnic, Nashik.

Principal
Government Polytechnic, Nashik.