

## 5.1 INDUSTRIAL MANAGEMENT

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### RATIONALE

The knowledge of this subject is required of all diploma holders who wish to choose industry/field as his career. This course is designed to develop understanding of various functions of management, role of workers and engineers and providing knowledge about safety and labour, industrial laws and management in different areas.

### DETAILED CONTENTS

1. Principles of Management (2 hrs)
  - Management, different functions of management: Planning, organizing, coordination and control.
  - Structure of an industrial organization.
  - Functions of different departments. Relationship between individual departments.
  
2. Human and Industrial Relations (4 hrs)
  - Human relations and performance in organization.
  - Understand self and others for effective behaviour.
  - Behaviour modification techniques.
  - Industrial relations and disputes.
  - Relations with subordinates, peers and superiors.
  - Characteristics of group behaviour and trade unionism.
  - Mob psychology
  - Grievance, handling of grievances.
  - Agitations, strikes, lockouts, picketing and gherao
  - Labour welfare.
  - Workers' participation in management.
  
3. Professional Ethics (4 hrs)
  - Concept of ethics.
  - Concept of professionalism.
  - Need for professional ethics.
  - Code of professional ethics.
  - Typical problems of professional engineers.
  - Professional bodies and their role.

4. Motivation (4 hrs)
  - Factors determining motivation
  - Characteristics of motivation.
  - Methods for improving motivation.
  - Incentives, pay, promotion, rewards.
  - Job satisfaction and job enrichment.
5. Leadership (4 hrs)
  - Need for leadership.
  - Functions of a leader.
  - Factors for accomplishing effective leadership.
  - Manager as a leader.
6. Human Resource Development (4 hrs)
  - Introduction.
  - Staff development and career development.
  - Training strategies and methods
7. Wage Payment (4 hrs)
  - Introduction
  - Classification of wage payment scheme.
8. Labour, Industrial and Tax Laws (4 hrs)
  - Importance and necessity of industrial legislation.
  - Types of labour laws and disputes.
  - Brief description of the following Acts: The Factory Act 1948; Payment of Wages Act 1936; Workmen Compensation Act 1923; Industrial Dispute Act 1947; Employee' State Insurance Act, 1948; Provident Fund Act.
  - Various types of Taxes-Production Tax, Local Tax, Sales Tax, Excise Duty, Income Tax.
  - Labour Welfare schemes.
9. Accidents and Safety (4 hrs)
  - Classification of accidents; according to nature of injuries i.e. fatal, temporary; according to event and according to place.
  - Causes of accidents-psychological, physiological and other industrial hazards.
  - Effects of accidents.
  - Accidents-prone workers.
  - Action to be taken in case of accident with machines, electric shock, road accident, fires and erection and construction accidents.

- Safety consciousness & publicity.
- Safety procedures.
- Safety measures-Do's and don'ts, good housekeeping (5S).
- Safety measures during execution of Electrical Engineering works.

10. Environment Management (4 hrs)

Basics of environmental pollution, various management techniques for control of environmental pollution, various control acts for air, water, solid waste and noise.

11. Materials Management (4 hrs)

Materials in industry, basis of inventories and inventory control, ABC analysis, Safety stock and re-order quantity, Store keeping, Methods of storing, Requisition and insurance of material, Bin card and Cardex systems.

Material handling equipment classification, working and uses of manual lifting, Hoist, Cranes, Conveyors, fork truck.

12. Financial Management (3 hrs)

Importance, Ledger, Journal, Profit and Loss Account, Balance Sheet, Interpretation of Statements, Ratio Analysis, Project financing, Project appraisal, return on investment.

13. Marketing and Sales (3 hrs)

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligraphy, perfect competition, Elements of Cost, Contribution, Break even analysis, Budget, Pricing Policies.

### RECOMMENDED BOOKS

1. Industrial Engineering and Management by TR Banga.
2. Industrial Engineering and Management by OP Khanna, Dhanpat Rai Publications, Delhi.
3. Industrial Management by VK Sharma, OP Harkut.
4. Sharma BR, Environmental and Pollution Awareness: Satya Prakashan, New Delhi.
5. Thakur Kailash, Environment Protection Law & Policy in India: Deep & Deep publication, New Delhi.
6. Handbook of Small Scale Industry by P.M. Bhandari.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi.
8. Principles of Management by Philip Kotler, TEE Publication.
9. Industrial Organization and Management by Tara Chand; Nem Chand and brothers, Roorkee

## 5.2 CERAMIC WHITEWARE TECHNOLOGY -II

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### 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.

### DETAILED CONTENTS

#### THEORY

1. Heavy Clay Wares:- Brickware, Salt glazed pipes, Sanitary ware, Earthen ware body, Terracotta body, Stoneware & body. (10 hrs.)
2. Fine Ceramics:- (10 hrs.)  
Manufacturing, properties & their applications: floor tiles, Wall tiles, Dental porcelain, Insulators Low tension and High tension, Electrical porcelain, Chemical stoneware, Bone china ware, Hotel ware
3. Study of the following properties of ceramic body:- (10 hrs.)  
Loss on ignition, Plasticity, thermal shock resistance, corrosion resistance, abrasion resistance, Lead solubility test, Porosity, Impact and chipping resistance, acid resistance.
4. Health & safety with glazes & ceramic materials-labeling of hazardous material, ceramic material hazards, recommended health & safety procedures, disposal of materials. (10 hrs.)
5. Defects of Ceramic Body:- Crawling, pinholes, Peeling, Crazeing, spit-out dunting, blistering, sulphering, rolling, chipping and their records. (8 hrs.)

#### 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 corrosion resistance of a given sample.
5. Determination of abrasion resistance of a given sample.
6. Determination of impact & chipping resistance of a given sample.
7. Determination of acid resistance of a given sample.

8. Steatite body preparation.
9. Preparation of lead and Borax frits.
10. Application and firing of transfer prints.
11. Study the milling of enamel & glaze in pot mill.
12. Application of glaze frit by dipping & spraying.
13. Study the defects like pinholes, chipping and dunting of fired product.
14. Preparation of clay models like statue, pen stands, paper weights.

### **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 Publication

### 5.3 CERAMIC REFRACTORY TECHNOLOGY-II

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#### RATIONALE

This specialized subject enables the diploma holders to perform sintering process efficiently. This subject also provides them details of special refractories and their applications.

#### DETAILED CONTENTS

##### THEORY

1. Sintering-Sintering process with oxide system, Production, properties and uses of Magnesite, Zirconia, Thoria, Insulating bricks, Insulating castables, Ceramic fibre, glass wool. Preparation, properties and uses. Preparation of crucibles, mufflers, saggars, fused alumina, & used magnesite. (16 hrs.)
2. Special Refractories (Manufacture, Properties and uses) (16 hrs.)  
Refractory-Borides, Carbides, Nitrides (for example SiC, Silicon nitride etc.) Cermets and composite materials, Titania, Beryllia, Abrasives, Monolithics-Castables, Ramming and Patching mixes, Refractory mortars and cements.
3. Application of refractories:-  
Glass Tank furnace, Blast furnace, Basic and open hearth furnace, Soaking pits, Reheating furnace, Hot metal mixer, Laddles, Steel melting furnace by electricity. Refractories used in nuclear power plant-Coke-ovens, Cement and lime industries.

##### LIST OF PRACTICALS

1. Refractoriness under load determination.
2. Spalling resistance for the refractories.
3. Conductivity determination for the compacted bricks.
4. Conductivity determination for the composite walls.
5. Permeability determination of bricks.
6. Shrinkage effect determination on bricks.
7. Instrumental analysis: X - Ray diffractometry, Flame Photometry & spectroscopy.
8. Determination of thermal shock resistance.

9. Determination of volume shrinkage by direct & indirect method.
10. Determination of coefficient of thermal expansion.
11. Refractoriness determination of various materials

#### **RECOMMENDED BOOKS**

1. Refractories by Nandi, New Age Publication
2. Refractories by Mishra, Tata McGraw Hill Publishers, New Delhi
3. Refractories by Chester, Prentice Hall of India Publication
4. Refractories by Chesty, PHI Publication

## 5.4 GLASS TECHNOLOGY - II

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### RATIONALE

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

### DETAILED CONTENTS

#### THEORY

1. Fundamental concept of glassy state, chemistry of glass in light of atomic structure, viscosity, thermal expansion and density measurement, origin of thermal stresses, tempering and annealing of glass, detection and measurement of strain, chemical durability, effect of composition on glass manufacturing. (8 hrs.)
2. Melting and refining of glass, annealing and decolourisation, strain, temporary and permanent strain, durability, attack of water on glass, acid attack, alkali attack (8 hrs.)
3. Colourants of glass-Titanium, oxides, Chromium oxide, manganese oxide, Iron oxide, Cobalt oxide, Nickel oxide, Copper oxide, Selenium oxides and others. (4 hrs.)
4. Manufacturing of glass bottles, hollow and pressed ware, sheet and plate glass, safety glass, optical glass, toughened glass, fibre glass, heat resistance glass, window glass (5 hrs.)
5. Defects in glass, their detection and prevention:- stones, cords, blisters and seeds bad colour, bad workmanship etc. (4 hrs.)
6. ASTM methods for determination of Strain point, Annealing point, Softening point, Density, Co-efficient of Thermal expansion, Viscosity. (5 hrs.)
7. Elementary knowledge of Glass Ceramics and Fibre Optics. (3 hrs.)
8. Introduction to- (i) Statistical quality control (3 hrs.)  
(ii) Basis of ISO-9000 and TQM
9. Principles and methods of glass working- fourcaults machine, pitsburg process, blowing, gobfeeder, ribbon machine, spinning glass. (8 hrs.)



**LIST OF PRACTICALS**

1. Determination of thermal expansion of glass
2. Determination of refractive index of glass
3. Determination of low temperature viscosity
4. Examination of Common defects in glass
5. Examination of strain in glass
6. Determination of hardness and durability of glass
7. Determination of viscosity of molten glass.
8. Determination of glass, cutting, sandblasting, silvering and enameling
9. Preparation of container glass, mixing, melting, tests during melting.
10. Preparation of special glasses such as crystal, semi crystal and signal glasses.

**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

## 5.5 MODERN CERAMICS

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### 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 specialised areas like nuclear ceramics, electronic device, bio ceramics etc.

### DETAILED CONTENTS

#### THEORY

1. Introduction to new ceramics, Scope & classification. (4 hrs.)
2. Superconductivity:- (8 hrs.)  
Phenomenon & properties of superconductor, Meissner effect. Development of high temperature Ceramic super conductors, their crystal structure, application of super conductors.
3. Nuclear Ceramics:- (10 hrs.)  
Nuclear energy, types of reactors, fuel elements, containers, moderators, control rods, structural parts, irradiation effect, ceramic materials used in tech., their classification & applications.
4. Dielectric & magnetic ceramics:- (12 hrs.)  
Barium titanate, manufacture of barium titanate, property, hexagonal & polycrystalline ferrites, rare earth garnets, orthoferrites, ilmenites, classification of ferrites, types of ferrite, hard & soft ferrites, Manufacturing of soft ferrites, hard ferrite, applications.
5. Ceramic capacitors:- (6 hrs.)  
Thin film capacitor, thick film capacitor, multilayer capacitors.
6. Ceramic sensors:- (8 hrs.)  
Resistors, Varistors and Thermistors, Ceramic materials- Properties, Manufacturing, Piezoelectricity phenomenon Ceramic materials, their shaping, sintering and finishing, their applications.

7. Bio-Ceramics:- (8 hrs.)

Ceramic materials for artificial tooth and bone joints, Elementary idea about preparation, Properties and Manufacture of bio-ceramics, their applications.

8. Piezoelectric, ferroelectric, Pyroelectric and electro-optic ceramics (8 hrs.)

Basic theory of development of piezoelectricity, Ferroelectricity in ceramic materials, PZT and PLZT based materials.

### **RECOMMENDED BOOKS**

1. Ceramic materials for electronics by R.C. Buchahan, McGraw Hill Publishing
2. Introduction to Ceramics by W.D. Kingery, Prentice Hall of India Publication

## 6.1 MINOR PROJECT WORK

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Minor project work aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students during last semester of the course, are required to be sent for a period of 5 weeks at different work sites. Some of the good industries are suggested by the expert group as follows:

1.	Hindustan Sanitaryware Industries Ltd.	Bahadurgarh (Haryana)
2.	Hindustan National Glass Industries Ltd.	Bahadurgarh (Haryana)
3.	Somani Pilkington Ltd.	Bahadurgarh (Haryana)
4.	Diamond Potteries	Bahadurgarh (Haryana)
5.	Gulati Glass	Bahadurgarh (Haryana)
6.	Yash Ceramics	Bahadurgarh (Haryana)
7.	Anat Raj Industries	Rewari (Haryana)
8.	P.K. Stonewares	Bhiwadi (Rajasthan)
9.	Kajaria Ceramics	Bhiwadi (Rajasthan)
10.	Orient Tiles	Sikunderabad (UP)
11.	Haryana Sheet Glass	Sonepat (Haryana)
12.	OSRAM Industries	Sonepat (Haryana)
13.	AASHI Glass Industries	Bhiwadi (Rajasthan)
14.	Bosch and Lamb Industries	Bhiwadi (Rajasthan)
15.	Glass Equipments Ltd.	Bahadurgarh (Haryana)
16.	Cosmo Ferrites Ltd.	Jabli, Distt. Solan (HP)

As a minor project activity, each student is supposed to study the material and technology used at site and prepare a detailed project report of the observation of process seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

The teacher along with field supervisors will conduct performance assessment of students. This minor project work will carry 200 marks. 100 marks will be given by Industrial/field supervisors and 100 marks by the teacher supervising this training. The components of evaluation will include the following:

a)	Punctuality and regularity	15%
b)	Initiative in learning new things	15%
c)	Relationship with workers	15%
d)	Industrial training report	55%

## 6.2 MAJOR PROJECT WORK

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In this particular diploma in “Ceramic Engineering” a complete semester is devoted to project work (minor and major project) so as to provide on-the-job-training to the diploma holders before completing the course. The reason for this is that in 1984 this diploma programme was started at Jhajjar on the request of ceramic industries in Bahadurgarh especially Hindustan Sanitarywares, Somani Pilkington and Hindustan National Glass Industries as they had to get persons from Southern part of India and since then these industries along with many upcoming ceramic industries are giving employment to large number of students from diploma in ceramic engineering being conducted at Govt. Polytechnic, Jhajjar. By devoting one full semester as Project Work these industries assure the employment to students and save time and money spent on, on-the-job-training.

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various 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. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. 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 for a group. The students should identify or given project assignment at least two to three months in advance. The project work identified in collaboration with industry may be preferred.

Each teacher is expected to guide the project work of 5-6 students.

- Design of process equipment
- Development of prototypes
- Study of the process of manufacturing of whitewares, refractories and glasses
- Fabrication of components/equipments
- Fault diagnosis and rectification experiences
- Bringing improvements in the existing system/equipment
- Calibration and testing of equipment or any other innovative project which can develop creative skills in the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max.** marks	Rating Scale				
			Excellent	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
<b>Total marks</b>		<b>100*</b>	<b>100</b>	<b>80</b>	<b>60</b>	<b>40</b>	<b>20</b>

\* For the external examinations all the marks can be doubled.

The overall grading of the practical training shall be made as per following table

	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

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance of undergoing 8 -10 weeks of project oriented professional training in the same industry and re-evaluated 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.

### Important Notes

- 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.**
- The criteria for evaluation of the students have been worked out for 100 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 another 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 organisations in such an exhibition. 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 industries are approached for instituting such awards.