CURRICULUM FOR THREE YEAR(SIX SEMESTER)
DIPLOMA COURSE IN
GLASS AND CERAMIC ENGINEERING

For the State of Uttar Pradesh

Prepared by:

Institute of Research Development & Training

U. P., (Government Polytechnic Campus)

Kanpur-208002

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Approved By:

Board of technical

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PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the Technical Education, UP to revise the existing curricula of diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system

Manoj Kumar
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Coordinator
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Kanpur, U.P.

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN GLASS AND CERAMIC ENGINEERING

1) Name of the Programme : Diploma Programme in Glass & Ceramic Engineering

2) Duration of the Programme : Three years (Six Semesters)

3) Entry Qualification : Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP

4) Intake : 60 (or as prescribed by the Board)

5) Pattern of the Programme : Semester Pattern

6) NSQF Level : Level - 5

7) Ratio between theory and Practice : 50:50 (Approx.)

8) Industrial Training:
Four weeks of industrial training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.

9) Ecology and Environment :
As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.

10) Energy Conservation:
A subject on Energy Conservation has been incorporated in the curriculum.

11) Entrepreneurship Development:
A full subject on Industrial Management and Entrepreneurship Development has been incorporated in the curriculum.

12) Student Centred Activities:

A provision of 3-6 periods per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co–curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

13) Project Work :
A project work has been included in the curriculum to enable the student Get familiarize

With the practices and procedures being followed in the Industries and provide an opportunity to work on some live projects in the Industry.

2. EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN GLASS & CERAMIC ENGINEERING

Employment opportunities for diploma holder in Ceramic Engineering are visualized in following industries at various levels/positions.

i) White Ware Industry
   - (a) Sanitary ware
   - (b) Tiles
   - (c) Crockery
   - (d) Pottery ware
   - (e) Handicraft

ii) Refractories

iii) Glass Industry

iv) Cement Industry

v) Modern Ceramic industries-metallurgical cosmoferrites, modern insulators, Special Ceramic as High alumina , Zirconium, etc

vi) Iron and Steel Industry

vii) DRDO, ISRO, NNFL (National Nuclear Fuel Limited), NALCO (National Aluminum Cooperation Limited), BALCO (Bharat Aluminum Cooperation Limited)

viii) Lab Instructor in teaching institution

ix) Self employed in setting up small units

- Ceramic Engineer/Ceramist/Glass Technologist in small and medium industries.
- Quality Control and Inspection Supervisors.
- In plant Laboratory Supervisor/R & D Supervisor.
- Sales or Marketing Officer.
- Conducts tests on raw materials and ascertain their suitability.
- Supervises milling operations, glaze preparation, body preparation, shaping, drying and firing of ceramic goods.
- Selects appropriate processes and machines for manufacture of ceramic goods and glassware.
- Makes batch calculations.
- Plans men, materials and machines for achieving target production.
- Conducts quality control tests from raw materials and finished products.
- Detects common faults in processes, equipment and furnaces and suggests remedial measures.

- Make cost calculations of ceramic goods.
- Keep record of production.
- Conducts market survey and promotes sales.
- Assist in testing laboratories.
- Assist in R & D laboratories.

3. LEARNING OUTCOMES OF THE PROGRAMME GLASS AND CERAMIC ENGINEERING

Sr. No.	Learning Outcomes
After due completion of the course, a GLASS AND CERAMIC ENGINEERING will be able to:	
1.	Read and interpret any engineering drawing.
2.	Plan, schedule, organize direct, control and coordinate men, materials and machines for the production of ceramic/glass products.
3.	Knowledge of physical, chemical and thermal properties of raw materials, additives and finished product.
4.	Select appropriate raw materials, processes, machines and make cost calculations for production of ceramic/glass products.
5.	Knowledge of work measurement and materials handling techniques.
6.	Detect faults in equipment's / processes / product and suggest remedial measures.
7.	Undertake quality control tests on raw materials, materials in the process and finished products.
8.	Assist in developmental activities at any label
9.	Knowledge of marketing and sales promotion of ceramic/glass products.
10.	Ability to manage stores and Ware house
11.	Knowledge of labour laws, factory safety rules, and handling of labour problems.
12.	Establish and run a small enterprise & Select material as per desired application
13.	Use electrical and electronic instruments to measure various engineering parameters
14.	Use various measuring and gauging instruments
15.	Understand the general Layout of Plant, process, equipments and testing
16.	Understand different renewable sources of energy and their applications.
17.	Understand different process in different plants and maintenance of their using equipments
18.	Understand the factory acts, laws and taxes

19.	Use various software tools for automation and process development.
20.	Communicate effectively in English and local language in oral and written form with others
21.	Prepare detailed project proposal and report.
22.	Plan and execute given task/project as a team member or leader
23.	Use computer and IT tools for creating documents, making spread sheet, DPR and making presentation
24.	Use various software tools for automation and process development.
25.	Handle the customers Effectively as Sales Person and Increase the Sales
26.	Prepare the Planning for Production and Maintenance schedule also
27.	Apply the Basic Knowledge of Electrical, Mechanical, and Civil Engg. Etc.
28.	Select the Refractory for the different types of Furnace / Kiln as Processed material
29.	Modify the Process / Furnace / Batch composition and take the corrective action
30.	Testing carryout of Ceramic raw materials as IS specification
31.	Understand and carryout the different Testing of Ceramic Finished Products as IS specification
32.	Determined the Physical & Mechanical Properties of Raw materials and Finished Product
33.	Carryout the Chemical Analysis of Ceramic Raw materials Finished Product
34.	Understand and execute the different techniques in Glass decoration
35.	Understand the manufacturing of Models / Statue, Working Mould & Master Mould of POP
36.	Understand the manufacturing process and Testing of Lime, Cement, High Alumina Product

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	– Communication Skills
2.	Apply basic principles of Mathematics to solve engineering problems	– Applied Mathematics
3.	Apply basic principles of Physics and Chemistry to solve engineering problems. Apply concepts of mechanics to solve engineering problems	– Applied Physics – Applied Chemistry – Applied Mechanics
4.	Prepare and interpret drawings of engineering components and plants	– Engineering Drawing-I
5.	Basic concept of about Glass, Enamel, Pottery, Refractory & Cement	Introduction to Glass & Ceramic Engg.
6.	Prepare computerized reports, presentations using IT tools and computer application software	– Basics of Information Technology
7.	Use cutting tools, equipment and tooling for fabrication of jobs by following safe practices at workplace	– General Workshop Practice
8.	Basic knowledge of Electrical, Mechanical & Civil Engineering. Use electrical and Mechanical instruments	Elementary Electrical, Mech. & Civil Engineering
9.	Use and know the function of all machine which are use in the Ceramic Industry	– Industrial Operations

10.	Calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process	– Industrial Calculation
11.	Understand about Pottery & Refractory wares, their Raw material, making process, uses & Testing in Laboratory	– Pottery & Refractory
12.	Understand about compounds and Its use in Ceramic	– Applied Chemistry-II
13.	Understand about Glass, Enamel Raw material, manufacturing and uses & different type of coating	Glass, Enamel & Ceramic Coating
14.	Practice to draw the pictorial view of ceramic Machinery, pulley, Bearings, different joint, Symbols	Glass & Ceramic Engg. Draw-II
15.	Understand about the Fuels, Furnace & temperature measuring equipment	Fuels, Furnaces & Pyrometers
16.	Understand about the importance of Geology & Mineralogy for Ceramic Engg.	Elementary of Geology & Mineralogy
17.	Use appropriate Practices for Conservation of Energy and prevention of Environment Pollution	– Energy Conservation – Environmental Studies
18.	Know the Values & Skills to ensure happiness and prosperity	– Universal Human Values

19.	Interpret Labour laws, factory acts/laws and taxes, Quality of supervisor	Industrial Management and Entrepreneurship Development
20.	Understand about the types of Pottery ware, composition, properties, Uses	Pottery & Porcelain-I
21.	Understand about the Refractory, types of refractory, composition, properties, Uses	Refractory Technology
22.	Understand Glass composition, raw materials, types of glass, properties, Uses	Glass Technology-I
23.	Understand about the latest Ceramic, high temp. ceramic & their composition, properties, Uses	Modern Ceramics & Its Application
24.	Understand about the Lime & Cement its batch composition, Manufacturing process, types, properties	Lime & Cement Technology
25.	Understand about the Machinery & Furnace its working principle, working capacity & Factory Layout	Ceramic Machinery & Furnace Expose
26.	Practice to draw the Sectional view of ceramic Machinery(Assembly & disassembly) layout of Ceramic Plant	Glass & Ceramic Engg. Drawing-III
27.	Understand in Detail the Manufacturing process of Different Types of Glass Ware as Bottle, Sheets etc Understand in Detail the Manufacturing process of Different Types of Pottery Wares, new trends	Elective (Any One) (I) Glass Technology-II (II) Pottery & Porcelain-II
28.	To know about the Ceramic Industries To get the Practical knowledge at Industries Floor	– Field Exposure-I (One Weeks) – Industrial Training (2Weeks)

	Gain the working Experience at Industries Seeing the Many types of Ceramic Industries	– Industrial Training (3Weeks) – Industrial Tour/ Visit
29.	Prepare the Detailed Project Report for given Product Solve real life problems by application of acquired knowledge and skills Presentation in 5 to 10 Power Point Slides	– Project work & Power Point Presentation
30.	Identify the Ceramic raw material by Physical properties	Geology & Mineralogy Lab
31.	Make & Melt the Glass, Enamel Batch & Coating	Glass, Enamel & Ceramic Coating Lab
32.	Understand the making different type of Model / Shape and Mould	Modeling & Mould Lab
33.	Understand/testing of Pottery & Refractory Ware's properties, composition	Pottery & Refractory Lab
34.	Analysis of Ceramic Raw material	Silicate Analysis Lab
35.	Know the Physical Properties of Ceramic ware/ body	Physical Testing of Ceramic Lab
36.	Understand/testing of Glass, Enamel & Cement Ware's properties, composition	Glass & Ceramic Workshop Practice (Glass, Enamel & Cement) Lab
37.	Use energy conservation methods to manage energy efficiency and prevention of environment	– Energy Conservation Lab – Environmental Studies Lab – Universal Human Values Lab
38.	Evaluate the activity except the Students	– Student Centred Activities (SCA)

5. Abstract of Curriculum Areas

(a) General Studies

1. Communication Skills
2. Energy Conservation
3. Environmental Studies
4. Universal Human Values
5. Industrial Management and Entrepreneurship Development

(b) Applied Sciences

1. Applied Mathematics
2. Applied Physics
3. Applied Chemistry

(c) Basic Courses in Engineering / Technology

1. Engineering Drawing-I
2. General Workshop Practice
3. Basic of Electrical, Mechanical & Civil Engineering
4. Basic of Information Technology

(d) Applied Courses in Engineering / Technology

1. Applied Chemistry-II
2. Applied Mechanics

3. Introduction to Glass & Ceramic Engg.
4. Industrial Operation / Unit Operation
5. Industrial Calculation
6. Pottery & Refractory
7. Glass, Enamel & Ceramic Coating
8. Engineering Drawing –II
9. Elementary Geology & Mineralogy
10. Fuel Furnace & Pyrometers
11. Pottery & Porcelain-I
12. Refractory Technology
13. Glass Technology-I
14. Modern Ceramic & Its Application
15. Lime & Cement Technology
16. Ceramic Machinery & Furnace Expose
17. Engineering Drawing-III

(e) Industrial Training

1. Field Exposure –I (One week)
2. Industrial Tour/ Visit
3. Industrial Training – 2 Weeks
4. Industrial Training – 3 Weeks
5. Project work & Power Point Presentation

(f) Elective

1. Pottery Porcelain-II
2. Glass Technology-II

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No	Subjects	Distribution in Periods Per week in Various Semesters					
		I	II	III	IV	V	VI
1	Communication Skills (Theory + Lab)	4+2	-	-	4+2	-	-
2	Applied Mathematics	5	5	-	-	-	-
3	Applied Physics (Theory + Lab)	5+2	5+2	-	-	-	-
4	Applied Chemistry (Theory + Lab)	5+2	-	-	-	-	-
5	Applied Mechanics (Theory + Lab)	-	5+2	-	-	-	-
6	Applied Chemistry-II	-	-	5	-	-	-
7	Engineering Drawing-I, II, III	8	-	-	8	-	8
8	Basic of Information Technology	6	-	-	-	-	-
9	General Workshop Practice	8	8	-	-	-	-
10	Introduction to Glass & Ceramic Engg.	-	6	-	-	-	-

11	Elementary of Electrical, Mechanical and Civil Engg.	-	6+4	-	-	-	-
12	Industrial Operation / Unit Operation	-	-	4	-	-	-
13	Industrial Calculation	-	-	5	-	-	-
14	Fuel Furnace & Pyrometers	-	-	5	-	-	-
15	Environmental Studies (Theory + Lab)	-	-	3+2			
16	Pottery & Refractory (Theory + Lab) –I, II	-	-	6+8	-	0+8	-
17	Modeling & Mould Lab	-	-	0+8	-	-	-
18	Glass, Enamel & Ceramic Coating (Theory + Lab)	-	-	-	6+8	0+8	-
19	Elementary Geology & Mineralogy (Theory + Lab)	-	-	-	6+2	-	-
20	Energy Conservation (Theory + Lab)	-	-	-	4+2	-	-
21	Universal Human Values (Tutorial + Lab)	-	-	-	2+2	-	-
22	Industrial Management & Entrepreneurship	-	-	-	-	5	-
23	Pottery & Porcelain-I	-	-	-	-	6	-
24	Refractory Technology	-	-	-	-	6	-
25	Glass Technology-I	-	-	-	-	6	-
26	Modern Ceramic & Its Application	-	-	-	-	6	-
27	Lime & Cement Technology	-	-	-	-	-	6
28	Ceramic Machinery & Furnace/Kiln Expose	-	-	-	-	-	6
39	**Elective -** Pottery Porcelain-II / Glass Technology-II	-	-	-	-	-	6
30	Silicate Analysis Lab	-	-	-	-	-	8
31	Physical Testing Of Ceramic Lab.	-	-	-	-	-	8
32	Project work & Power Point Presentation	-	-	-	-	-	2
33	Employability Skills	-	-	-	-	-	2
34	Field Exposure/Industrial Training/ Tour/visit	-	2	-	-	-	-
35	Student Centred Activities (SCA)	1	3	2	2	3	2

7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN GLASS AND CERAMIC ENGINEERING

Note – 1. Each period will be 50 minutes duration. 2. Each session will be of 16 weeks But Effective teaching will be at least 14 weeks

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	G.Total
1.1	*Communication Skills-I	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
1.2	*Applied Mathematics – I	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
1.3	*Applied Physics – I	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.4	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.5	*Engineering Drawing-I	-	-	8	2	-	40	40	60	3	-	-	60	100
1.6	*Basic of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
1.7	*General Workshop Practice-I	-	-	8	2	-	40	40	-	-	60	4	60	100
	#Student Centered Activities (SCA)	-	-	1	1	-	30	30	-	-	-	-	-	30
	Total	**19**		**29**	**26**	**80**	**180**	**260**	**260**		**180**		**440**	**700**

* Common with other diploma programmes

\# Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	Marks in Evaluation Scheme								Total Marks of Internal & External
						Internal Assessment			External Assessment					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	G. Total
2.1	*Applied Mathematics-II	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
2.2	*Applied Physics-II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.3	*Applied Mechanics	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.4	Introduction to Glass & Ceramic Engg.	4	2	-	6	20	-	20	50	2 ½	-	-	50	70
2.5	Elementary of Electrical, Mechanical and Civil Engg.	6	-	4	6	20	20	40	50	2 ½	40	3	90	130
2.6	*General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100
2.7	Lab & Field Exposure-I (One Week)	-	-	2	-	-	20	20	-	-	30	Viva	30	50
	#Student Centered Activities	-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**25**	**2**	**21**	**30**	**100**	**130**	**230**	**250**		**170**		**420**	**650**

* Common with other diploma programmes

➢ Common with diploma in Chemical Engg.

\# Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Note: Field Exposure-I for 1 week should be carried out/Complete after first semester exam during evaluation vacation/Period

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	Marks in Evaluation Scheme								Total Marks of Internal & External
						Internal Assessment			External Assessment					
		L	**T**	**P**		Th	Pr	**Tot**	Th	Hrs	Pr	Hrs	**Tot**	**G. Total**
3.1	*Applied Chemistry-II	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
3.2	➢ Industrial Operation	4	-	-	4	20	-	20	50	2 ½	-	-	50	70
3.3	➢ Industrial Calculation	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
3.4	Pottery & Refractory	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
3.5	Fuel Furnace & Pyrometers	6	-	8	6	20	30	50	50	2 ½	60	6	110	160
3.6	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
3.7	Modeling & Moulding Lab	-	-	8	2	-	20	20	-	-	40	4	40	60
3.8	Industrial Tour/ Visit	-	-	-	-	-	20	20	-	-	-	-	-	20
	#Student Centered Activities	-	-	2	1	-	30	30	-	-	-	-	-	30
Total		28	-	20	31	120	110	**230**	300		120		**420**	**650**

* Common with other diploma Programmes

➢ Some Subject Common with diploma in Chemical Engg.

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Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Note: Industrial Tour / Visit should be complete during third semester.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	Marks in Evaluation Scheme								Total Marks of Internal & External
						Internal Assessment			External Assessment					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	G. Total
4.1	*Communication Skills-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	Glass, Enamel & Ceramic Coating	6	-	8	6	20	30	50	50	2 ½	60	6	110	160
4.3	Glass & Ceramic Engg, Drawing –II	-	-	8	2	20	-	20	50	3	-	-	50	70
4.4	Elementary Geology & Mineralogy	6	-	2	6	20	20	40	50	2 ½	40	3	90	130
4.5	*Energy Conservation	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.6	*Universal Human Values	-	2	2	2	-	20	20	-	-	30	3	30	50
4.7	Industrial Training –2 Weeks	-	-	-	-	-	20	20	-	-	40	-	40	60
	#Student Centered Activities	-	-	2	1	-	30	30	-	-	-	-	-	30
	Total	20	2	26	25	100	140	**240**	250		210		**460**	**700**

* Common with other diploma Programmes

Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography, seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Note: Industrial Training for 2 weeks should be carried out/Complete after third semester exam during evaluation vacation/Period

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	Marks in Evaluation Scheme								Total Marks of Internal & External
						Internal Assessment			External Assessment					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	G. Total
5.1	*Industrial Management & Entrepreneurship Development	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
5.2	Pottery & Porcelain-I	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
5.3	Refractory Technology	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
5.4	Glass Technology-I	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
5.5	Modern Ceramic & Its Application	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
5.6	Pottery & Refractory Lab -II	-	-	8	2	-	30	30	-	-	70	6	70	100
5.7	Glass, Enamel & Ceramic Coating Lab-II	-	-	8	2	-	30	30	-	-	70	6	70	100
5.8	Industrial Training – 3 Weeks	-	-	-	-	-	30	30	-	-	40	Viva	40	70
	#Student Centered Activities	-	-	3	1	-	30	30	-	-	-	-	-	30
	Total	29	-	19	34	100	120	**220**	250		180		**430**	**650**

* Common with other diploma Programmes

\# Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Note: Industrial Training for 3 weeks should be carried out/Complete after Fourth semester exam during evaluation vacation/Period

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	Marks in Evaluation Scheme								Total Marks of Internal & External
						Internal Assessment			External Assessment					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	G. Total
6.1	Lime & Cement Technology	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
6.2	Ceramic Machinery & Kiln/Furnace Expose	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
6.3	Glass & Ceramic Engineering Drawing-III	-	-	8	2	20	-	20	50	3	-	-	50	70
6.4	**Elective (Any One)	6	-	-	6	20	-	20	50	2 ½	-	-	50	70
6.5	Silicate Analysis Lab	-	-	8	2	-	20	20	-	-	40	3	40	60
6.6	Physical Testing of Ceramic lab	-	-	8	2	-	30	30	-	-	60	3	60	90
6.7	Project work & Power Point Presentation	-	-	2	2	-	30	30	-	-	80	Viva	80	110
6.8	Employability Skills	-	-	2	2	-	20	20	-	-	30	Viva	30	50
6.9	Industrial Tour/ Visit	-	-	-	-	-	30	30	-	-	-	-	-	30

#Student Centered Activities			2	1	-	30	30	-	-	-	-	-	30
Total	18	-	30	29	80	160	**240**	200		210		**410**	**650**

** Elective (Any one of the following)

Glass Technology-II OR Pottery & Porcelain-II

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Note: Industrial Tour / Visit should be complete during Sixth Semester.

8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

8.1 Guidelines for Assessment of Student Centred Activities (SCA)

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 10 Marks for general behavior and **discipline**
(by HODs in consultation with all the teachers of the department)

ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	2 Marks
b)	80 - 85%	4 Marks
c)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	State/National Level participation
b)	10	-	Participation in two of above activities
c)	5	-	Inter-Polytechnic level participation

8.2 Guidelines for Internal Assessment

- The distribution of marks for Internal Assessment in theory subjects shall be made as per the following guidelines:
  i. 60% of internal assessment shall be based on the performance in the house tests. At least three such tests shall be conducted during the semester out of which best two shall be counted for assessment.
  ii. 20% marks shall be given based on performance in seminar, group discussion etc. by assessing the technical and communication skills of the student.
  iii. 20% marks shall be given for attendance/punctuality in the subject concerned and for assignments, in equal proportion.
- The distribution of marks for Internal Assessment in practical subjects shall be made as per the following guidelines:
  i. 60% marks shall be awarded for performance in practical
  ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
  iii. 20% marks shall be for Viva-voce conducted during the practical.

Note: There should be no marks for attendance in the internal sessional of different subjects.

I Semester

1.1 COMMUNICATION SKILLS – I

L	T	P
4	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension

.

DETAILED CONTENTS

1 Basics of Communication (13 periods)
- 1.1 Definition and process of communication
- 1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal
- 1.3 Communications barriers and how to overcome them
- 1.4 Barriers to Communication, Tools of Communication

2 Application of Grammer (18 periods)
- 2.1 Parts of Speech (Noun, verb, adjective, adverb) and modals
- 2.2 Sentences and its types
- 2.3 Tenses
- 2.4 Active and Passive Voice
- 2.5 Punctuation
- 2.6 Direct and Indirect Speech

3 Reading Skill (10 periods)

Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

4 Writing Skill (15 periods)
- 4.1 Picture composition
- 4.2 Writing paragraph
- 4.3 Notice writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.
Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Listening and Speaking Exercises

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.

INSTRUCTIONAL STRATEGY
Student should be encouraged to participate in role play and other student centred activities in class room and actively participate in listening exercises

MEANS OF ASSESSMENT
- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria & Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

Websites for Reference:

1. http://www.mindtools.com/ page 8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	13	24
2	18	32
3	10	16
4	15	28
Total	**56**	**100**

1.2 APPLIED MATHEMATICS - I

L	T	P
5	-	-

RATIONALE

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Apply Binomial theorem to solve engineering problems
- Apply determinants properties and Crammer's rule to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems
- Use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- Find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

DETAILED CONTENTS

1. Algebra -I (12 Periods)

   1.1 Series : AP and GP; Sum, nth term, Mean

   1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.

   1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule

2. Algebra- II (12 Periods)

   2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.

   2.2 Complex number.
   Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. Trigonometry (10 Periods)

   3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relationship between sides and angle of a triangle.

   3.2 Inverse circular functions : Simple case only

4. Differential Calculus - I (18 Periods)

4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logaritimic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.

5. Differential Calculus - II (18 Periods)

5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.

5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

INSTRUCTONAL STRATEGY

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content**.**

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-I by Chauhan and Chauhan, Krishna Publications, Meerut**.**
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

UGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	12	20
2	12	20
3	10	12
4	18	24
5	18	24
Total	**70**	**100**

1.3 APPLIED PHYSICS – I

L	T	P
5	-	2

RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

After undergoing this course, the students must be able to:

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc. .
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

DETAILED CONTENTS

1. Units and Dimensions (10 Periods)

   1.1 Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
   1.2 Dimensions and dimensional formulae of physical quantities.
   1.3 Principle of homogeneity of dimensions
   1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
   1.5 Limitations of dimensional analysis
   1.6 Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.
   1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc (at least two each).

2. Force and Motion (10 periods)

   2.1 Scalar and vector quantities – examples, representation of vector, types of vectors
   2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
   2.3 Resolution of Vectors and its application to lawn roller.
   2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
   2.5 Impulse and its Applications
   2.6 Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
   2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
   2.8 Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.
   2.9 Application of various forces in lifts, cranes, large steam engines and turbines

3. Work, Power and Energy (10 periods)

   3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,
   3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
   3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.
3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
3.6 Power and its units, calculation of power in numerical problems
3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

4 Rotational Motion (10 periods)

4.1 Concept of translatory and rotatory motions with examples
4.2 Definition of torque with examples
4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples
4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.
4.5 Rotational kinetic energy, Rolling of sphere on the slant plane,
4.6 Comparison of linear motion and rotational motion.
4.7 Application of rotational motions in transport vehicles, and machines.

5 Motion of planets and satellites (08 periods)

5.1 Gravitational force, Kepler's law of planetary motion,
5.2 Acceleration due gravity and its variation,
5.3 Gravitational Potential and Gravitational potential energy,
5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity,
5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology,
5.6 Concept of Black Holes

6. Properties of Matter (12 periods)

6.1 Elasticity: definition of stress and strain, different types of modulii of elasticity, Hooke's law, significance of stress strain curve
6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
6.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension
6.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications.

7. Heat and Thermodynamics (10 periods)

7.1 Difference between heat and temperature
7.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
7.3 Different scales of temperature and their relationship

7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co-efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.
7.6 Isothermal and Adibatic process
7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.
7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS (to perform minimum six experiments)

1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.
2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.
3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
4 To verify parallelogram law of forces
5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.
6 To find the Moment of Inertia of a flywheel about its axis of rotation
7 To determine the atmospheric pressure at a place using Fortin's Barometer
8 To determine the viscosity of glycerin by Stoke's method
9 To determine the coefficient of linear expansion of a metal rod
10 To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSEMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voce

RECOMMENDED BOOKS

1 Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi

4 B.Sc.Practical Physics by C L Arora, S. Chand Publication..
5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6 Engineering Physics by DK Bhhatacharya & Poonam Tandan; Oxford University Press, New Delhi
7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8 V. Rajendran,physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10 Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

TOPIC WISE DISTRIBUTION OF PERIODS AND MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	10	15
3	10	15
4	10	15
5	08	10
6	12	16
7	10	14
Total	**70**	**100**

1.4 APPLIED CHEMISTRY

L	T	P
5	-	2

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and their relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select polymer/rubber/plastic materials for engineering applications.

DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)

   1.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
   1.2 Bohr's model of atom and successes and limitations of atomic theory (qualitative treatment only).
   1.3 Atomic number, atomic mass number isotopes and isobars.
   1.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
   1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
   1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)

1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma (σ) and pi (π) covalent bonds in H_2, HCl, Cl_2, elementary idea of hybridization in $BeCl_2$, BF_3, CH_4, NH_3 and H_2O, VSEPR, Molecular orbital Theory

1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding- explanation with the help of electron gas (sea) model.

2. Fuels and Lubricants (18 periods)

2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels

2.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.

2.3 Coal - types of coal and proximate analysis of coal

2.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers

2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.

2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.

2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.

2.8 Synthetic lubricants and cutting fluids.

3. Water (14 periods)

3.1 Demonstration of water resources on Earth using pie chart.

3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.

3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water. Primming and foaming and caustic embrittlement in boilers.

3.4 Removal of hardness -Permutit process and Ion-exchange process.

3.5 Physico-Chemical methods for Water Quality Testing

a) Determination of pH using pH meter, total dissolved solids (TDS)

b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).

c) Understanding of Indian Water Quality standards as per WHO

3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.

3.7 Municipality waste water treatment. Definition of B.O.D and C.O.D.

4. Electrochemistry (4 periods)

Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrobytes); Nernst equation.

5. Corrosion and its Control (10 periods)

5.1 Definition of corrosion and factors affecting corrosion rate.

5.2 Theories of
   a) Dry (chemical) corrosion- Pilling Bedworth rule
   b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism
5.3 Definition of passivity and galvanic series
5.4 Corrosion control:
   a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel – Application of Metal Zn (Sheradizing),Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage
   b) Inorganic coatings – Anodizing and phosphating,
   c) Organic coatings - use of paints varnishes and enamels
   d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

6. Organic compounds, Polymers and Plastics (10 periods)

6.1 Classification of organic compounds and IUPAC Nomenclature
6.2 Definition of polymer, monomer and degree of polymerization
6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)
6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics
6.5 Applications of polymers in industry and daily life

LIST OF PRACTICALS

1. Estimation of total hardness of water using standard EDTA solution
2. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution
3. Proximate analysis of solid fuel)
4. Estimation of temporary hardness of water sample by O' Hener's Method.
5. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

MEANS OF ASSEMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voce

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1.	14	20
2.	18	24
3.	14	20
4.	4	6
5.	10	15
6.	10	15
Total	**70**	**100**

1.5 ENGINEERING DRAWING - I

L	T	P
-	-	8

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

i) First angle projection is to be followed

ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD

iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)

1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.

1.2 Different types of lines in Engineering drawing as per BIS specifications

1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4

2. Dimensioning Technique (01 sheet)

2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)

2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches

3. Scales (02 sheets)

3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale

3.2 Drawing of plain and diagonal scales

4. Orthographic Projections (06 sheets)

4.1 Theory of orthographic projections (Elaborate theoretical instructions)

4.2 Projection of Points in different quadrant

4.3 Projection of Straight Line (1st and 3rd angle)

4.3.1. Line parallel to both the planes

4.3.2. Line perpendicular to any one of the reference plane

4.3.3. Line inclined to any one of the reference plane.

4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only

4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)

4.6 Identification of surfaces

5 Projection of Solid (02 sheets)

5.1. Definition and salient features of Solid

5.2. Types of Solid (Polyhedron and Solid of revolution)

5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.

6. Sections (02 sheets)

6.1 Importance and salient features

6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.

6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections

6.4 Orthographic sectional views of different objects.

7. Isometric Views (02 sheets)

7.1 Fundamentals of isometric projections and isometric scale.

7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.

8. Common Symbols and Conventions used in Engineering (02 sheets)

8.1 Civil Engineering sanitary fitting symbols
8.2 Electrical fitting symbols for domestic interior installations

*9. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

* **Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	14	15
2	18	15
3	14	15
4	14	10
5	14	10
6	12	10
7	10	10
8	8	8

9	8	7
Total	**112**	**100**

1.6 BASICS OF INFORMATION TECHNOLOGY

L	T	P
-	-	6

RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools(Google suits)

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. **Introduction to Computers and Peripherals.**
   Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD,Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

2. **Operation System and Application Software**
   System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/Libreoffice, Working with window, Desktop components, Menu bars, creating shortcut of program. Installation of Application softwares, Antivirus and Drivers.

3. **Word Processing, Spreadsheet and Presentation**
   Usage and creation of word document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc. Google presentation)

.

4. **Internet**
   Basics of Networking – LAN, WAN, Wi-Fi technologies, Concept of IP Addrsses, DNS, Search Engines, e-mail, Browsing and cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of various application software and peripheral drivers
3. Installation of operating system (windows/linux/others)
4. Creation and Management (Rename, delete, search of file and folders)
5. Installation of Antivirus and remove viruses
6. Scanning and printing documents
7. Browsing, Downloading, Information using Internet
8. E-Mail ID creation, comparing, sending and receiving e-mail. Attaching a file with e-mail message.
9. Word Processing (MS Office/Open Office)
   a) File Management
      - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file
   b) Page set up
      - Setting margins, tab setting, ruler, indenting
   c) Editing a document
      - Entering text, cut, copy, paste using tool- bars
   d) Formatting a document
      - Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
      - Aligning of text in a document, justification of document, inserting bullets and numbering

- Formatting paragraph, inserting page breaks and column breaks, line spacing
- Use of headers, footers: Inserting footnote, end note, use of comments, autotext
- Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders
- Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
- Print preview, zoom, page set up, printing options
- Using find, replace options

f) Using Tools like
- Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and lables
- Using shapes and drawing toolbar,
- Working with more than one window .

10. Spread Sheet Processing (MS Office/Open Office/Libre Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

b) Menu commands:

Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

c) Work books:

Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations

Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

d) Creating a chart:

Working with chart types, changing data in chart, formatting a chart, use chart to analyze data

Using a list to organize data, sorting and filtering data in list

e) Retrieve data with query:

Create a pivot table, customizing a pivot table. Statistical analysis of data

f) Exchange data with other application:

Embedding objects, linking to other applications, import, export document.

11. PowerPoint Presentation (MS Office/Open Office/Libre office)

a) Introduction to PowerPoint
- How to start PowerPoint
- Working environment: concept of toolbars, slide layout & templates.
- Opening a new/existing presentation
- Different views for viewing slides in a presentation: normal, slide sorter.

b) Addition, deletion and saving of slides

c) Insertion of multimedia elements
- Adding text boxes
- Adding/importing pictures
- Adding movies and sound
- Adding tables and charts etc.

- Adding organizational chart
- Editing objects
- Working with Clip Art

d) Formatting slides
- Using slide master
- Text formatting
- Changing slide layout
- Changing slide colour scheme
- Changing background
- Applying design template

12. Google Suits
Using Google drive, Google shut, Google docs, Google slides.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

MEANS OF ASSESSMENT

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi

2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi

3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi

4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.

5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi

8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

9. On Your Marks - Net…Set…Go… Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi

10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Reference websites

1. www. Tutorialspoint..com
2. www.sf.net

3. Gsuite.google.com
4. Spoken-tutorial.org
5. Swayam.gov.in

1.7 GENERAL WORKSHOP PRACTICE – I

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

L	T	P
-	-	8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop

4. Welding Shop
5. Plumbing Shop

1. CARPENTRY SHOP

1.1 General Shop Talk

1.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials

1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.

1.1.3 Specification of tools used in carpentry shop.

1.1.4 Different types of Timbers, their properties, uses & defects.

1.1.5 Seasoning of wood.

1.2. Practice

1.2.1 Practices for Basic Carpentry Work

1.2.2 Sawing practice using different types of saws

1.2.3 Assembling jack plane—Planning practice including sharpening of jack plane cutter

1.2.4 Chiselling practice using different types of chisels including sharpening of chisel

1.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.

1.3 Job Practice

Job I	Marking, sawing, planning and chiselling and their practice
Job II	Half Lap Joint (cross, L or T – any one)
Job III	Mortise and Tenon joint (T-Joint)
Job IV	Dove tail Joint (Lap or Bridle Joint)

1.4. Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

2. PAINTING AND POLISHING SHOP

2.1. Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.

2.2. Job Practice

Job I: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Job II: To prepare metal surface for painting, apply primer and paint the same.

Job III: To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

i) Abrasive cutting by leather wheel

ii) Polishing with hard cotton wheel and with polishing material

iii) Buffing with cotton wheel or buff wheel.

3. ELECTRICAL SHOP

3.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.

3.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.

3.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.

3.4 Introduction to the construction of lead acid battery and its working.

Job III Installation of battery and connecting two or three batteries in series and parallel.

3.5 Introduction to battery charger and its functioning.

Job IV Charging a battery and testing with hydrometer and cell tester

4. WELDING SHOP

4.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

4.2 Job Practice

Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).

Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

5. PLUMBING SHOP

5.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.

5.2. Introduction and demonstration of tools, equipment and machines used in plumbing shop.

5.3. Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.

5.4. Job Practice

Job I : Preparation of job using elbow, bend and nipple

Job II : Preparation of job using Union, Tap, Plug and Socket.

Job III: Threading practice on pipe with die

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.

4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

II Semester **2.1 APPLIED MATHEMATICS - II**

L	T	P
5	-	-

RATIONALE

Basic elements of integral calculus, differential calculus, numerical methods, differential m equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

DETAILED CONTENTS

1. Integral Calculus - I (20 Periods)

   Methods of Indefinite Integration :-

   1.1 Integration by substitution.
   1.2 Integration by rational function.
   1.3 Integration by partial fraction.
   1.4 Integration by parts.
   1.5 Integration of special function

2. Integral Calculus - II: (20 Periods)

   2.1 Meaning and properties of definite integrals, Evaluation of definite integrals..
   2.2 Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.
   2.3 Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

3. Co-ordinate Geometry (2 Dimension) (18 Periods)

   3.1 Circle

   Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

4. Co-ordinate Geometry (3 Dimension) (12 Periods)

   4.1 Straight lines and planes in space

   Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

INSTRUCTONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4 Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	20	28
2	20	28
3	18	24
4	12	20
Total	**70**	**100**

2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and its measurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- Explain Biot-Savart Law, Ampere's law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor
- Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

DETAILED CONTENTS

1. Wave motion and its applications (12 periods)

1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application

1.2 Wave equation y = r sin wt, phase, phase difference, principle of superposition of waves

1.3 Simple Harmonic Motion (SHM): definition and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., simple pendulum, concept of simple harmonic progressive wave,

1.4 Free, Damped and forced oscillations, Resonance with examples, Q-factor

1.5 Definition of pitch, loudness, quality and intensity of sound waves, intensity level, Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building defects and remedy.

1.6 Ultrasonic –production, detection, properties and applications in engineering and medical applications.

2. Wave Optics (6 periods)

2.1 Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, Power of lens, magnification.

2.2 Two-Source Interference, Double-Slit interference, Interference due to thin films, Fresnel's biprism.

2.3 use of interference making highly efficient solar panel.

2.4 diffraction, Single Slit diffraction, Intensity calculation etc

2.5 Polarization of electromagnetic waves, polarizing sheets, polarizing by Reflection (Browser's law), Malus law, use of polariods.

3. Electrostatics (12 periods)

3.1 Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.

3.2 Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals), charging and discharging of a capacitor.

3.4 Dielectric and its effect on capacitance, dielectric break down.

3.5 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)

4. Current Electricity (12 periods)

4.1 Electric Current, Resistance, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.

4.2 Kirchhoff's laws, Wheatstone bridge and its applications (meter bridge and slide wire bridge)

4.3 Concept of terminal potential difference and Electro motive force (EMF), potentiometer.

4.4 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy

4.5 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.

5. Magneto Statics and Electromagnetism (12 periods)

5.1 Magnetic poles, force on a moving charge, circulating charges, force on a current carrying wire, Hall effect, torque on a current loop.

5.2 Magnetic field due to moving charge(Biot-Savart Law), due to current (Biot-Savart Law), parallel currents, field of a solenoid, Ampere's law.

5.3 Faraday's law, Lenz' law, motional emf, induced electric fields.
5.4 Magnetic dipole and force on a magnetic dipole in a non-uniform field, Magnetization, Gauss' law for magnetism.
5.5 Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
5.6 Application of electromagnetism in ac/dc motors and generators.

6. Semiconductor physics (8 periods)
6.1 Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics
6.2 Diode as rectifier – half wave and full wave rectifier (centre taped),
6.3 Semiconductor transistor, pnp and npn (concepts only)
6.4 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.

7. Modern Physics (8 Periods)
7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.
7.2 Fibre optics: Total internal reflection and its applications, Critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture, types and applications of optical fibre in communication.
7.3 Introduction to nanotechnology, nanoparticles and nano materials,

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To find the focal length of convex lens by displacement method.
3. To find the refractive index of the material of given prism using spectrometer.
4. To find the wavelength of sodium light using Fresnel's biprism.
5. To verify laws of resistances in series and parallel combination
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw hysteresis curve of a ferromagnetic material.
10. To draw characteristics of a pn junction diode and determine knee and break down voltages.
11. To find wave length of the laser beam.
12. To find numerical aperture of an optical fiber.

INSTRUCTIONAL STATREGY
Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT
- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,

- Actual Lab & Practical Work,
- Viva-Voice

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	18
2	6	8
3	12	18
4	12	16
5	12	16
6	8	12
7	8	12
Total	**70**	**100**

2.3 APPLIED MECHANICS

L	T	P
5	-	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1. Introduction (06 periods)
   - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
   - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
   - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration
   - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 periods)
   - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
   - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition
   - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
   - 2.4 Free body diagram
   - 2.5 Equilibrant force and its determination
   - 2.6 Lami's theorem (concept only)

     [Simple problems on above topics]
   - 2.7 Type of Load, supports, Beams- analysis for simply supported, cantilever beams

3. Moment (14 periods)
   3.1 Concept of moment
   3.2 Moment of a force and units of moment
   3.3 Varignon's theorem (definition only)
   3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
   3.5 Parallel forces (like and unlike parallel force), calculating their resultant
   3.6 Concept of couple, its properties and effects
   3.7 General conditions of equilibrium of bodies under coplanar forces
   3.8 Position of resultant force by moment
   [Simple problems on the above topics]

4. Friction (14 periods)
   4.1 Definition and concept of friction, types of friction, force of friction
   4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
   4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
   4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane Horizontally
b) At some angle with the inclined plane

5. Centre of Gravity (10 periods)
   5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
   5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
   5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
   [Simple problems on the above topics]
6. Simple Machines (14 periods)
   6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
   6.2. Simple and compound machine (Examples)
   6.3. Definition of ideal machine, reversible and self locking machine
   6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
   6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
   6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
   [Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

INSTRUCTIONAL STRATEGY

Applied Mechanics being a fundamental subject, the teacher are expected to emphasize on the application of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid and end-term written tests
- Model/prototype making.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham,Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. A Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	8
2	12	18
3	14	20
4	14	20
5	10	14
6	14	20
Total	**70**	**100**

2.4 INTRODUCTION TO GLASS & CERAMIC ENGINEERING

L	T	P
4	2	-

RATIONALE:

The study of the subject is required to introduce the students with the materials used in ceramic engineering i.e. glass, enamel, pottery, refractory & cement. The only elementry knowledge of the raw materials used in different fields of ceramic industry and their applications is kept in the subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Basic idea about Glass & Its raw material
- How makes the Glass
- How many types of Glasses
- Basic idea about Enamel & Its raw material
- Basic idea about Pottery & Its raw material
- Basic idea about Refractory & Its raw material
- Basic idea about Special/Modern Ceramic

DETAILED CONTENTS

1. Glass

1.1 History of Glass
1.2 Elementary knowledge of raw materials
1.3 Manufacturing process of glass by flow chart
1.4 Types of glass - container glass, sheet glass, plate glass, bulb glass, laboratory ware glass,
1.5 Decoration of Glass, types/method of decoration

2. Enamel

2.1 history of Enamel, Definition of Enamel
2.2 Elementary knowledge of Enamel's raw materials
2.3 Manufacturing process of Enamel Slip
2.4 Making of enamel frits by quenching process
2.5 Classification of Enamels and their applications
2.6 Application methods of enamels

3. Pottery-

3.1 History of pottery
3.2 Definition of pottery
3.3 Elementary knowledge of raw materials .
3.4 Manufacturing methods of pottery wares with flow chart
3.5 Types of pottery wares- White wares as Earthen ware, stone ware, sanitary wares, Porcelain, and terracotta
3.6 Uses of pottery wares

4 Refractory

4.1 History of refractory
4.2 Definition of refractory materials
4.3 Elementary knowledge of raw materials considered as refractories ,
4.4 types of refractory acid refractory ,basic refractory , neutral refractory.
4.5 Manufacturing method of refractory
4.6 Properties of refractory bricks
4.7 Applications of refractory bricks

5 Cements-
5.1 History of cements
5.2 Definition of cements
5.3 Elementary idea of cements , raw materials
5.4 Types of cements
5.5 Manufacturing methods of cements by different methods
5.6 Application of Cement

6. Composites- Introduction to Ceramic Composites, Classification of composites, Properties & application, Define Cermet, application

7. **Electronic Ceramics**- Ceramic Capacitor, transistor, Piezo Electric Ceramic

8. **Non Oxide Ceramic** - Define & classify with example

INSTRUCTIONAL STATREGY
Teacher should show Raw material of Glass, Pottery wares, Enameled ware/Enameled Iron sheet, Refractory brick etc. The raw material should be show in both form Lumps & Grain/powder.

MEANS OF ASSEMENTS
- Assignments and Quiz/Class Tests
- End-term Written Tests
- Viva-Voce

RECOMMENDED BOOKS
1. Elementry of Ceramic Engineering by B.L. Yadav
2. Elements of Ceramics by F.H.Norton
3. Introduction to Glass Science Technology by James E. Shelby
4. Enamels by Andrewl & Andrewl
5. Technology of Enamels by V.I Vargin

TOPIC WISE DISTRIBUTION OF PERIODS AND MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	8	15
3	8	15
4	8	15
5	8	15
6	5	10

7	5	10
8	4	5
Total	**56**	**100**

2.5 ELEMENTARY ELECTRICAL, MECHANICAL & CIVIL ENGG.

L	T	P
6	-	4

RATIONALE

Glass & Ceramic Engineering Diploma holder has to interact with engineering and technicians in the Field of mechanical, electrical & civil engineering. This subject has been kept in the curriculum to provide a general introduction to mechanical, electrical & civil engineering elements. Teachers should lay more emphasis on basic concept while teaching the subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Understand the construction and function D.C. machine & A.C. machine
- Understand the principle of single phase Transformer
- Understand the types of bearing, use of bearing, types & Use of lubricant
- Understand the control systems as mechanical, hydraulic, Pneumatic & Electrical
- Understand how to improve the bearing capacity of soil, how to make the foundation for the Furnace & Kilns

DETAILED CONTENTS

Section A- Electrical Engineering:

1. D.C. Machines -
   Working, Principle, types and applications, Write the Ohm/s law & Kirchhoff's laws

2. Fundamentals of A.C.-
   Definition of Alternating current: Instantaneous value, maximum value, time periods, frequency, R.M.S. value, average value, phase and phase difference, leading and lagging power factor. Concept of 3-phase system: KVA, KVAr, KW, calculation of power consumed in single phase and three phase circuits. Star and delta connection (Line voltage, Line current, phase voltage and phase current only).

3. Transformers -
   Working principle of a signal phase transformer and its applications.

4. A.C. Machines:-
   Motors: Brief idea about construction, starting methods and applications (excluding winding details of single phase induction motors), three phase induction motors (squirrel cage & slip ring type).

5. Electrical Measuring Instruments:
   Ammeter, voltmeter, wattmeter and induction type energy meters (single phase only), meggars, multimeters. Temperature measuring thermocouple, Resistance, thermometer, Furnace Electrification.

Section B- Mechanical Engineering:

I. Internal combustion engines, classification of I.C. engines, mechanism of I.C. engine. Classification of control systems: mechanical, hydraulic, pneumatic and electrical, working and uses of simple machines- loaders and lift trucks, conveyors, Excavators , mixing and placing equipments. Combustion table in MM and Inch.

II. Bearing & Lubricants:
Types of Bearings, lubrication of Machines, types of lubricants, basic rules of lubrication. Properties of a good lubricant.

III. Safety and Accident Prevention:
Safety organization, prevention of accidents due to mechanical causes, safety in operation of electrical equipments, fire precaution of storage of lubricants.

Section C- Civil Engineering

Selection of site for location of a factory, orientation of a factory building, nature of soils and bearing capacity, Improving bearing capacities,

Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines.

Foundation materials for the construction of furnaces and kilns. Construction of kilns and furnace walls. Arches and domes etc.

Concrete- Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete, placing and curing of concrete.

RCC- Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building.

LIST OF PRACTICALS

NOTE: Do any eight. At least four from each section.

Sec. A. Electrical

1. To study the constructional details of a DC machine.
2. To measure power & calculate power factor of single phase load using ammeter, voltmeter and wattmeter.
3. To start a 3 phase induction motor with the help of star-delta starter.
4. To study the constructional details of (a) Moving iron (b) Moving coil measuring instruments.
5. Connect ammeter, voltmeter, wattmeter and energy meter to a single phase load and measure current voltage, power and energy for a given time.
6. Simple C.T.S. wiring up to 2 points only.
7. Identification of Resistor, Capacitor, Transformer,

Sec. B. Mechanical

1. To study the various types of lubrication system used in machines.
2. To study and sketch different types of bearings.
3. To study and sketch of both types Tensile and Compressive spring

4. To study and sketch 4-stroke and 2-stroke engines
5. Calibrate pressure gauge by using dead weight tester
6. To draw the characteristics curve of proportional temperature control.
7. To study closed loop automatic control setup and draw its block or circuit diagram.

Sec. C. Civil

1. Testing of bricks
   a) Shape and size
   b) Soundness test
   c) Water absorption
   d) Crushing strength
2. Testing of concrete
   a) Slump test
   b) Compressive Strength of concrete cube
3. The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works.

INSTRUCTIONAL STRATEGY

- Sketches
- Drawing
- Showing the models

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Textbook of Concrete Technology 2nd Edition, by Kulkarni, PD Ghosh TK and hull, YR; New Age International(P) Ltd, Publishers, New Delhi
2. Materials of Construction by Ghosh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Concrete Technology by J.Jha and Sinha; Khanna Publishers, Delhi
5. Building Construction by Jha and Sinha; Khanna Publishers, Delhi
6. Building Construction by Vairani and Chandola; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, New Delhi
8. Soil Mechanics and Foundation Engineering by SK Garg; Khanna Publishers, New
9. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
10. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	35	40
2	35	40
3	14	20
Total	**84**	**100**

2.6 GENERAL WORKSHOP PRACTICE –II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

L	T	P
-	-	8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1 Fitting Shop
2 Sheet Metal Shop
3 Mason Shop
4 Machine Shop

1. FITTING SHOP

Use of personal protective equipment and safety precautions while working. Basic deburring processes.

Introduction to fitting shop tools, marking and measuring devices/equipment.

Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)

Identification of various steel sections (flat, angle, channel, bar etc.).

Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

Job Practice

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of □.25 mm.

Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping

Job IV Drilling and tapping practice on MS Flat.

2. SHEET METAL SHOP

2.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

2.2 Introduction and demonstration of hand tools used in sheet metal shop.

Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

2.3 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanized corrugated sheet, aluminium sheet etc.

2.4 Study of various types of nuts, bolts, rivets, screws etc.

Job Practice

Job I: Shearing practice on a sheet using hand shears.

Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.

Job III :Practice on making Single cover plate chain type, zig-zag type and single riveted Butt Joint.

3 MASON SHOP

3.1 Introduction and importance of Mason shop

3.2 Introduction of tools, equipment and machines used in Mason shop

Job Practice

Job I : Preparation of simple bond

Job II : Preparation of Arched bond

Job III: Preparation of RCC structure (column and beam)

4 MACHINE SHOP

4.1 Study and sketch of lathe machine

4.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.

Plain and step turning and knurling practice.

4.3 Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

2.7 LAB & FIELD EXPOSURE- I (Two week)

Note :- 1 Weeks structured & Supervised branch specific task oriented industrial/field exposure to be organized during Semester break. The students will submit a report. This will be evaluated at institution level for 50 marks - 30 for Viva and 20 for report presented. (See Annexure–I)

ANNEXURE - I

Ceramic Engg. students will undergo a two week Industrial Exposure, (in small scale units at least) after I semester arranged and supervised by the institute staff. They may try their hands on simple tools and machines and will incorporate following points in their reports.

1. Name & Address of the unit

2. Date of
   i. Joining.
   ii. Leaving.

3. Nature of Industry
   i. Product.
   ii. Services.
   iii. Working Hrs.

4. Name of Department
   i. Names of the sections of the unit visited.
   ii. Number of person engaged.
   iii. Activities in the section.
   iv. Name of tools/machines/instruments used. Simple sketch of tools & instruments.
   v. Source of power.

5. Conclusion
   i. What is learnt. (Give on separate field)
   ii. What interested him most. (Give details)

Date
Authorized Signatory

III Semester

3.1 APPLIED CHEMISTRY -II

L	T	P
5	-	-

RATIONALE:

Chemistry has intricate and profound relationship with technology. This curriculum includes those topics of chemistry which enable a technician for better application of technology. Metals and compounds related to ceramic & glass technology are included in the subject to give better understanding of the technology.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Understand the source and use of different compound's in Glass, Enamel, Glaze etc
- Understand the different compound's properties for Glass ,Enamel, Glaze etc.
- Utilize theoretical knowledge for fundamental Glass, Enamel, Pottery etc.
- Identify the coloring oxides and their occurred color in acidic or basic nature.

DETAILED CONTENTS

1. **Compounds of:-**
   (a) Li, Na, K, Cu, Ag, Au.
   (b) Mg, Ca, Sr, Ba, Pb, Cd, Zn.
   (With special referance to their oxides, nitrates, helides, sulphats). their propoerties and application in ceramic industry.

2. **Compounds of:-**
   (a) Ti, V, Cr, Mn, Fe, Co, Ni.
   (b) Si, Ti, Zn.
   (With special reference to their oxides and other compounds related to ceramic industry) Colour Produce by these compounds in glass ,Enamel and Glaze

3. Phase rule, one component system (SiO_2, Al_2O_3, ZrO_2), two component systems (Al_2O_3-SiO_2, Na_2O-SiO_2, CaO-SiO_2, CaO-Al_2O_3

4. Compound of Al and B with special reference to aluminates and Borates and oxides.

5. Selenium and sulpher and their compounds used in ceramic industry.

6. Compound of Ce and Nd
7. **Metallurgy :-** Introduction to Metallurgy, Ferrous Metallurgy- Steel Making (Introduction, manufacturing methods), Non Ferrous metallurgy- Aluminum (Ores of aluminum, Extraction of aluminum from Bauxite)
8. **Paints & Varnishes :-** Constituents of Paints & their functions, Constiyuents of a good Varnish, Classification and types of Varnishes

9. Metalls & Alloys :- Introduction, Metals and Non metals & theirs ores

INSTRUCTIONAL STRATEGY

Teachers may take help of various oxides and their uses in different objects as in Glass, Glaze, Enamel, Cement etc. charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Engineering Chemistry by P.C.Jain and Monica Jain
2. Physical Chemistry by Puri, Sharma, Pathania
3. Applied Chemistry –II by Prof. Durga Nath Dhar
4. Modern Inorganic chemistry by Dr. K.N.Sharma

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	12	20
3	12	15
4	8	8
5	8	8
6	8	8
7	5	8
8	4	8
9	3	5
Total	**70**	**100**

3.2 INDUSTRIAL OPERATIONS

L	T	P
4	-	-

RATIONALE

Glass & Ceramic Engineering Diploma holder has to interact with engineering and technicians in the Field of Ceramic engineering. This subject has been kept in the curriculum to provide a knowledge as working principle about the equipment and machines which are using in Ceramic Industry. Teachers should lay more emphasis on basic concept while teaching the subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Understand the theory of crushing and grinding machines/mills
- Understand the principle/function of screening, Conveying, pugging, pressing, equipments
- Understand the types filtrations and for its equipment.
- Understand the function as mechanical, hydraulic, Pneumatic & Electrical power press
- Understand the type of mixing equipments
- Understand the type of conveyers

DETAILED CONTENTS

1. **Introduction:**
   - Concept and rule of unit operation in process industries and House Keeping.
   - Properties of Fluids
   - Types of Flow : Laminar & Turbulent, Newtonian and Non-Newtonian fluids
   - Concept of Bernoulli equation and its application

2. **Size reduction:**
   - Theory of crushing Rittinger's law and Kicks law, Cclassification and their general description of crushing and grinding machines as –
     a) Crusher - Jaw crushers, , gyratory crushers, roll crushers, hammer mills,
     b) Grinder - ball mills, tube mills, vibrating mills, Raymond mill
   - Maintenance of open circuit and closed circuit operations in ceramic machinery
   - To decide optimum speed of ball mill for best grinding and mill discharges.
   - Introduction & Construction of ball mill as Ball mill size, types of Lining
   - Determination of Ball size & ratio of Ball
   - Determination surface area of materials

3. **Handling of Solids & Slurries:-**

   Screening and grinding of solid particles. Standard screening equipments and standard sieves. Conveying equipments, classification, their general construction, industrial application and operation, belt conveyors, chain conveyors, screw conveyors, bucket conveyors, pneumatic conveying system, pumping and transportation of slurry and their flow control.

4. **Mechanical Operation:-**

   Screen analysis, Tyler standard screen series, screen effectiveness, Types of screening equipment i.e. gyrating screens, stationary screens and vibrating screens, Screen efficiency,

Screen capacity, Type of filtration apparatus their general construction, application and operation of filter press and rotary, filters, filter aids centrifugal filtration. Types of mixing equipment used in ceramic industry. Introduction for modernization of ceramic machineries

5. Heat Transfer & Thermodynamics

- Modes of heat transfer – conduction, convection and radiation
- First law of thermodynamics: calculation of internal energy, enthalpy, heat and work
- Second law of thermodynamics and its applications
- Third law of thermodynamics and its applications

INSTRUCTIONAL STRATEGY

- Sketches
- Drawing
- Practical in Lab
- Showing the models/Out door visit

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Mechanical Operations by Swain Palra, G.K. Roy, Tata McGraw Hill Publication
2. Mechanical Operations by Kiran D. Patil, Nirali Publication
3. Chemical Engineering, Vol. I and II by Coulson and Richardson, Pergamon Press Publication
4. Unit Operation of Chemical Engineering by McCabe and Smith; McGraw Hill Publication
5. Introduction to Chemical Technology by Badger and Banchero, McGraw Hill Publication
6. Unit Operations Vol. I & II by Chatterjii, Khanna Publishers,
7. Engineering Thermodynamics by P.K.Nag

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	10
2	12	25
3	12	25
4	12	25
5	8	15
Total	**56**	**100**

3.3 INDUSTRIAL CALCULATION

L	T	P
5	-	-

Rational

Glass & Ceramic Engineering Diploma holder has to interact with engineering and technicians in the Field of Ceramic engineering. This subject has been kept in the curriculum to provide a knowledge as working principle about the equipment and machines which are using in Ceramic Industry. Teachers should lay more emphasis on basic concept while teaching the subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Have understanding of scope of material and balance in chemical industries.
- Carry out conversions of units and equations.
- Have knowledge of the solution concentrations, specific gravity, density, molarity, normality, molality in the chemical industries.
- Find the contents and properties of given analyzed gas.
- Find out quantity of material input and outputs of various unit operations.
- Calculate material input and outputs of chemical reactions to identify excess and limiting reactants.
- Calculate the enthalpy associated with a reaction.
- Calculate the quantities of utility required.
- Carry out combustion calculations, proximate analysis and ultimate analysis

DETAILED CONTENTS

1. **Introduction & Scope**
   Introduction & Scope of material and Energy Balances in Ceramic Industry

2. **Unit Conversion**
   Unit conversion of units, and their conversion factors, S.I Units, MKS System, CGS System, FPS

3. **Stoichiometric and composition relationships -**
   Conservation of mass, mass and volume relationships in chemical reactions, concept of gram-mole and gram-atom, mass and volume relationship for gaseous substance, use of molal units, choice of basis of calculation.

4. **Gases and Gas Mixture** - Ideal gas law, Boyle's law, Charles's law, value of universal gas constant, Behaviour of ideal gases - P & T relationship, standard condition, gauge pressure, Dalton and Amagat's laws, average molecular weight of a gaseous mixture.

5. **Humidity and Saturation** – Simple problem using Chart

6. **Material Balance**- Drying and firing problems. Solving problems on various unit operations

like drying, evaporation, crystallization, distillation, mixing, blending, absorption, extraction.

7. **Combustion processes**
Analysis of the products of combustion: proximate and ultimate analysis.
Problems of fuel analysis, air fuel ratio, theoretical oxygen/air required.
Problems of fuel analysis Oxidation of sulphur and its compounds

8. **ENVIRONMENT & POLLUTION**
Ceramic industry aud its influence on the environment. How to make it environment friendly. Major pollutants and their remedies. Industrial waste disposal .Waste minimization and recycling. Reduction of GHS (Green House Gases), Control of combustion by improved process (Reduction in fuel consumption)

INSTRUCTIONAL STRATEGY

Teacher should give small assignments to the student. Give industrial based practical problems for material and energy calculations.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Stoichiometry by B. I. Bhatt &S. M. Vora; McGraw Hill Publication
2. Material Science by Narula and Gupta
3. Engineering Materials by B.K. Agarwal
4. Material Science by R.K. Rajput; SK Kataria and Sons, Ludhiana
5. Introduction to Matrial Science for Engineers by J.F. Shackelford,
6. Chemical Process Principles Part-1 by O.A. Hougen and K.M. Watson.
7. Chemical Process Principles Part-1 by R.A. Rastogi
8. Solved Examples in Chemical Engineering by G.K. Ray

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	7	10
2	12	15
3	10	15
4	12	15
5	7	10
6	5	10
7	5	10
8	10	15
Total	**70**	**100**

3.4 POTTERY & REFRACTORY

L	T	P
6	-	8

RATIONALE

This subject has been designed to introduce the diploma holders to the properties related to the structure and the characteristics of various types of pottery & refractory materials used in the ceramic industries. The usage of these materials in various industries is also covered in this subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

1. Kmow various raw materials used in white ware and heavy clay wares
2. Know the process of manufacturing of various white ware & heavy clay wares
3. Understand various composition and body formulation of various types of white ware& heavy clay wares their manufacturing process and the characteristic
4. Understand various qualities and process of testing of various ceramic products
5. Know the general idea about the specification as per the BIS for white ware and heavy clay wares

DETAILED CONTENTS

SEC. A - POTTERY

1. **Introduction:** Ancient pottery, Definition of pottery, Classification of Pottery ware

2. **Raw Materials:**
   Origin of clay, Principle of formation and classification. Primary and secondary clays, washing methods of clays. Winning and mining of clays. Behavior, functions and physical properties of the important pottery raw materials -china clay, ball clay, fire clay, Red burning clay, quartz, feldspar, nepheline syenite, whitening ,talc, pyrophyllite, sillimanite group minerals and bone ash, places of occurrence of important raw materials in India.

3. **Body Preparation & Shaping:**
   Raw material unloading and storage, batch calculations, ball milling, batching, blunging, , screening, dewatering clay slips, casting slip, plastic forming, dry press bodies.
   Jiggering, i.e. Jolly and rotary Table type Jigger, extrusion, dry pressing different types of dry pressing, finishing, drying.
   The casting process, different types of casting-
   1. Ordinary or Notch casting
   2. Bench/Batch casting
   3. Battery casting
   4 . Capillary casting,

2. **Drying:-** Removal of water, factors affecting drying, types of driers-batch & continuous, hot flow, steams pipes, chamber driers & tunnel driers etc., defects in drying.

5. **Firing:-** Describe the different Firing stages for pottery wares, kiln furnitures and placing of wares in kiln, Effect of heat on clay & other materials

6. **Mould Materials:-** Mould materials and their properties. (Different Types of dies and mould), Process of mould making using POP. Rubber Mould,

SEC. B - REFRACTORIES

7. **Raw Materials:**
Classification of refractory materials, clay minerals, alumina silica, magnesite, dolomite, chromite, and other refractory oxides. Synthetic raw materials - Fused alumina, sintered alumina.

8. **Making of Refractory Bricks:**
Moulding methods, drying, effect of heat on clay, Manufactrure and properties of silica and semi-silica refractories, fire clay and other alumino silicate refractories, application of phase diagrams related to the manufacture of above refractories.

9. **Manufacturing of Crucibles & Saggers:**
A detailed study of the manufacture of crucibles, furnace blocks, refractory block for furnace, saggars and muffles used in different industries.

INSTRUCTIONAL STRATEGY
Students must visit various industries like White ware industries, Glass industries; refractory industries etc. to get exposure to various raw materials used indifferent ceramic industries.

MEANS OF ASSESSMENT
- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Industrial Ceramic by Singer & Singer
2. White ware by W. Ryan & Redford
3. Pottery Industry by H.N.Bose
4. Modern pottery Manufacture by H.N.Bose
5. White wares by S.Sen
6. White ware by F.H.Norton

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	12	15
3	12	15
4	9	10
5	9	10
6	8	8
7	8	10
8	10	12
9	10	10
Total	**84**	**100**

POTTERY & REFRACTORY LAB - I

LIST OF PRACTICALS

Emphasis should be given to Testing and quality Control wherever applicable.

A. POTTERY PRACTICALS:

(1) Determination water of plasticity of clays
(2) Ddetermination Water content in prepared body for making the ware by jiggering method
(3) Determination the Particle size distribution in Clay by Anderson Pipette
(4) Determination the Moisture content in china clay/given sample.
(5) Determination of dry and fired shrinkage of china clay/test specimen of body.
(6) Determination the Relative density/Specific gravity of casting slip by R.D. Bottle
(7) Preparation of different types bodies and their glazes. Fabrication of test specimens by different process
(8) Preparation of suitable casting slip by Filter Cakes/body for making the white ware by Casting Method
(9) Determination the fineness of various grind/pulverize raw materials used for white ware bodies.
(10) Making the white ware cup/Plate by casting/Jiggering method.

B. REFRACTORY PRACTICALS:

1. Determination the Particle size of refractory raw materials by sieve analysis.
2. Determination the packing density of given raw material
3. Determination the Green & Fired Density of given refractory Sample
4. Determination the Porosity/ Water Absorption of fired test specimen
5. Preparation of refractory sample by dry press.
6. Firing of sample at appropriate temperature.
7. Determination the modules of rupture (MOR) of different green and fired refractory bricks
8. Determination the Cold Crushing Strength (CCS) of different fired refractory bricks
9. Study the density Variance with Pressure Variance
10. Determination the following properties by water absorption test-
    a. Percentage of water absorption
    b. Bulk density & specific gravity
    c. Apparent specific gravity
    d. Apparent porosity

Note :- Those practicals which are not possible at institute level, can be demonstrated /performed in Industrial Training/field exposure.

3.5 FUELS, FURNACES AND PYROMETRS

P	L	T
5	-	-

RATIONALE

Ceramic materials are manufactured at high temperature so the knowledge of fuels and furnaces is necessary for proper processing and quality products. Moreover ceramic materials are also used for high temperature applications therefore, for their characterization knowledge of fuels and furnaces are required. For measuring the high temperature we know pyrometer equipment & their uses.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand types of fuels required for ceramic industry
2. Know in detail of various solid, Liquid & Gaseous fuels base kilns
3. Know the construction & operation of various type Ceramic Kilns
4. Know regarding various types of metallurgical furnaces and their Construction & Operation
5. Know the conservation of energy in the of ceramic Kilns
6. Understand general idea on Pyrometer, Pyroscope, Thermocouple

DETAILED CONTENTS

1. **INTRODUCTION TO FUEL & COMBUSTION**
   - 1.1 State & Explain introduction to solid, Liquid and Gaseous fuels
   - 1.2 Explain Non-conventional source of energy for burning ceramic Kiln
   - 1.3 State and explain combustion of fuels
   - 1.4 Combustion calculation
   - 1.5 Spontaneous combustion, its causes and remedy.
   - 1.6 Terms & Definition relating to Fuel testing

A. Solid Fuels:

i. State various types of solid fuels
ii. Classify solid fuels
iii. Describe the methods/ theories of formation of Coal
iv. State & explain the properties/nature of Coal and occurrence,
v. Describe impurities in coal, grading of coal, reason for washing of coal,
vi. Describe hardness and grindability of coal, agglomeration and swathing of coal, calorific value of coal, coal ash and clinkering.
vii. Describe in detail how coke is prepared in coke oven and state properties of coke

B. Liquid Fuels:

i. State various types of liquid fuels
i. Classify liquid fuels, Nature of oil, its origin and composition
ii. Describe the process of refining for the crude petroleum product- petrol, kerosene, Diesel
iii. Describe the procedure for storage and handling practices of liquid fuels in industry.
iv. State the advantages of liquid fuels over solid fuels.

v. Testing of liquid fuels such as flash point, fire point, pour point, smoke point, dew point

C. Gaseous Fuels:

i. Classify gaseous fuel
ii. Design and description of producer gas plant, chemical reactions, composition and calorific value in relation to operating conditions and quality of coal.
iii. Describe the manufacturing method of Bio Gas
iv. Describe Water Gas, Carburetted water gas. Coke oven Gas, Blast furnace Gas, Coal Gas, Oil Gas, BOF Gas, Refinery Gases, low and high temperature carbonisation,
v. Describe the Natural Gas-Composition and calorific value.
vi. Explain the advantages of gaseous fuel over liquid and solid fuel
vii. Describe the Rocket Fuels
viii. Describe the Nuclear Fuels

2. CERAMIC KILNS

i. Define the Kiln, Furnace and Oven
ii. Classify ceramic kiln/Furnace in details – as per used fuel, Shape, working method(Periodic, Continuous kiln)
iii. List the advantage of continuous kiln over periodic kiln
iv. Describe various type of kiln furniture used in ceramic kilns
v. Describe the construction & operation of the following kilns with sketch in detail :-
   a) Scobs /woodfibre kiln
   b) Down Draft Kiln
   c) Up Draft Kiln
   d) Chamber kiln
   e) Muffle kiln - Modern muffle kilns for enamel industries.
   f) Shaft kiln
   g) Tunnel kiln - advantages of muffle type tunnel kiln.
   h) Rotary kiln
   i) Roller hearth kiln

3. FURNACES

3.1 Classification of Furnaces
3.2 Furnace used in Glass plant & their classification
3.3 Furnace & Fuel used in Steel plant & their classification
3.4 Sketch the following furnaces showing various section
   a) Glass Melting Tank Furnace
   b) Glass Melting Pot Furnace (Day tank furnace)
   c) Blast Furnace
   d) Muffle Furnace-
   e) Cupola
   f) Open Hearth Furnace
   g) Basic Oxygen Furnace (BOF)
   h) Electric Arc Furnace

4. Continuous Kilns:

Fundamentals of continuous kilns - construction, working and firing circuits
Methods of setting in continuous kilns.

5. Importance of Chimney for Kiln & Furnaces:

chimney construction, draught pressure and chimney draught.

6 Burner & Blower Equipments
Design and operation of Burners, Burner efficiency, blowers And measurement of air flow meater, regenerator, recuperator etc.

7. Pyrometry :-

a. Definition pyroscope & pyrometer, classification of pyrometers,
b. seger cones - classification of cones, Behaviour of cones etc.
c. Thermo electric pyrometers - general principle, Material used for thermal junction - chromel-Alomel, Platinum -Rhodiun etc.,
d. Indicators, recorders, Advantage of thermo electric method of measuring
e. Optical pyrometers: General Prinicple, Lien's law of Ferry's optical pyrometer, Le – Chateleir's optical pyrometer, colour extinction pyrometer.
f. Resistance Pyrometers, Radiation Pyrometers: Ferry's mirror pyrometer, Ferry's spiral radiation pyrometer, indicators for radiation pyrometers.

INSTRUCTIONAL STRATEGY

The teachers should give emphasis on the basic concepts and principles in the subject.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Fuels and Combustion by S.Sarkar
2. Fuels Solid, liquid & Gaseous by J.S.S.Brame & King
3. Furnace by Trink
4. Industrial Ceramic by singer and singer
5. Fuels Furnace Refractory by O.P.Gupta

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	12	20
3	12	20
4	9	10
5	9	10
6	9	10
7	7	10
Total	**70**	**100**

3.6 ENVIRONMENTAL STUDIES

L	T	P
3	-	2

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Introduction (04 Periods)
   1.1 Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

2. Air Pollution (04 Periods)
   2.1 Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (08 Periods)
   3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O_2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (06 Periods)

4.1 Sources of soil pollution
4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
4.3 Effect of Solid waste
4.4 Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (06 Periods)

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (08 Periods)
Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)
Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	**42**	**100**

3.7 MODELING AND MOULDING LAB

L	T	P
-	-	8

RATIONALE

Basic principles of Design, study of forms through nature, ornamentation in design .Designing of ceramic products, Stencilling & screen printing designs.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

1. Knowledge of how to make the statue
2. Knowledge of how to make the Master Mould of as POP, Wooden Etc.
3. Knowledge of how to make the POP Working Mould & Its Working Life
4. Knowledge of how to make the statue to Working mould to Master mould
5. Knowledge of how to Work at Jigger Jolly for make the Model, Working & Master Mould
6. Knowledge of how to make the Design in POP made Working & Master mould

DETAILED CONTENTS

1. Modeling :-Prepare the various type of models / Statue (regular & irregular) by the help of Plastic clay/ POP
2. Prepare the Foot Rest by POP material With the help of Wooden Frame
3. Prepare the Design of POP and, in Mould / Master Mould with the help of Tools
4. Determination the setting time of plaster of paris (P.O.P)
5. Prepare POP(Plaster of Paris) moulds by the help of Jigger jolly
   a). One piece mould
   b). Two piece mould
   c). Multi piece mould

Note :- 1.Students should get a complete idea about the operations involved in transferring the design of POP Mould to the actual ceramic product, while preparing the job.
2.Emphasis should be made on demonstration of actual shapes of ceramic products.

IV Semester

4.1 COMMUNICATION SKILLS – II

L	T	P
4	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized set up and social context.

DETAILED CONTENTS

1. Functional Grammar (16 periods)
   - 1.1 Prepositions
   - 1.2 Framing Questions
   - 1.3 Conjunctions
   - 1.4 Tenses

2 Reading (16 periods)
   - 2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic.

3 Writing Skill (24 periods)
   - 3.1. Correspondence
     - a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters.
     - b) Official Letters- Letters to Government and other Offices
   - 3.2. Memos, Circular, Office Orders
   - 3.3. Agenda & Minutes of Meeting
   - 3.4. Report Writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Speaking and Listening Skills

1. Debate
2. Telephonic Conversation: general etiquette for making and receiving calls
3. Offering- Responding to offers.
4. Requesting – Responding to requests
5. Congratulating
6. Exploring sympathy and condolences
7. Asking Questions- Polite Responses
8. Apologizing, forgiving
9. Complaining
10. Warning
11. Asking and giving information
12. Getting and giving permission
13. Asking for and giving opinions

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/ NITTTR, Chandigarh.

Websites for Reference:

2. http://www.mindtools.com/ page 8.html – 99k
3. http://www.letstalk.com.in
4. http://www.englishlearning.com
5. http://learnenglish.britishcouncil.org/en/
6. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28

2	16	28
3	24	44
Total	**56**	**100**

4.2 GLASS, ENAMELS & CERAMIC COATING

L	T	P
4	2	8

RATIONALE

A thorough knowledge of different type of coatings done on ceramic & metallic materials in the ceramic industries enable the students to know different type of coatings and their application methods.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand about the Raw materials of Glass, Enamel & Its Batch Calculation
2. Understand about the Melting of Glass, Enamel & Refining of Molten Glass
3. Understand about How to Quality control of Glass, Enamel & Coating
4. About different types of coatings applied over metals & other materials
5. We get an idea about metallurgy industries where maximum tonnage of ceramic materials are used
6. Students get a knowledge about Enameling on Different Metal & How to Melt the Enamel
7. Students get an idea about Stenciling on Enameling surface then Cover coat enamel applied and Firing in furnace
8. Students get an idea about Enamel's Defect & Its remedies.

DETAILED CONTENTS

SECTION A - GLASS

1. **Raw Materials:**
   Chemical and Physical Characteristics of principal glass making batch materials, their storage, mixing and conveying , minor ingredients and their function, factor influencing choice of batch materials..

2. **Batch Calculation:**
   Calculation of glass batch oxide composition to raw material And raw material composition to oxide composition.

3. **Typical Commercial Glasses:**
   Types of glass and their chemical composition, container glass, sheet and plate glass, scientific laboratory glass.

4. **Melting and Refining:**
   Essential requirements of glass melting, mechanization of melting, thermal currents, production of homogeneous liquid, refining, shaping and moulding.

5. Quality Control & Test: Quality control/methods of testing of glass

SEC. B - ENAMEL

1. History of enameling, Definition of Enamel, Classification of Enamels, Types of enamels, raw materials for enamels, Base metal preparation by smelting & Pickling,

2. Preparation & Application:- Batch composition, Frit making, Preparation of Enamel slip, milling additives. Methods of enameling by dipping, spraying, Brushing, and screen printing
3. Defects in Enamel: control firing, Under fired, rolling, scaling, chipping, pinholes, crazing, & their causes and remedies.
4. Quality Control and Testing Enamel

SEC. C – CERAMIC COATING

1. Introduction of Glaze: Definition of Glaze, Similarities & Dissimilarities between glaze and glasses. Classification of glazes, Definition and explanation of Raw glaze, Fritted glaze, Lead glaze, Leadless glaze, Vapour glaze, Opaque glaze, Matt glaze & Crystalline glaze
2. Preparation of glaze: Selection of raw materials, composition, batch preparation, mixing, grinding. Definition of frit, preparation of frit & importance of fritting
   Application Methods of glaze: Dipping, brushing, pouring & Spraying
3. Firing of glazed ware: Drying, placing precautions of glazed ware before firing.
   Glaze defects & remedies : Crazing, Crawling, Peeling, Pin hole discuss their causes and remedies
4. Decorations: Under glaze, in glaze & on glaze decorations, Decoration methods like painting, stamping, stenciling, screen printing, & chromolithography

GLASS, ENAMEL & CERAMIC COATING LAB - I

LIST OF PRACTICALS

A. GLASS PRACTICALS:

1. Purification & Sieve Analysis of Sand
2. Removal of iron from sand & Compounding of glass batches.
3. Weighing, Mixing & Melting of simple Glass Batch
4. Weighing, Mixing & Melting of color Glass Batch
5. Density of glass by float and sink method
6. Simple decoration processes e.g. etching, silvering staining, sand-blasting, lustering, cutting and polishing.
7. Examination the Common defects & strain in glass ware
8. Determination the refractive index of glass
9. Determination the thermal expansion of glass.
10. Determination the low temperature viscosity.
11. Determination the viscosity of molten glass

B. ENAMEL PRACTICALS:

1. Weighing, Mixing & Melting for Prepare the Enamel frit
2. Grinding the enamel frit in pot mill to prepare the enamel slip and its application

3. Determination the Fineness test of enamel slip.
4. Determination the Density of enamel slip using specific gravity bottle.
5. Smelting, Cleaning and pickling of small mild steel plates for enameling
6. Application of Enamel slip on Iron sheet for making sign plates.
7. Firing and fusion of applied enamel slip on M.S. Iron Sheet

INSTRUCTIONAL STRATEGY

Students must visit different ceramic industries to know more about different coating techniques and defects in coating

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Porcelain Enamels by Andrew
2. Industrial ceramics by Singer F and Singer SS
3. Modern pottery by HN Boss
4. Hand Book of ceramics
5. White ware by W. Rayan
6. Fine ceramics by FH Norton.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	40
2	35	40
3	14	20
Total	**84**	**100**

4.3 GLASS & CERAMIC ENGINEERING DRAWING-II

L	T	P
-	-	8

RATIONALE

Drawing of all ceramic equipment and Machinery. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Student will take the knowledge how to make the symbol of different electrical equipments
2. Knowledge of about simple domestic wiring circuit diagram etc.
3. Knowledge of making the drawing of pulleys, Bearings, Blocks, Brackets, Joints etc.
4. Knowledge of making 3D view of all Ceramic Machinery and equipments.
5. Basic knowledge of about Auto CAD

DETAILED CONTENTS

Unit I

(a) Detail use of abbreviation in electrical drawing symbols for simple equipment used in circuit, lamp, switches, condenser, resistance, reactors, transformer and motor.

Sheet - 1

(b) Simple domestic wiring circuit diagram.

Sheet -1

(c) Wiring diagrams of simple switch board(lab), general electrical layout for substation.

Sheet -1

Unit II

Types of pulleys, bush bearing, foot step bearing, plumber block, wall brackets.

Sheet -2

Unit III

Sectional views of cotter-joint, knuckle joint, Jib and cotter joint, flange coupling.

Sheets -2

Unit IV

Pictorial views of the following ceramic machinery.

(a) Ball Mill
(b) Edge runner mill
(c) Jaw Crusher — Sheets -2
(d) Plunger
(e) Filter press

Unit V – Auto CAD

1. To Study the basis of Auto Cad
2. To draw 2 D ceramic drawing of block diagram, plot layout, machine and lilne
3. To draw simple 3 D ceramic Product
   (i) Porcelain Insulator
   (ii) Refractory Product

INSTRUCTIONAL STRATEGY

Teacher should show model of equipments and component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. The institute should procure Auto CAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in Auto CAD/Engineering Graphic. Separate labs for practice on Auto CAD should be established.

MEANS OF ASSESSMENT

- Sketches making
- Drawing Sheet work

RECOMMENDED BOOKS

1. Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
4. Engineering Drawing I by DK Goel, GBD Publication.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	20
2	20	20
3	20	20
4	32	25
5	20	15
Total	**112**	**100**

4.4 ELEMENTRY GEOLOGY & MINERALOGY

L	T	P
4	2	4

RATIONALE:

The knowledge of geology is essential for the students of ceramic and glass engineering with related to the raw materials used in the industry. It will help them to understand the industrial map of industry in the country and sources of raw materials used in the industry.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand importance of Geology in the field of ceramic engg.
2. Know the formation of rocks, minerals and Clay.
3. Know the classification of rocks in details.
4. Understand Physical properties of minerals.
5. Understand types of clay and other important raw materials, their properties, Sources and application in ceramic industries.
6. Understand the process of beneficiation of ceramic raw materials.

DETAILED CONTENTS

1. **ELEMENTRY GEOLOGY**
   - 1.1 Various Branches of Geology
   - 1.2 Origin of earth and earths crust
   - 1.3 Geological ages
   - 1.4 Elementary and general idea of rocks and minerals
   - 1.5 Utility of geology specially for ceramic industries.
   - 1.6 Occurrence of ceramic raw materials in India.

2. **PHYSICAL GEOLOGY & PETROLOGY**
   - 2.1 Define Petrology
   - 2.2 Discuss the types of weathering
   - 2.3 Discuss various types of weathering agencies
   - 2.4 Discuss the process of weathering

3. **PETROLOGY**
   - 3.1 Formation of rocks, classification of rocks
   - 3.2 Geological characters of rocks
   - 3.3 General characters of rocks
   - 3.4 Engg. Properties of rocks/ Lab Test of rocks
   - 3.5 Rocks a construction material
     - a) For Building
     - b) For Roads
       - Define & Describe stratigraphy, Principal of stereography.

4. **MINERALOGY**

4.1 Define mineralogy

4.2 Describe various process of formation of minerals – Rock forming minerals.

4.3 State & explain Formula/Composition of minerals

4.4 Explain the following physical properties of the minerals :-

a. Color	b. Streak	c. Luster
d. Cleavage	e. Hardness	f. Crystal Form
g. Fractures	h. Specific Gravity	I. Texture

4.5 Describe various process of testing of minerals

5. IMPORTANT CERAMIC RAW MATERIALS

5.1 Describe the types of clays and Clay minerals

5.2 State & Explain the physical and chemical properties of clay

5.3 Describe availability of various ceramic raw materials in India and Special emphasis to state of Uttar Pradesh

5.4 Discuss the properties and uses of the following ceramic raw materials

i) Silica –Quartz, Quartzite, Glass Sand
ii) Lime stone, Dolomite, Magnesite, Calcite, Gypsum
iii) Alumina Anhydrous – Bauxite, Diaspore, Pyrophilite
iv) Alumino silicate – Sillimanite, Kaynite, Andalusite
v) Magnesium silicate – minerals – Talc, Forsterite, Steatite
vi) Flourine Minerals – Flourspar, Cryolite
vii) Boron Compound – Borax
viii) Feldspar and other fluxes, Nephline, Sodalite, Wolastonite, Bentonite
ix) Graphite, Chromite, Zircon
x) Miscellaneous – Olivine, Asbestos, Rutile, Vermiculite, Mica, Beryal, Lithium minerals

6. ECONOMIC GEOLOGY WITH REFERENCE TO CERAMIC: Economic use of ceramic raw materials such as Clay, Silica, Felspar, Talc, Limestone, Dolomite, Gypsum, Magnesite, Chromite, Bauxite, Sellimanite, Kyanite and Andalusite, Zircon, Mica, Calcite, Pyrophilite.

7. Petrological microscope, study of physical and optical properties with special reference to the following minerals-Quartz, china clay, ball clay, feldspar, mica, basalt calcite, lime stone, gypsum, corundum.

INSTRUCTIONAL STRATEGY

Teacher should give emphasis on understanding the various processes involved in formation of rocks. Samples of different rocks must be shown to the students for better understanding of various properties.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid and end-term written tests
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. A Text book of Geology by P. Singh

2. Geology by G.B.Mahapatra
3. Text Book of Geology by P.K.Mukharjee
4. Engineering & General Geology by Praveen Singh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	15
2	12	15
3	12	15
4	12	15
5	20	20
6	8	10
7	8	10
Total	**84**	**100**

GEOLOGY & MINERALOGY LAB

LIST OF PRACTICALS

1. Identification & describe the physical characteristics of hand specimen as Colour, lusture, streak, hardness, cleavage, fracture, Crystal System(tenacity), structure, and specific gravity. of the following rocks and minerals-
   Talc, Graphite, Basalt, Sand Stone, Kaolinite, Diaspore, Quartz, Quartzite, Feldspar, Calcite, Baryte, Bauxite, Dolomite, Limestone, Hematite, Magnetite and Magnesite.

2. Determination of specific gravity of minerals

3. Determination the Hardness of minerals by Moh's scales.
4. Identification of rocks/Minerals in hand specimen as igneous / Sedimentary / Metamorphic rocks

5. Study the optical Properties of minerals by Polarizing Microscopic:- Light, ordinary light, double refraction, refractive index, optical axis, positive and negative minerals
6. Study the Crystal system of minerals

RECOMMENDED BOOKS

1. Introduction of Physical Geology - A. K. Datta
2. Optical Mineralogy - A. F. Rogers & P. F. Kerr
9. Fundamental of Engg. Geology by
10. Mineral & Crystal Science by B.C.Jaish

4.5 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

DETAILED CONTENTS

1. Basics of Energy

1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.

1.2 Global fuel reserve

1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)

1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

2.1 Introduction to energy management, energy conservation, energy efficiency and its need

2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.

2.3 Standards and Labeling

2.3.1 Concept of star rating and its importance

2.3.2 Types of product available for star rating

3. Electrical Supply System and Motors

3.1 Types of electrical supply system

3.2 Single line diagram

3.3 Losses in electrical power distribution system

3.4 Understanding Electricity Bill

3.4.1 Transformers Tariff structure

3.4.2 Components of power (kW, kVA and kVAR) and power factor, improvement of power factor

3.4.3 Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

3.5 Transformers

3.5.1 Introduction

3.5.2 Losses in transformer

3.5.3 Transformer Loading

3.5.4 Tips for energy savings in transformers

3.6 Electric Motors
- 3.6.1 Types of motors
- 3.6.2 Losses in induction motors
- 3.6.3 Features and characteristics of energy efficient motors
- 3.6.4 Estimation of motor loading
- 3.6.5 Variation in efficiency and power factor with loading
- 3.6.6 Tips for energy savings in motors

4. Energy Efficiency in Electrical Utilities

4.1 Pumps
- 4.1.1 Introduction to pump and its applications
- 4.1.2 Efficient pumping system operation
- 4.1.3 Energy efficiency in agriculture pumps
- 4.1.4 Tips for energy saving in pumps

4.2 Compressed Air System
- 4.2.1 Types of air compressor and its applications
- 4.2.2 Leakage test
- 4.2.3 Energy saving opportunities in compressors.

4.3 Energy Conservation in HVAC and Refrigeration System
- 4.3.1 Introduction
- 4.3.2 Concept of Energy Efficiency Ratio (EER)
- 4.3.3 Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5 Lighting and DG Systems

5.1 Lighting Systems
- 5.1.1 Basic definitions- Lux, lumen and efficacy
- 5.1.2 Types of different lamps and their features
- 5.1.3 Energy efficient practices in lighting

5.2 DG Systems
- 5.2.1 Introduction
- 5.2.2 Energy efficiency opportunities in DG systems
- 5.2.3 Loading estimation

6 Energy Efficiency in Thermal Utilities

6.1 Thermal Basics
- 6.1.1 Types of fuels
- 6.1.2 Thermal energy
- 6.1.3 Energy content in fuels
- 6.1.4 Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

6.2 Energy Conservation in boilers and furnaces
- 6.2.1 Introduction and types of boilers
- 6.2.2 Energy performance assessment of boilers
- 6.2.3 Concept of stoichiometric air and excess air for combustion
- 6.2.4 Energy conservation in boilers and furnaces
- 6.2.5 Do’s and Don’ts for efficient use of boilers and furnaces

6.3 Cooling Towers

6.3.1 Basic concept of cooling towers

6.3.2 Tips for energy savings in cooling towers

6.4.1 Efficient Steam Utilization

7 Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features

7.2 Tips for energy savings in buildings

7.2.1 New Buildings

7.2.2 Existing Buildings

8 Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery

8.2 Concept and types of co-generation system

9 General Energy Saving Tips

Energy saving tips in:

9.1 Lighting

9.2 Room Air Conditioner

9.3 Refrigerator

9.4 Water Heater

9.5 Computer

9.6 Fan, Heater, Blower and Washing Machine

9.7 Colour Television

9.8 Water Pump

9.9 Cooking

9.10 Transport

10 Energy Audit

10.1 Types and methodology

10.2 Energy audit instruments

10.3 Energy auditing reporting format

PRACTICAL EXERCISES

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

COURSE OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial and residential areas. A student will be able to:

- Define principles and objectives of energy management and energy audit.
- Understand Energy Conservation Act 2001 and its features.
- Understand various forms & elements of energy.
- Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- Identify areas of energy conservation and adopt conservation methods in various systems.
- Evaluate the techno economic feasibility of the energy conservation technique adopted.

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are

Expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

Important Links:

(i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.

(ii) Ministry of New and Renewable Energy (MNRE),Government of India. www.mnre.gov.in.

(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

(iv) **Central Pollution Control Board (CPCB),** Ministry of Environment, Forest and Climate

Change, Government of India. www.cpcb.nic.in.
(v) Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.

4.6 UNIVERSAL HUMAN VALUES

L-T- P
2 -0 -2

Course Objectives

This introductory course input is intended

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or value prescriptions.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

The syllabus for the lectures is given below:

- After every two lectures of one hour each, there is one hour practice session.
- The assessment for this subject is as follows:
- Sessions Marks (Internal): 20
- Practical Marks (External): 30
- Total Marks: 50

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material the Body'
2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Swasthya

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding Harmony in the family – the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
   a. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
3. Understanding the meaning of Vishwas; Difference between intention and competence
4. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
   a) Ability to utilize the professional competence for augmenting universal human order
   b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
   a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
   b) At the level of society: as mutually enriching institutions and organizations
7. To inculcate Human Values among Students: The Role of self ,Parents and Teachers

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Practical assessment

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

b. The teacher's manual (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming,Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ekParichay,Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if peoplemattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in

2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology–the Untold Story
6. Case study Hevade Bazar Movie
7. RC Shekhar , Ethical Contradiction ,Trident New Delhi
8. Gandhi A., Right Here Right Now, Cyclewala Production

SUGGESTED DISTRIBUTION OF MARKS

Unit	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
Total	**42**	**100**

4.7 INDUSTRIAL TRAINING

2 Weeks structured & Supervised branch specific task oriented industrial/field exposure to be organized during Semester Break. The Students Will Submit a Report Separately. This will be evaluated at institution level for Total 60 marks - 40 for Viva and 20 for report presented.

See Annexure - I

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 2 weeks duration to be organized during the semester break starting after second year i.e. after III Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 20 and external assessment of 40 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

V Semester

5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

After undergoing this course, the students will be able to :

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organisation.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organisation.
- Use marketing skills for the benefit of the organization.
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, JIT and CRM.

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. Introduction (04 Periods)
   - 1.1 Concept /Meaning and its need
   - 1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship
   - 1.3 Sole proprietorship and partnership forms and other forms of business organisations
   - 1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District – level, organisation: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. Market Survey and Opportunity Identification/Ideation (04 Periods)
   - 2.1 Scanning of the business environment

2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities
2.3 Types and conduct of market survey
2.4 Assessment of demand and supply in potential areas of growth
2.5 Identifying business opportunity
2.6 Considerations in product selection
2.7 Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)
3.1 Preliminary project report
3.2 Detailed project report including technical, economic and market feasibility
3.3 Common errors in project report preparations
3.4 Exercises on preparation of project report
3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)
4.1 Definitions and importance of management
4.2 Functions of management: Importance and process of planning, organising, staffing, directing and controlling
4.3 Principles of management (Henri Fayol, F.W. Taylor)
4.4 Concept and structure of an organisation
4.5 Types of industrial organisations and their advantages
4.6 Line organisation, staff organisation
4.7 Line and staff organisation
4.8 Functional Organisation

5. Leadership and Motivation (08 Periods)
5.1 Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders
5.2 Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)
6.1 Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods
6.2 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ
6.3 Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion
6.4 Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)
   7.1 Introduction and importance of Healthy Work Culture in organization
   7.2 Components of Culture
   7.3 Importance of attitude, values and behavior
   7.4 Behavioural Science – Individual and group behavior.
   7.5 Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)
   8.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company
   8.2 Objectives of Financial Management: Profit Maximization v/s Wealth Maximization
9. Miscellaneous Topics (10 Periods)
   9.1 Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)
   9.2 Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/Prototype making.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	**70**	**100**

5.2 POTTERY AND PORCELAIN-I

L	T	P
6	-	-

RATIONALE

In this specialized subject, Pottery & Porcelain-I inputs are provided to the students about raw materials, processes, fabrication, drying and firing techniques.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know the various raw materials used in white ware Industries
2. Know the process of manufacturing of various white ware
3. Understand various composition and formulation of various types of white ware & their characteristic
4. Understand various qualities and process of testing of various ceramic products

DETAILED CONTENTS

NOTE: Recapitulation of main topics from II year.

(A) POTTERY

I. A study of the various ceramic fabrication process (for manufacture of Products).

II. A detailed study of the manufacture of floor and wall tiles, sanitary ware, table ware, parian art ware, semi-vitreous bone china, chemical stone ware, chemical porcelain, electrical porcelain.

III. Ceramic glazes - Different types of glazes, their composition preparation and application.

IV. Ceramic Stains - Their composition, preparation, application & use. Decoration with stains.

V. Ceramic Transfer - Their preparation, application and firing.

VI. Mechanization in pottery works - Introduction to simple hand tools, equipments & Machines.

(B) PORCELAIN

I. Definition of porcelain, Describe the different types of porcelain as Hard porcelain, Soft Porcelain, Chemical Porcelain, Dental Porcelain, Electrical Porcelain, Bone China etc.

II. High and low tension insulators : High voltage low frequency application Porcelain Insulator, Low voltage high frequency application, Steatite, Magnesium titanate, cordierite, Porcelain.

III. Lithography :

(A) Lithium Compounds

(B) Prepare and Design For making Lithograph transfer.

IV. Quality Control & Testing

a). Green and dry properties of body mixes such as shrinkage, bulk density, strength.

b). Fired charactertics such as fired shrinkage, fired strength (MOR and Compressive strength), water absorption, apparent porosity, bulk density, fired colour at different temperatures.

c). Pressing effect on the fired and green bodies.

d). Thermal expansion of body and Glage.

e). Testing - Physical testing : thermal behaviour, MOR, Porosity, Density, Crazing, etc.

INSTRUCTIONAL STRATEGY

Students must get industrial exposure of various white ware/ Pottery industries to know more about process and products

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Ceramic Whitewares by Sudhir Sen
2. Industrial Ceramics by Singer & Singer, Khanna Publishers, New Delhi
3. Handbook of Ceramics by S. Kumar & Others, Prentice Hall of India
4. Whiteware by W. Rayan

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
A 1	9	10
2	9	10
3	8	10
4	8	10
5	9	10
6	8	10
B 1	8	10
2	9	10
3	9	10
4	7	10
Total	**84**	**100**

5.3 REFRACTORY TECHNOLOGY

L	T	P
6	-	-

RATIONALE

In this specialised subject on refractory technology, a thorough knowledge of classification and testing of refractories is provided along with manufacturing techniques of important refractories. Phase diagrams are also dealt in this subject. This subject also provides them details of special refractories and their applications.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand various types of refractories their classification and their manufacturing process
2. Know testing of refractories as per BIS specification
3. Understand refractory cement and monolithic and their application in metal extraction
4. Know about insulating brick and fibrous refractory materials.
5. Understand the use of refractory in Steel, Cement, Glass, Ceramic Industries

DETAILED CONTENTS

NOTE: Recapitulation of main topics from II year.

1. **ACID & BASIC REFRACTORY:-** (Manufacturing, properties & uses):-
   Silica, Alumino silicate, Alumina, Magnesite, Dolomite, Kayanite, Sillimanite, chrome and chrome-magnesite, Magnesite-chrome, Forsterite refractories,

2. **NEUTRAL AND OTHER REFRACTORY:-**
   2.1 Describe the preparation, properties and uses of following refractory in brief:-
   Graphite Refractories, Silicon Carbide refractories, Fused Magnesia, Fused Silica, Mullite,
   2.2 Fusion cast Refractories – type , Properties, application/Uses
   2.3 Insulation refractories bricks – type of insulatingbrick, Properties, uses, Manufacturing
   2.4 Carbon Containing refractories – (Manufacturing, Properties, Uses) –Magnesia-Carbon ref, Alumina-Carbon ref, Alumina-Magnesia-Carbon ref
   2.5 Super refectories, Synthetic raw materials, Cordierite refractory

3. **SPECIAL REFRACTORY:-** Pure Alumina Ref, Zircon Ref, Zirconia Ref, Thoria Ref, Spinal Ref, Boron Nitride

4. **Refractory Hollow Ware:-** Stopper, Nozzle, Pipes, Crucibles, Muffles, Saggars and Glass Pots.

5. **Fibrous Refractory materials:-** Refractory Tile, Refractory Blanket, Refractory Rope

6. **Properties :-** Testing and Quality control of refractory articles as per BIS specification
   a. Physical : Porosity, apparent porosity, bulk density, specific gravity, permeability, modulus
   of rupture(MOR), Abrasion, Resistance to weather and frost conductivity.

b. Thermal : Pyrometric Cone Equivalent (PCE), Thermal expansion, thermal conductivity, Thermal Shock
c. Mechanical : Cold crushing strength (CCS)
d. Thermal Mechanical: Refractoriness under load (RUL). Hot modulus of rupture (MOR), Hot crushing strength.
e. Thermochemical - corrosion.

7. Application of Ferrous Metal Refractories:-

b) Describe with sketch the Refractories used in different areas of Blast Furnace
c) Describe with sketch the Refractories used in different areas of Basic Oxygen Furnace
d) Describe with sketch the Refractories used in different areas of Steel Ladles and hot metal ladle
e) Describe with sketch the Refractories used in Continuous casting (Tundish)
f) Describe with sketch the Refractories used in different areas of Coke Oven Furnace
g) Describe with sketch the Refractories used in different areas of open hearth furnace and Bessemer converters,
h) Describe with sketch electric furnace for steel melting

8. Refractories for cement Industry:- Describe with Sketch Refractory use in different area/zone in detail as –Rotary Kiln, Vertical Shaft Kiln

9. Refractories for Glass Industry:- Describe with Sketch refractory use in different zone in detail of – Glass tank Furnace, Regenerator/Recuperator, Glass Pot Furnace, Kiln use in Ceramic Industry

10. Monolithic Refractories - Castables/Mortar, Plastic masses, Ramming Masses, Gunning Masses, Spraying Masses, Patching Masses.

11. High Alumina Cement (HAC):- Introduction, Raw materials, Manufacturing process, Uses, and Hydration Chemistry & properties

INSTRUCTIONAL STRATEGY

Industrial visits of students may be organized for better understanding of various manufacturing process and products of refractories.

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Refractories production and properties by J.H.Chester
2. Industrial Ceramic by Singer & Singer
3. Refractories their manufacturing properties & uses by M.L.Mishra
4. Technology of ceramics & refractories by P.P.Budnikov
5. Refractories by Chesti & Nandi
6.Refractories by F.H.Norton

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	7	8
2	9	15
3	7	8
4	6	6
5	10	7
6	10	15
7	10	15
8	8	7
9	5	7
10	7	6
11	5	6
Total	**84**	**100**

5.4 GLASS TECHNOLOGY-I

L	T	P
6	-	-

RATIONALE

In this specialized subject on glass technology, starting from fundamental concepts, characteristics, composition and properties, furnaces for glass making are also discussed in detail for making the students competent in this technology area.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know various types of raw materials for glass making & formulating batch composition
2. Understand general ideas about glass melting furnace & glass melting process
3. Know knowledge about strain in glass & its elimination
4. Understand idea about the various process of glass forming methods
5. Understand general idea about the quality of glass
6. Understand different glass defects & their remedies
7. Know the decoration of glass and Special glass making
8. Know idea on layout of modern glass plant

DETAILED CONTENTS

NOTE: Recapitulation of main topics from II year.

1. RAW MATERIAL & BATCH

Storage of raw materials, batch house, melting furnace, fabrication-machines, annealing Lehar, sorting and packaging section, ware house.

2. GLASS MELTING PROCESS

Batch calculation of raw materials for glass making, Process of glass formation, Refining of glass, refining mechanism, refining agent, factor affecting refining, Role of viscosity in glass refining,

Colourising and Decolourising- Theory and agent

3. MANUFACTURING & FORMATION OF GLASS WARE

Various methods used for glass products making, Various machines used for glass making, Manufacturing of glass by blowing & manual process, float process, semi automatic & Automatic process,

Manufacturing of glass bottle, glass Jar glass sheet, Picture tube, thermo flask, electric bulb & tube, glass bangles,

Manufacturing of fiber glass, glass wool, Optical fiber,

Manufacture of sheet, plate and rolled glass, toughened glass, laminated safety glass.

Optical Glass- Composition, manufacture of optical glass quality control measures.

4. ANNEALING & TOUGHENING OF GLASS

Describe the annealing, process of annealing, aim of annealing, determine annealing bschedule for various glass products,

Define the Toughening of glass, Explain tempering of glass by various methods, State & explain Chemical & mechanical toughening of glass, Relation between annealing and viscosity of glass.

5. PROPETIES OF GLASS

Describe the following properties of glass – Viscosity, Density, Thermal properties, optical properties, Electrical properties, Chemical durability

Viscosity, variation with temperature and composition, transformation range

6. DEFECTS IN TESTING OF GLASS

Describe in brief – defects of glass by visual observation as cords, Blister, Seeds, Bad colours etc, Describe their causes and remedies

Origin of thermal stresses, generation and release of stresses, strain viewer.

Chemical durability of glass measurement of chemical durability by A.S.T.M & I.S.I Method,

Effect of glass composition and its significance in glass processes & its measurements.

7. GLASS DECORATION

Describe the following methods of glass decoration in brief –

Grinding, Polishing, Etching, Sand Blasting, Painting, Engraving, Cutting, Staining, Engobing, Lustering, Enameling

8. SPECIAL GLASSES

Define & describe the characteristics and application of the following glasses -

b. Borosilicate glass
c. Vycor glass
d. Pyrex glass
e. Heat resisting glass
f. Coloured glass
g. Ruby glass
h. Glass for electrical & electronic Industries
i. Laminated glass
j. Glass for optical communication
k. Alumino silicate glass, Alakali Silicate glass, Vitreous Silica glass, Lead glass

INSTRUCTIONAL STRATEGY

Different glass industries like sheet glass industry, hollow ware glass industry, float glass industry must be shown to students for better understanding of raw materials, processes an products etc.

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,

– Viva Voice

RECOMMENDED BOOKS

i. A Hand Book of Glass (Vol. I & II) by F.B. Tulley
ii. Modern Glass Practice by S.G. Scholse, Publisher McGraw Hill
iii. Glass by Scholes
iv. Glass by R. Charan
v. Glass by Shand

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	10	12
3	14	18
4	12	18
5	8	7
6	9	8
7	9	8
8	12	15
Total	**84**	**100**

5.5 MODERN CERAMICS & ITS APPLICATIONS

L	T	P
6	-	-

RATIONALE

Development of new materials which have better performance & reliability in service are in demand in the industry. This course has been designed to give the diploma holders of ceramic engineering a thorough knowledge of the new ceramics, their properties and applications in the specialized areas like nuclear ceramics, electronic devices, bio ceramics etc.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand about the Low & High tension Insulator Body
2. Understand High temperature Ceramic & Abrasive
3. Understand about Fibers & Whiskers
4. Understand about the Special ceramic & Bio-Ceramic
5. Know about the Capacitor & Condenser

DETAILED CONTENTS

I. **Introduction To Low loss ceramics:** The importance of low dielectric losses in high frequency work, steatite and cordierite bodies and their composition, manufacturing methods, properties and uses.

II. **Introduction To High permittivity ceramics:** Electrical condensors, advantage of ceramic condensors, rutile bodies, Titenates ceramics. Ferro electric and Piezo electric ceramics

III. Introduction To Magnetic ceramics: Soft spinel ferrites and hard hexagonal ferrites.

IV. Special Ceramics: High temperature ceramics, Berillia, Magnesia, alumina and zirconia.

V. Recent developments in the field of ceramics (lectures to be delivered by eminent ceramic engineers) in kilns, materials, energy efficiency. Elementary idea of non-oxide ceramic and fuel cells.

VI. Ceramic raw materials, Chemical analysis and Physical Testing, Investigations of Clay firing properties, Glaze and Process control.

VII. **Abrasive :-** Definition, Classification, properties, Manufacturing process of abrasive grains & product, Bonded & Coated Abrasive, Ceramic Cutting tools

VIII. **Fibers & Whiskers:-** Definition, types, Properties, application

IX. **Bio-Ceramics: -** Ceramic materials for artificial tooth and bone joints, Elementary idea about preparation, properties and manufacture of bio-ceramics and their applications.

INSTRUCTIONAL STRATEGY

Students must get exposure of various industries like ferrite industry, semi conductor industry, capacitor industry to know more about products and processes.

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Viva Voice

RECOMMENDED BOOKS

1. Ceramic materials for electronics by R.C. Buchahan, McGraw Hill
2. Introduction to Ceramics by W.D. Kingery, Prentice Hall of India
3. Industrial Ceramic by Singer & Singer
4. Ceramic Material For electronic by Heneb & West
5. Special Ceramic by Popper
6. Magnetic Ceramic by Richerson
7. Abressive by Coes L. Jr.
8. Cutting Tools by R.Edwards
9. Non Oxide Technical & engg. Ceramic by S.Hampshire
10. Ceramic Matrix Composites by R. Warren
11. Ceramic Material for Electronics by Marcel Dekker

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	10	12
3	9	12
4	9	10
5	9	10
6	9	12
7	9	10
8	9	12
9	10	10
Total	**84**	**100**

5.6 POTTERY & REFRACTORY LAB - II

L	T	P
-	-	8

RATIONALE

In this specialized subject Lab Pottery & Refractory inputs are provided to the students about Different manufacturing processes, Preparation of Different types of Glaze Colors & Decoration methods, drying and firing techniques. Know the how to make Refractory Bricks and testing of its different Parameters.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand & Practice the Different shaping methods of Pottery & Refractory ware
2. Understand & Prepare the Different types of Glaze, colors and Stains.
3. Understand & Practice the Different decoration methods of Pottery
4. Understand & Practice the Different glazing methods on Pottery ware
5. Execute /Evaluate the different properties of Pottery & Refractory ware

DETAILED CONTENTS

(A) POTTERY PRACTICALS:

1. Shaping of pottery wares by different processes e.g. throwing. Jigger & Jollying, slip castings & pressing etc.
2. Preparation of different types of glazes and strains.
3. Preparation of different types of colours and strains.
4. Decoration of wares e.g. glazing, printing, painting, spraying Free hand drawing etc.
5. Drying finishing and firing of pottery wares and furnace control.
6. To prepare vetrification curve of a firing the ceramic body.
7. Practice the Biscuiting and glost firing of test pieces
8. Determine the Fired properties of test specimens (such as colour,W.A., Apparent porosity, B.D
9. Determine the Thermal expansion upto 1000^0C
10. Determine the fired Strength (MOR) of White ware body

(B) REFRACTORY PRACTICALS :

1. Shaping of refractories by :
   a. Slip casting
   b. Extrusion
   c. Pressing
2. Firing of refractory sample at different temperature

3. Determination of its fired properties (B.D., Shrinkage, Apparent Porosity, MOR, Thermal expansion, Warpage)

5.7 GLASS, ENAMEL & CERAMIC COATING Lab-II

L	T	P
-	-	8

RATIONALE

In this specialized Lab Glass & Ceramic Workshop Practice, inputs are provided to the students as compounding the different types of Glass batches. Grinding , Polishing and Powering of Lenses Decoration of glass by the different methods. Preparation of Different types of Enamel Slip and apply to this on metal sheets after smelting , Pickling & Neutralization. Stenciling then decoration of Enameled plate.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand & Practice the Compounding different types of Glass & Enamel
2. Understand & Melting the Different types of Glass, colors glass and Stains.
3. Understand & Practice the Different decoration methods of Glass & Enamel
4. Understand & Practice the Grinding, Polishing & Powering of Lens
5. Know the application of enamel on Iron sheet after smelting & pickling

DETAILED CONTENTS

(A) GLASS PRACTICALS :

1. Compounding of glass batches.
2. Melting of special glasses, ruby glass, opaque glass, aventury glasses such as chromium, copper.
3. Grinding, polishing and powering of lenses.
4. Decoration of Glass by different processes such as screen painting, spraying, brush painting.

(B) ENAMEL PRACTICALS:

1. Compounding of different enamel batches.
2. Printing and Milling.
3. Cleaning and pickling of metal sheets.
4. Application and fusion of enamels on cast iron, steel and coppers.
5. Stencil cutting.
6. Decoration.
7. Furnace control.

(C) CEMENT PRACTICALS :

1. Determination of fineness of cement.
2. Determination the Setting time of cements.
   a. Initial setting
   b. final setting
2. Determination the Tensile strength of Cement & Balu/Sand (1:4 ratio) mortar bracket
3. Determination the Compressive strength of Cement & Balu/Sand (1:4 ratio) mortar Cubes

4. Workability- Determination the water (cement+Sand) ratio.
5. Determination the soundness of cement by Le Chatteliers apparatus

5.8 INDUSTRIAL TRAINING (3 WEEKS)

3 weeks structured & supervised branch specific task oriented industrial training to be organized during after exam of IV semester. Students will submit a report. This will be evaluated Total for &70 marks. 40 marks by external examiner and 30 marks at institute level.
(See Annexure I)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.
This document includes guided and supervised industrial training of a minimum of 3 weeks duration to be organized during the semester break starting after third year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.
Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.
An internal assessment of 30 and external assessment of 40 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

VI SEMESTER

6.1 LIME & CEMENT TECHNOLOGY

L	T	P
6	-	-

RATIONALE

This specialized subject is taught to the diploma holders of ceramic engineering in order to widen their scope of employment cement manufacturing units also.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know Lime & Lime Stone, their qualities, calcinations and Cementing properties
2. Understand details about Portland cement
3. Understand manufacturing of various type of cement, their qualities
4. Know about cement Kiln and its operation
5. Know various method of testing quality of cement
6. Know various types of cement concrete product and its manufacturing process
7. Know details about gypsum, Plaster of Paris and plaster product

DETAILED CONTENTS

(A) LIME

1. Origin of lime stones, Varieties of lime stones and chemical composition of lime stone.
2. Properties of lime stone & uses, Burning of lime stone
3. Explain Calcinations and Slaking of Lime stone
4. Describe with sketch calcinations of lime stone in lime kilns
5. Effect of the presence of magnesia and use of lime mortar.
6. Preparation of hydrated lime, grinding the quick lime, mixing with water.

(B) CEMENT

1. Definition and Raw material of cement, Chemistry of anhydrous and hydrated cement compounds. The constitution of portland cement. Method of manufacture of port land cement, and testing. Action of acid and sulphate water on port land cement, the physical and chemical properties of port land cement, defects causes and remedies.

4. Different types of cements, e.g. Portland cement, quick setting cement, pozzolanas and pozzolanic cement, high alumina cement, water proof cement, oil well cement, hydrophobic cement, masonry cement, white cement, coloured cement, rapid hardening cement, castable refractories, low and ultra low Cement Castables.

5. Additives - accelerators, retarders, water proofers, pigments, dispersing agents.
6. Testing of Cement :- Fineness of cement, Initial and final setting time of cement, Expansion of cement, Compressive and tensile strength, Impurities in cement, Specific gravity of cement, Chemical analysis of cement

INSTRUCTIONAL STRATEGY

Students must visit cement plants to be familiar with raw materials and manufacturing process of cement. And another way is to showing the slide & video

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Actual Lab & Practical Work
- Model Making,

RECOMMENDED BOOKS

1. Text Book of Cement and Concrete by Lee
2. Advances in Cement Technology by S.M. Ghose
3. Hand book on Cement Technology by Dudda

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	10
2	08	10
3	08	20
4	15	14
5	15	14
6	15	20
7	15	12
Total	**84**	**100**

LIST OF PRACTICALS

1. Determination of fineness of cement.
2. Determination of water cement ratio.
3. Determination of initial & final setting time of cement.
4. Determination of tensile strength of cement mortar bracket.
5. Determination of cold crushing strength of cement cubes
6. Determination of soundness of cement by Le Chatteliers apparatus.

6.2 CERAMIC MACHINERY & FURNACE EXPOSE

L	T	P
6	-	-

RATIONALE

A thorough knowledge of the important machineries used in the ceramic industries enable the students to carry out various processes efficiently; hence this subject is very essential.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Understand about the Plant layout and its setup machinery
2. Understand details about Size Reduction & size Separation Machine
3. Understand manufacturing of various type of cement, their qualities
4. Know about Mixing & Body making Machine as per Requirement
5. Know about different type of Shaping machines
6. Know various types furnace / Kiln used in Ceramic Industries

DETAILED CONTENTS

1. **Plant Layout:** plant location, layout of the factory building, selection, operation and maintenance of ceramic machinery and equipment (for Pottery, Refractory, Glass, Enamel and Cement).
2. **Size Reduction:** Selection of crushing & grinding equipments. Definition of closed and open circuit operations.
3. **Size Separation:** wet classifiers, Air, Electromagnetic / magnet separators, vibrating sieve, slip lifting & Diaphragm pump, Filter press, Vacuum filter, Centrifugal Dewatering
4. **Mixing and Body Making:** Simple & De-airing pug mills and pugging equipments. Extruders, kneading equipments, wet pan mill, mixers, blunger, agitator etc
5. **Shaping Machine:** Potters wheel, Jigger & Jolly, Batting machine, Semi & fully automatic jiggers, Roller machines, Extrusion wire cutting machines,
6. **Pressing Machines:** Important parameters of pressing (Die, Powder & Pressure) Toggle press, Screw press, friction press, Hydraulic press, vibratory compaction machine Isostatic press, Hot isostatic press(HIP),Injection moulding, Tape casting, Tile press and their parts.
7. **Furnace Design:** study of common types of furnaces in use in ceramic industries i.e. glass melting tank furnaces including unit melters, tunnel kiln, chamber kiln and down draft kiln, rotary cement kiln, muffle kiln and annealing lehrs. Environment friendly gas fired Kiln for glass beeds making
8. Chimney and chimney calculation. Furnace capacity, Fuel efficiency and firing efficiency, Essential operations of a furnace i.e. Preheating of air, gas, fuel and oil, Flame-system, preheating of batch, firing, charging, melting and reversal etc

9. Furnace life and selection of refractories, Heating and cooling down of a furnace ccombustion, calculation, Solid and Liquid Fuel, gaseous Mixture.
10. Elementary idea of design, construction and thermal calculation of at least one of the above mentioned furnaces

INSTRUCTIONAL STRATEGY

First Teacher should be Demonstrate by Making the figure in Class Board. Students must visit the different types of Ceramic plants to be familiar with Different types of Furnace / Kiln and manufacturing process of Ceramic industries. And another way is to showing the slide & video

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Actual Lab & Practical Work
- Model Making,

RECOMMENDED BOOKS

1. Industrial Ceramic by Singer & Singer, IBH Publisher.
2. A Concise Introduction to Ceramics by George C. Phillips, Amazon Publication
3. Ceramics, Mastering the Craft by Richard Zakin, American Ceramic Society Publication,

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	9	10
2	9	10
3	9	10
4	9	10
5	8	10
6	9	10
7	8	10
8	8	10
9	8	10
10	7	10
Total	**84**	**100**

6.3 GLASS & CERAMIC ENGINEERING DRAWING-III

L	T	P
-	-	8

RATIONALE

Drawing of all ceramic Machinery and Furnace in sectional views (assembly and disassembly). Layout of small scale Ceramic Industry. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Student will take the knowledge to make the sectional view of all ceramic Machinery
2. Student will take the knowledge to make the sectional view of all ceramic Kiln / Furnace
3. Knowledge of making the Layout of Pottery, Refractory, Enamel and cement plant etc.
4. Students will take the knowledge of dimensioned drawing of electrical Insulator

DETAILED CONTENTS

I. Sectional views of the following ceramic machinery
(Assembly and disassembly where possible)

1. Ball mill, Tube Mill
2. Edge runner mill
3. Jaw crusher
4. Plunger
5. Filter press
6. Vibrating screen
7. Sieve shaker
8. Muffle furnace
9. Jigger jolley
10. Down draft furnace
11. Hand press
12. Pugmill
13. Frit furnace
14. Glass melting furnace, Tank and Pot Furnace
15. Rotary Kiln
16. Chimneys for glass and pottery furnace

II. Layouts of ceramic plant:

a. Pottery
b. Refractory
c. Glass
d. Enamel
e. Cement

III. Dimensioned drawing of Insulator.

MEANS OF ASSESSMENT

– Sketches work
– Drawing / Card Sheets

RECOMMENDED BOOKS

1. Engineering Drawing by N.D.Bhatt

ELECTIVE - I

6.4 GLASS TECHNOLOGY-II

L	T	P
6	-	-

RATIONALE

In this specialized subject, melting and refining of glass, colorants of glass, manufacturing of glass bottles and defects in glass are in detail. Elementary knowledge about glass ceramics and fibre optics is also provided along with quality procedures.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know various raw materials for glass ceramic
2. Understand general ideas about Ornamental glass, melting furnace & glass melting process
3. knowledge about colourants in glass
4. Understand idea about the various process/technique of glass decoration
5. Understand Float glass making process & other glass products
6. Know the various process/technique decoration of glass and Special glass making
7. Know idea on layout of modern glass plant

DETAILED CONTENTS

1. **GLASS CERAMICS:-** Introduction on Nucleation and crystallization in glasses, Controlled heat treatment for crystallization, Ultra low thermal expansion glass ceramics, Machinable glass ceramics.

11. **ORNAMENTAL GLASS:-** History of glass beeds making, Tools and apparatus for glass beads making. Raw materials of ornamental glass i.e. Soda Lime, Types of ornamental products i.e. Glass beads, Glass Pendants, Different techniques of glass beads making

12. Colourants of glass-Titanium, oxides, Chromium oxide, manganese oxide, Iron oxide, Cobalt oxide, Nickel oxide, Copper oxide, Selenium oxides and others.

13. Different techniques of decoration i.e. Silvering, Fuming, Lustering, Feathering, Dating, Banding, Dichroic, Millefiori,.

5. **FLOAT GLASS:-** Theory of float process, construction of float tank, Control of glass ribbon thickness, application/uses of Float glass

6. **OPTHELMIC GLASSES:-** Refractive and dispersion in glass, Design of glass lens.

7. **GLASS AND REFECTORY TECHNOLOGY:-**Different types of refractories used in glass industry, Properties, Behaviour, Conditions in the different zones of glass. Melting furnace and selection of refractory accordingly.

8. ASTM methods for determination of strain point, annealing point, softening point, density, co-efficient of thermal expansion, viscosity

9. Manufacturing of glass bottles, hollow and pressed ware, sheet and plate glass, safety glass,

optical glass, toughened glass, fiber glass, heat resistance glass, window glass

INSTRUCTIONAL STRATEGY

Different glass industries like sheet glass industry, hollow ware glass industry, float glass industry must be shown to students for better understanding of raw materials, processes and products etc.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Handbook of Glass Manufacturing by F.V. Tooley, Prentice Hall of India Publication
2. Modern Glass Practice by S.G. Scholse, McGraw Hill Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	10	12
3	12	12
4	12	12
5	10	12
6	8	8
7	12	12
8	8	12
9	4	8
Total	**84**	**100**

ELECTIVE - II

6.4 POTTERY & PORCELAIN-II

L	T	P
6	-	-

RATIONALE

This specialized subject enables the students to handle heavy clay wares and fine ceramics. Students are also made aware of health and safety guidelines and defects in ceramic body.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know the various raw materials used in white ware Industries
2. Know the Defects in various white ware
3. Understand various composition and formulation of various types of white ware bodies & their characteristic
4. Understand various qualities and process of testing of various ceramic products

DETAILED CONTENTS

1. Raw material for white wares. Thermal effect, high temperature reactions in raw materials and their chemical change. Properties effect on ceramic whitewares, Texture and other physical properties. Influence of size and shape of particles. Particles size of ceramic materials and their determination. Changes in volume factors which influence the change.

2. Defects in white ware bodies caused by thermal expansion effects. Factors which influence changes in porosity and water absorption. Factors involved in the strength of whiteware bodies.

3. Define Calcination, sintering and vitrification. Development of the grain growth Microstructure of white wares.

4. Triaxial and other white wares and compositions with their Batch calculations.

5. Mechanism of firing and control : Modern trends in firing of whitewares.

6. Strength of porcelain insulators. Factors effecting breakdown of high and low voltage insulators.

7. White wares bodies : Earthen Ware, Stone ware, sanitary wares, bone china, chemical porcelain, electrical porcelain manufacturing method, properties and uses.

8. Describe the Ceramic Glaze, Raw material & their influence, Preparation, classification, application(Dipping, spraying, pouring, brushing, dusting) & decoration, Properties, Defects(Crawling, pinholes, peeling, crazing, spit-out dunting, blistering, sulphering, rolling, chipping) and their remedies.

9. Ceramic colours and decoration, Factor affecting colour.

10. Recent development and control techniques applied to the whitewares processes- Kilns, Roller Head Jigger, Digital Printing.

INSTRUCTIONAL STRATEGY

Students must get industrial exposure of various white ware industries to know more about process and products.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Industrial Ceramics by Singer & Singer, Khanna Publishers, New Delhi
2. Fine Ceramics by F.H. Norton.
3. A Handbook of Ceramics, Prentice Hall of India

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	12
2	10	12
3	9	12
4	7	7
5	7	7
6	9	12
7	10	12
8	9	12
9	7	7
10	8	7
Total	**84**	**100**

LIST OF PRACTICALS

1. Determination of porosity of a given sample.
2. Determination of density of a given sample.
3. Determination of thermal shock resistance of a given sample.
4. Determination of impact & chipping resistance of a given sample.
5. Determination of acid resistance of a given sample.
6. Steatite body preparation.
7. Preparation of lead and Borax frits.
8. Application and firing of transfer paper.
9. Study the milling of enamel & glaze in pot mill.
10. Application of glaze by dipping & spraying.

6.5 SILICATE ANALYSIS LAB

L	T	P
-	-	8

RATIONALE

In this specialized Lab Silicate Analysis Students will analyze Ceramic materials as Loss on Ignition, they can check purity of Chemicals Determine the alkali in different types of Glass batches by using of Flame photo meter.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

1. Know the students how carryout loss on ignition of any Ceramic material
2. Understand the students to analyze ceramic raw material as Quartz, Feldspar, Glass etc.
3. Determined the Iron in China clay, Glass sand, Quartz etc
4. Determined the Alkali in ceramic material by Flame Photo meter.

DETAILED CONTENTS

i. Determination the Loss on Ignition of Given sample as silica sand,

ii. Determination of purity of chemicals used in Ceramic industry.

iii. Analysis of ceramic raw materials and glass raw materials such as lime, glass-sand, felspar, clay and quartz.

iv. Colorimetric estimation of iron in China clay, glass sand and quartz.

v. Analysis of Soda-lime glass.

vi. Determination of alkali by conventional method and by flame photometer.

MEANS OF ASSESSMENT

- Actual Lab & Practical Work
- Laboratory Test
- Mid-term and end-term Lab tests

6.6 PHYSICAL TESTING OF CERAMIC LAB

L	T	P
-	-	8

DETAILED CONTENTS

(A) POTTERY:

1. Particle size determination of ceramic raw materials by Anderson pipette,
2. Determine the Strength (M.O.R) of green and fired bodies.
3. pH-measurement of casting slip.
4. Determine the Viscosity of slurry by Torsion Viscometer
5. Thickness of weight, per unit area of glaze applied.
6. P.C.E. test for clays.

(B) REFRACTORY:

7. Determination the Pyrometric Cone Equivalent (P.C.E) of refractory
8. Determination the Refractoriness under load (RUL) of refractory
9. Spolling test. (upto 1000^0C)
10. Thermal expansion test (upto 1000^0C)
11. Thermal conductivity (upto 1000^0C)
12. Slag or glass resistance test (corrosion test)
13. Determination the Permanent linear change(P.L.C) of refractory
14. Determination the Permeability of refractory sample
15. Determination the Cold crushing strenght (C.C.S) of refractory cubes
16. Determination the Packing Density of refractory materials
17. Study the Grading of Grog
18. Warpage of Refractory Slab

(C) GLASS :

19. Softening point by littinton methods or by Softening point Apparatus
20. Low temperature viscosity.
21. Chemical durability of Glass ware by
    a. I.S.I. method
    b. ASTM Method
22. Determination the Thermal expansion of glass up to 1000^0C.
23. Determination the Thermal Shock of glass ware
24. Annealing test by strain viewer.
25. Determination the Wall thickness of glass ware by varnier caliper / Dial gauge
26. Light absorption of coloured glass at different wave length by spectro photometer.

(D) ENAMEL:

27. Study the enamel defect after Fusion / firing
28. Determine the Alkali Resistance Test
29. Determine the Acid Resistance Test
30. Determine the Impact Resistance Test
31. Determine the Water Resistance Test
32. Study the Gauge and Dimension of Metal sheet

(E) FUEL AND PYROMETRY:

33. Determine the moisture content of a given fuel.

34. Proximate analysis of coal.
35. Determination the viscosity of oil fuel by Redwood viscometer or Torsion viscometer
36. Determine the Flash point of oil fuel.
38. Determination the sulphur content in the coal.
39. Uses & Study of different types of pyrometers and Thermocouples.
40. Determine the Calorific value of coal by Bomb calorimeter.

MEANS OF ASSESSMENT

- Assignments and quiz
- Laboratory Test
- Giving Lab tests,

6.7 PROJECT WORK & POWER POINT PRESENTATION

L	T	P
-	-	2

RATIONALE

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the project work, the students will be able to:

- Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.
- Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.
- Setup a small scale unit & run smoothly.

General Guidelines

In the final year of the course, student can be divided in groups of 3 to 5 to take up a project for setting up a small scale industry to produce glass wares, white wares, electrical insulating items, refractory bricks etc.

The project report will include selection of site, market survey , list of equipments & machinery, raw materials, power, human resources, and investment involved. These things be rationally determined by the basis of actual data collected during survey. They are expected to visit existing industry for the purpose.

The project will also clearly mention amount of raw material wanted for 3 months working and yearly turn over and expected profit.

Prepare at least a few samples of the product, intended for manufacture, at institute level for producing before the examiner.

The project should have a table of the results of test and quality control of the product.

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no

Supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

NOTE:
The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance Criteria	Max.** Marks	Rating Scale				
			Excel lent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10 %	10	8	6	4	2
2.	Planning and execution of considerations	10 %	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table.
In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not eligible to receive diploma". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

S.No.	Range of maximum marks	Overall Grade
i	More than 80	Excellent
ii	79 < > 65	Very Good
Iii	64 < > 50	Good
Iv	49 < > 40	Fair

v	Less than 40	Poor

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.

4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition.

6.8 EMPLOYABILITY SKILLS

L	T	P
-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market and survive in cut throat competition among professionals.

DETAILED CONTENTS

1. Writing skills (08 hrs)
   i) Official and business correspondence
   ii) Job application - covering letter and resume
   iii) Report writing - key features and kinds

2. Oral Communication Skills (10 hrs)
   i) Giving advice
   ii) Making comparisons
   iii) Agreeing and disagreeing (Group Discussions Techniques)
   iv) Motivation & Leadership
   v) Fixing and cancelling appointments

3. Generic Skills (04 hrs)
   i) Stress management
   ii) Time management
   iii) Negotiations and conflict resolution
   iv) Team work and leadership qualities

4. Interview Skills/ Techniques (06 hrs)
   In-Person Interviews, Telephonic Interview, Panel interviews, Group interviews and Video Conferencing etc.

   Q1 Tell me about yourself.
   Q2 What are your greatest strengths?
   Q3 What are your greatest weaknesses?
   Q4 Why should I hire you?
   Q5 Where do you see yourself five years from now?
   Q6 Why do you want to work at our company?
   Q7 Would you lie for the company?
   Q8 Looking back, what would you do differently in your life?
   Q9 Could you have done better in your last job?
   Q10 Can you work under pressure?
   Q11 Why aren't you earning more money at this stage of your career?
   Q12 Who has inspired you in your life and why?

Q13 May I contact your present employer for a reference?
Q14 Sell me this stapler…(this pencil…this clock…or some other object on
Q15 The Salary Question – How much money do you want?
Q16 The Illegal Question

6.9 INDUSTRIAL TOUR

Industrial Tour : Students will go on industrial tour (various industries related to ceramics). Student will submit a Industrial Visit report this will be evaluated at institute level for 30 marks.

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Equipment requirement:

Following Laboratories are required for Diploma Programme in Civil Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Applied Mechanics Laboratory
- Engineering Drawing
- Basics of Electrical, Mechanical, Civil Engg.
- Basics of IT/Computer Applications \Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Plumbing Shop
- Welding Shop
- Fitting and Plumbing Shop
- Sheet Metal Shop
- Black smithy / Mason Shop
- Machine Shop
- Pottery & Refractory Lab and Modeling & Mould Lab
- Glass, Enamel & Ceramic Coating Lab
- Elementary Geology & Mineralogy Lab
- Energy Conservation Lab
- G.C. Workshop Practice Lab
- Silicate Analysis Lab
- Physical testing of Ceramic Lab

EQUIPMENT REQUIRED FOR

COMMUNICATION SKILLS LABORATORY			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500

APPLIED PHYSICS LABORATORY			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil weston-type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers	8	8,000

	Sensitivity : 20 microamperes per scale division,		
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000

APPLIED CHEMISTRY LABORATORY			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Digital Balance	1	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000
8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Able's Flash Point apparatus	2	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000
14.	Decicators	06	8,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	2,000
16.	Chemicals EDTA-1 kg Eriochrome Black-T(solochrome black T)-200g Buffer solution (NH3 - 2.5 ltr, NH4Cl – 1 kg) Zinc sulphate- 500g H2SO4- 2.5 ltr Phenolphthalein indicator (as per requirement) Methyl orange indicator (as per requirement) Charcoal (as per requirement) Kerosene- 1 ltr	LS	20,000

17.	Miscellaneous	LS	2,000

APPLIED MECHANICS LAB				
Sr. No.	Description	Qty	Rs	Total Price (Rs)
1	Polygon of Forces Apparatus	4	1500	6000
2	Universal Force Table	2	2500	5000
3	Principle of Moment Apparatus Bell Crank lever	4	1500	6000
4	Combined Inclined plane & Friction apparatus	4	1500	6000
5	Simple wheel and axle	2	2500	5000
6	Differential wheel and axle	2	3500	7000
7	Double sleave Pulley Block	1	800	800
8	Simple Screw Jack	4	3000	12000
9	System of pulleys (Any I,II,III)	2 set	4000	8000
10	Worm & Worm wheel	2 set	5000	10000
11	Simply Support Beam with different weights (2 Sets)	2	3000	6000
12	Jib Crane	2	2500	5000
13	Jointed Roof Truss Apparatus	2	2500	5000
14	Misc. Lum Sum			5000

ENGINEERING DRAWING LAB			
Sr. No.	Description	Qty	Total Price (Rs)

1.	Drawing Boards (700 x 500mm)	60	25,000
2.	Draughtsman Tables	60	1,80,000
3.	Draughtsman Stools	60	40,000
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Model of different wooder joints	1	1,000
6.	Model of different screw threads	1	1,000
7.	Model of various locking devices	1	1,000
8.	Model of various joints	1	1,000
9.	Cut section Model of various couplings	1	3,000
10.	Miscellaneous	LS	5,000

BASICS OF IT LABORATORY/COMPUTER LABORATORY			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Computer System with latest configuration	30	8,00,000
2	Printer (MFP)	1	25,000
3	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitiser	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000
8.	LCD Projector	1	35,000
9.	UPS	60	1,20,000
10.	Software (latest windows, latest MS Office)	1	1,00,000
11.	Scanner	1	10,000
12.	Miscellaneous	LS	5,000

CARPENTRY SHOP			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000

3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	**Miscellaneous**	**LS**	**1,500**
PAINTING AND POLISHING SHOP			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
ELECTRICAL SHOP			
1.	Tool kit (Plier, Screw driver, Knife, Steel rule, hammer, scriber, pincer steel tape etc.)	20	20,000
2.	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.(as per requirement)		8,000
3.	Electric Iron	1	1,500
4.	Electric kettle	1	1,500
5.	Ceiling fan/table fan	1	2,500
6.	Desert cooler	1	5,000
7.	Lead acid battery	2	8,000
8.	Battery Charger	1	6,000
9.	Miscellaneous		3,000

SMITHY SHOP			
Sr. No.	Description	Qty	Total Price (Rs)
1.	Black smithy forge (with open hearths, accessories to match the forge)	20	40,000
2.	Wrought iron anvils	20	20,000
3.	Swage blocks	4	8,000
4.	Blower with accessories, motor switch etc	1	6,000
5.	Work benches with vices	2	6,000
6.	Power hammer	1	20,000
7.	Tools and accessories – hammers, swages, tongs, pokers, pullers etc	20	10,000
8.	**Miscellaneous**	**LS**	**1,500**

FITTING AND PLUMBING SHOP			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribers	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chiesels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	*Miscellaneous*	*LS*	*1,500*

SHEET METAL SHOP			
Sr. No.	**Description**	Qty	Total Price (Rs)
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	1	20,000
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminum)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00

10.	*Miscellaneous*	*LS*	*1,000*
WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000
16.	Welding Partition Screen	5	2,500
17.	*Miscellaneous*	*LS*	*3,000*

FOUNDRY SHOP			
Sr. No.	Description	Qty	Total Price (Rs)

1.	Moulding boxes	40	8,000
2.	Ladles	5	2,000
3.	Tool Kits	10 set	5,000
4.	Quenching tanks	2	5,000
5.	Portable grinder	1	3,000
6.	Pit furnace with blower	1	10,000
7.	*Miscellaneous*	*LS*	*1,000*
MACHINE SHOP			
1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000
6.	Work bench	3	10,000
7.	Precision instruments	1	10,000
8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	*Miscellaneous*	*LS*	*5,000*

ENVIRONMENT ENGINEERING LABORATORY			
	pH Meter	01	500
	Turbidity Meter	01	5000
	Oven with Temperature Controller and Forced Air Circulation Type	01	20000
	B.O.D. Incubator	01	25000
	Water Analysis Kit	01	5000
	High Volume Sampler	01	40000
	Electrical Balance for weighing upto 1/10 of milligram (capacity)	01	1000
ENERGY CONSERVATION LABORATORY			
1	Clamp meter	02	5000
2	Multimeter	02	2000
3	Power Analyzer	01	20000
4	Different types of lamps (LS) 60 W lamp, 230 V , 100 V 200 W lamp 500 W lamp 100 W lamp, 110 V, 150 V	10	500
5	Lux meter	02	5000
6	Centrifugal pump, 1 kW	1	15,000
7	Standard window A.C.	01	20000
8	Anemometer	02	5000
9	Thermometer	03	2000
10	Flow meter	02	10000
11	Pumping set with at least two pumps of different capacity.	1 set	10000
12	Pressure gauge fitted on discharge lines	1 set	2000
13	Variable Frequency Drive	02	50000
14	A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switch.	1	3000
15	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	1	10000
16	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25000

ENERGY CONSERVATION LABORATORY

Sr. No	Particulars	Qty	Estimated Cost (Rs)
1	Multimeter	1	17,000
2	Power Analyzer	1	20,000
3	Luxmeter	1	5,000
4	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25,000
5	Centrifugal pump, 1 kW	1	15,000
6	Variable Frequency drive	2	50,000
7	Water Flow meter	1	10,000
8	Pressure Gauge	1	2,000
9	Experimental Set up for Valve Throttling vs VFD	1	50,000
10	Compressor, 20 cfm, single-stage	1	50,000
11	Air leakage meter	1	18,000
12	Blower (2 HP)	1	8,000

1	POTTERY & REFRACTORY LAB			
S. No	**Name of Equipment**	**Qty**	**Rs.**	**T. Rs.**
1	Ball Mill(Porcelain line inside with pebbles)Capacity-2 Cubicfeet	1	20000	20000
2	Pot Mill Rotatary with pot & grinding media	1	8000	8000
3	Screw Blunger Lab Size	1	5000	5000
4	Wooden Plunger Lab Size	1	5000	5000
5	Vibrating m/c	1	3000	3000
6	Filter Press Lab Size with Diaphram Pump	1	30000	30000
7	Universal Jigger Jolleys	2	5000	10000
8	Toygle Press Lab Size	1	10000	10000
9	Jaw Crusher Capacity small Lab size	1	10000	10000
10	Double Roller crusher 10"x8" Roller size. Lab Size	1	20000	20000
11	Hand Screw Press (No.-1or 2)	1	10000	10000
12	Hot air oven (Heavy Duty)inner size-14"x14"x14"	1	8000	8000
13	Kanthal Furnace upto 1200^0C	1	25000	25000
14	High temperature furnace horizontal type up to 1450^0C	1	200000	200000
15	Ph meter	2	1500	3000
16	Test Sieves set (No of sieves-10 of different micron size)	2	2500	5000
17	Adherence test Apparatus.	1	5000	5000
18	Vernier Calipers (Branded) Plane & Dial type	2	1500	3000
19	Permanent Magnet for casting slip	1	500	500
20	De-airing pug mill Lab Size	1	25000	25000
21	Painters Wheel (H x Dia)-18”x10”	2	1000	2000
22	Cyclone Dryer / Separator Small / Lab Size	1	10000	10000
23	Travelling Microscope	1	10000	10000
24	Permeability App.	1	6000	6000
25	Hydraulic press (25 MT Capacity) Lab Size	1	250000	25000
26	Diamond Cutter Tile cutter with dia of blade (8"/10")	1	5000	5000

2	GLASS, ENAMEL & CERAMIC COATING LAB			
S. No	**Name of Equipment**	**Qty**	**Rs.**	**T. Rs.**
1	Physical Balance (Branded -max capacity-250 gm)	1	5000	5000
2	Silica Crucible (50 ml, 100 ml) =(Lump sum)		2500	2500
3	Platinum Crucible 50 ml & weight >50 gm	2	20000	40000
4	Strain Viewer	1	1000	1000
5	Thermal baths for thermal shock	1	15000	15000
6	High Temp.Furnace, bottem moveable,vertical type upto1450^{0}C	1	200000	200000
7	Lens Grinding & Polishing m/c. Small Size	1	25000	25000
8	Sand blasting m/c. Small Size with Compressor	1	15000	15000
9	Electric Muffle Furnace Small size 1200ºC	1	20000	20000
10	Electric furnace 30x30x30cm.Temp.1000ºC	1	25000	25000
11	Enamel slip Spray gun	2	1500	3000
12	Softening Point testing app. for Glass.	1	80000	80000
13	Thermal Expansion Testing App. for Glass	1	100000	100000
14	Ultrasonic Drilling Machine	1	25000	25000
15	Thickness Viewer for non-metal coating on metal	1	10000	10000
16	Ultra Violet Glass Viewer	1	25000	25000
17	Graphite Paddles For Glass Beeds Making	1	50000	50000
18	Optic Moulds for millefiori Glass rods	10	10000	100000
19	Optical Microscope of high magnify power with light	2	20000	40000
20	Optical Microscope (Ordinary)	2	800	1600

3	SILICATE ANALYSIS LAB.			
S. No	**Name of Equipment**	**Qty**	**Rs.**	**T. Rs.**
1	Chemical Balance(Branded -max capacity 250 gm)	2	5000	10000
2	Digital Electronic Balance (Branded-max 200gm,min least count 0.001gm)	1	15000	15000
3	Hot Plate 2KW	1	3000	3000
4	Hot air oven (Heavy Duty)inner size-14"x14"x14"	1	8000	8000
5	Platinum Crucible with lid 25 ml.& Weight >25gm	3	10000	30000
6	Platinum Disc with lid 5 cm dia, weight 20 gm approx	2	8000	16000
7	Platinum dish with lid 10 cm dia, weight 35 gm approx	1	14000	14000
8	Hydro Flourication Chamber	1	10000	10000
9	Calorimeter for determination of Iron titanium content in clay	1	6000	6000
10	Lovibond comporotor with test tube.	1	1500	1500
11	Flame Photometer	1	4000	4000
12	Water Bath	3	4500	4500
13	Water De-ioniser Plant Glass Made	1	5000	5000

14	Glass Ware (Lump sum)		2500	2500
15	Silica Crucible (25 ml, 50 ml)		2000	2000
16	Tongs (Stainless Steel) size 10” & 12”	5	100	500
4	**PHYSICAL TESTING OF CERAMIC LAB**			
S. No	**Name of Equipment**	**Qty**	**Rs.**	**T. Rs.**
1	Physical Balance (Branded -max capacity-250 gm)	1	5000	5000
2	Electronic Digital Physical Balance-max capacity-250gm	1	8000	8000
3	Auto clave Testing for Crazing deffect	1	15000	15000
4	Vicats Needle apparatus	2	500	1000
5	Le Chatteliers apparatus.	2	500	1000
6	Density Comparator Testing App.	1	3000	3000
7	Infra Red Moisture Balance	1	12000	24000
8	Speedy moisture test for direct reading	1	12500	12500
9	Electric Muffle Furnace Small size 1000ºC	1	25000	25000
10	Refractometer & Glossy Meter	1	3500	3500
11	Optical pyrometer Range 400 to 1600^0C	1	25000	25000
12	Radiation Pyrometer up to 1600ºC	1	80000	80000
13	Thermo couples upto 1500ºC With Digital Indicator	1	10000	10000
14	Red Wood Viscometer	1	11500	23000
15	Orset apparatus for Gas Analysis	1	5000	5000
16	Bomb calorimeter with complete accessories	1	50000	50000
17	Flash point Apparatus for liquid fuel	1	5000	5000
18	Thermal Expansion Apparatus up to 1000^0C.	1	100000	100000
19	Planetary Ball Mill PM 100 with complete accessories	1	500000	500000
20	Ultimate Tensile strength testing machine	1	40000	40000
21	Apparatus for testing c.c.s. of refractory/Concrete cube	1	40000	40000
22	Rotory Viscosity meter/ Torsion viscosity meter	1	5000	5000
23	Softening point apparatus			
	i. Vertical tubler furnace upto 1000ºC	1	10000	10000
	ii. Thermocouple	1	3000	3000
	iii. Temperature indicator	1	5000	5000
	iv. Vertical Graduated Telescope	1	40000	40000
24	Low temperature viscosity apparatus			
	i. Tubler furnace upto 1000ºC.	1	25000	25000
	ii. Thermocouple	1	3000	3000
	iii. Temperature indicator	1	3000	3000
	iv. Vertical graduated telescope	1	10000	10000
	v. 1/2 kg. weight	1	100	100

v

5	GEOLOGY & MINERALOGY LAB.			
S. No	**Name of Equipment**	**Qty**	**Rs.**	**T. Rs.**
1	Mineralogical Microscope	6	10000	60000
2	Steel Books Shelves	2	6000	12000
3	Electronic Digital balance Max capacity-25kg/100 kg	2	1500	3000
4	Moh's Scale for hardness	10	500	5000
5	Rockwell Hardness Tester with computer Programming	1	120000	120000
6	Grinding & Polishing Machines for sample preparation	1	30000	30000

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

(C) Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

10.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve

problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals /field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feed back to every student

8. The student centred activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

13. LIST OF PARTICIPANTS

The following experts have participated in workshop for Developing the Curricula Structure and Contents of Glass & Ceramic Engineering Diploma Programmes for UP State on 11 September, 2019 at IRDT Kanpur & on 16 November, 2019 at GP Firozabad:

1. Dr. Ram Pyare, Professor at B.H.U Varanasi
2. Dr. Devendra Sah, Senior Glass Technologist at C.D.G.I, Firozabad,
3. Mool chand (Lecturer Ceramic), S.G.S.J. Polytechnic Khurja
4. Karan Pal (Lecturer Ceramic), Govt. Polytechnic Firozabad
5. KC Sharma, Retired HOD Govt. Polytechnic Firozabad
6. Ms. Kalpana Devi, Assistant Professor/Coordinator, IRDT Kanpur