SYLLABUS

DIPLOMA IN LABORATORY GLASSWARES

PAPER – I: (Glass blowing, Types of glasses, Development of glasses, Fibre and Special glasses, safety Measures)

Unit I - Types of Glasses & Developments: History of the Glass - The beginning of Glass manufacture - Definition of Glass - Types of Glasses and composition: Fused quartz, Commercial Glasses, Coloured Glasses, Soft Glass, Soda glass, Borosilicate glass, Led Glass, Vycor Brand glasses - Physical properties of Glass: Working Point, Annealing Point, Strain Point, Flam Annealing Point, Bloom in Soft Glass, Devitrification from Overheating, Co-efficient of Expansion.
Unit - II - Fibre and Special Glasses: Fibre glass, Lime Alumino Silicate Glasses, Barium Alumino Silicate, Photo Sensitive Glasses, 96% silicate glasses, Fused Silica glass.
Unit III - Measuring Glass Tubes, Storage and Furniture: Measuring Glass Tubing - Storing Glass Tube and Rod Ordering Stock - The Workshop : Location, Lighting, Floor - Burners and hand lamps Fuel gas - Glass Blowing Equipment.
Unit – IV : Laboratory Glass Working Hazards : Hazard Due to Glass, Burn Hazards, Eye Hazards, Emphysema, Mercury, Hazard due to Repairable glassware, Hazards due to gas.
Unit V : Safety Measures : Safety Measures in Lab Glass Working due to repairable glassware, Acids - Gas Breakages Due to Explosion or implosion Pollution.
Unit – VI : Glass Blowing : Basic Operation - Identification of different glasses, Soft glass, Pyrex glass - Rotation of glass tubing - Drawing of two tubes, Cleaning of Glass tubing, cutting glass tube, Cutting glass tubing with a file Hot wire cutting, Glass Cutting Saw - Preliminary Glass blowing operation - Fundamental Glass blowing seals : Straight seals, different diameters seals, 'T' seals, Ring seals, insertion seals, Side Ring seals, Cutting Glass with a hot rod.

PAPER – II: (General and Laboratory glasses, Glass joint, Glass to Metal Seals, Volumetric glasseswares, Machine Experience)

UNIT I - Laboratory General and Glasses, Seals For Different Glass Systems : Practice pieces to make, planning the work, working Instruction, Standard condensers cold trap, Inverted Ring seals, Glass expansion bellows, Addition Funnels. Vacuum Jacketed transfer tubes, General Laboratory Apparatus.
UNIT II - Interchangeable Ground Glass Joints Stopcocks : The Manufacture of Ground Glass joint, Specification for Interchangeable Glass Ground Joint, Use of Glass Ground joints in modern Research, Testing Reground surface for Leakage, Sperical Ball and Socket Joint, Stop Cocks straight Bore and Oblique Bore, Flate flange Joints.
UNIT III - Volumetric Glassware : Principles of Volumetric Calibration, Unit of Volume, reference temperature, Volumetric Accuracy, Methods of Verification and use, Scales, Patten, Position of Graduation Lines, Figuring of Graduation Lines, Visibility of Graduation Lines, Figures and inscriptions - Typical Calibration Techniques for different glass system, Tables for Calibration of Volumetric Glassware - Procedure based on the use of water - Procedure based on the use mercury - Tools and techniques.
UNIT IV - MACHINE EXPERIENCE : Glass blowing Lathe Operation - Grinding Glass, Manufacturing of Glass Ground Joints, Grinding tools made from a joints, Sets of metal grinding Tools, selection of Abrasive for Grinding, Grinding Equipments, Grinding procedure.
UNIT V - Glass application in cryogenic System Stage of construction and Chemical Silvering : Making Dewar Flask, Cylindrical and tail Dewer, Processing of materials, Silverings, Chemicals, Cleaning Glass Surface, Mixture of Solution, Vacuum Application, Operation of Vacuum Systems, Vacuum Techniques Technical Data.
UNIT VI - Corbon Die Making : Corbon Paddles, Corbon Reaming tools, Making Dies for Different Glass apparatus
UNIT VII - Glass to Metal Seals, Seals for different Glass : Glass to metal seals, Procedure for sealing glass to metal, Tungsten Pyrex – No 7740, Tungsten to Pyrex –No 7720 (Nonex) Copper to glass seals, Platinum to soft glass seals, Platinum to Pyrex seals, Dumet to glass seals, graded seals.

PAPER – III: (Workshop Tools, Measuring Tools, & Metals)

UNIT I - WORKSHOP TOOLS: Standard Rules – Different types of Making Tools and Punchs – vice – Different type of vice – File – Different type of Files – Cutting Tools – Hack saw, Drill bit, Taps and Die set – Various type of Spanners – Jigs & Fixtures – Figures – Functions.

UNIT II - MEASURING TOOLS : Standard Steel Rule – Types of Steel Rules – Caliper – Types of Caliper – Precision Tools – Micro Meter – Vernier Sliding Caliper – Vernier Bevel Protractor – Vernier Height Gauge – Function and Structure for Measuring Precision Tools – Gauge – Definition of Gauge – Plug Gauge – Ring gauge – Types of Ring gauge – Angular gauge – Pitch gauge – Thickness gauge – Standardization – Sine Bar – Structure – Slip Gauges – Functions and Uses of Sine Bar and Slip Gauge, Figures.

UNIT III - METALS : Ores – Types of Ferrous Metals – Properties of Ferrous Metals – Iron – Manufacturing of Iron – Non Ferrous – Types of Non Ferrous Metals and Properties – Ferrous Alloys – Types of Ferrous Alloys and Properties – Non Ferrous Alloys – Types of Non Ferrous Alloys and Properties, Hardening, Annealing, Timbering.

PAPER – IV: (Lathe, Drilling Machine, Safety Measures & Precautions)

UNIT I - Lathe Machine : Structure of Lathe – Parts of Lathe and Operations – Types of Lathe – Attachments - Driving Plate, Phase Plate, Fixed Steady, Follower Rest – Lathe Centres – Types of Centres and Uses – Types of Cutting Tools – Various types of Turning – Types of Thread Cutting – Spindle Speed – Cutting Speed – Feed – Depth of Cut – Figures of Lathe Accessories – Types of Coolant and Uses.
UNIT II - Drilling Machine : Functions of Drilling – of Drilling Machine – Machine Parts – Holding Devices (Job) – Various types of Drilling Operation – Holding Devices (Drill Bit) – Cutting Speed – Feed – Symbols and Angle for Drill Bit.
UNIT III - Safety Precaution : General Safety Precaution on Workshop – Safety Precaution on Hand Tools – Safety Precaution on Machine and Equipments – Personal Safety Precaution – First Aid.

PAPER – V: (Engineering Drawing)

ENGINEERING DRAWING : Introduction – Drawing Instruments – Different Types of Lines – Lettering and Numbering – Details of Plane and Simple Solid Figures – Dimensions – General Principles of Dimensioning – Surfaces – Types of Surfaces – Geometrical Constructions – Polygon – Parabola – Involute –Types of Scales – Pictorial Drawings – Types of Pictorial Drawings – Method of drawing Circle in Isometric View – Method of Drawing Circles in Isometric View – Method of Drawing Circles and Arcs – Projections – Orthographic Projection – Systems of Orthographic Projection – principles of Drawing Orthographic Projection – Isometric Projection – Sphere – Sectional Views Developments of Surfaces.

References:

1. Glass Blowing for Laboratory Technicians By R. Barbour Second Edition, Pergamon Press, 1978.
2. Organic experiments by L.F. Floser and K.L. Williams on D.C. Heach and Co. Fifth edition 1979.
3. Scientific Glass Blowing E.L Wheeler, Dept. of Chemistry, University of California with a preface by G. Rose Robertson Interscience Publishers, INC New york 1958.
4. Modern Glass Working and Laboratory Technique By M.C. Nokers, Published by Heinemann Educational Books Ltd. Fifth Edition 1962.
5. Laboratory Glass – Working For Scientists A.J. B. Robertson, D.J Fabian, A.J. Crocter, J. Dewing, Scientific Publications 1957.
6. Creative Glass Blowing, James E. Hammesfahr Clair L. Stong with Foreword by Charles H. Green W.H. Freeman and company -1968.
7. Glass Science Robert H. Doremus Rensselaer Polytechnic Institus A. Wiley – Interscience publication John Wiley & Sons INC -1994.
8. Introduction to Glass Science and Technology James E. Shelby, The Royal Society of Chemistry 1997.