Board of Examination (for Boiler Engineers)

Syllabus SAULT

(Safety, Automation, Utilities, Laws & Techniques)

1. **Safety:** Definition of HSE, definition of hazard and its kind.

   - Methods of identifying hazards on work place (statements, analysis of significant risks
   - Potential harms, causes & prevention...confined places, electric shock, fire etc.
   - Appropriate control measures... engineering and administrative controls, safe practices, controls, personal protective equipments, Tag & permit system etc.
   - Safety devices.....circuit breakers, fuses, guards, sensors etc.
   - Reporting & recording of accident.....fatal accidents, near-miss, responsibility of owner and employees, recording & reporting procedure (health & safety files), procedure to deal with accidents.
   - Pollution & environmental protection... pollutants, industrial hygiene & sanitation.
   - Safety Laws.

2. **Automation**

   1. Automation...Introduction, basic features, advanced automation functions, level of automation.
   2. Instrumentation... introduction & importance.
   3. Electronics.....introduction, its basics, difference between electrical & electronics.
   4. Modes of control... Two positions, proportional, interlocking, digital & analogue, pneumatic & motorized controls, 24 volts & 220 volts usages.
   5. Control systems....feed water, flame-failure, De-superheating, packaged boiler operation.
   6. Definitions..... PLC & DCS and their difference, voltage, current, resistance, Ohm law, electric supply, conductor, semi-conductor, doping, ICs (Integrated circuits), resistance, capacitors, transistors, relays, diodes, battery, motor, solenoids, photoelectric tubes, ultraviolet tubes, limit devices, alarms, calibration, pressure & flow measuring devices, level indicators, sensors, actuators, transducer, transformers.

3. Utilities

- Air Compressors... introduction, classification, types, theory of compressor.
- Pumps..... theory of pumping, uses and selection of pumps, types. Impeller types, packing boxes, mechanical seals, types of heads.
- Turbines... types, principles, efficiency, advantage, losses, flow diagram.
- Basic HVAC... Refrigeration:- Introduction, units, refrigeration cycles, refrigerants, types & characteristics. Air-Conditioning...Introduction, comfort, air-conditioning types, selection of plant etc.
- Cooling towers... types, principles, precautions, water treatment.

4. Laws

- Definition & its characteristics, Act, Ordinance, Rules, Regulations.
- Codes, standards, specifications, procedures (ASME, BS, TRD, ISO, ASTM etc.)
- Related laws...Boilers & Pressure Vessels Ordinance 2002, Pakistan Boiler Rules 2009
- Pakistan Boiler Regulations 1951, Punjab Pressure Vessels Regulations 2018
- Important sections of related laws...

  Definitions.....Boiler, pressure vessel, department, Board (Punjab Boilers & Pressure Vessels Safety Board), Board of Examination, Inspection Authority.

  Important law points....Categorization of pressure vessels, duration of Inspection, registration, annual inspection, responsibilities of owner & boiler engineer (overall), qualification of boiler engineer, qualification of operational staff of pressure vessels, responsibilities of owner & boiler engineer in case of accident, prohibition use of boiler (section-6), offences & punishments.

5. Inspection Techniques

- Destructive Testing (DT).....Tensile Test, Impact Test, Hardness Test,
- Non Destructive Testing (NDT):-
  Visual Inspections (Lenses & optical...Borescope, Endoscope etc.)
  Instrument-Aided-Inspections.....Radiography, Ultrasonic, DPT, MPT, Metallography, Thermography, Acoustic etc

6. **Engineering Materials**

- Metals....Ferrous Metals & Non-Ferrous Metals
  Ferrous Metals:-Iron, Steel, Alloy Steels...Stainless, High Speed etc.
  Non-Ferrous Metals:- Copper, Aluminum, Zinc, Lead, Brass, Nickle, Cr,
- Non-Metals....Wood, Asbestos, Glass, Rubber, Plastic, Ceramics, Refractory.
- Others.....Composite Materials.
- Properties of materials...Strength, hardness, toughness, brittleness, ductility etc

7. **Report writing**

1. By a boiler engineer.....To the concerned Inspector of Boilers:

(i) Accident report of boiler or pressure vessels.

(ii) Application for registration / renewal of inspection certificates.

(iii) Application for transfer of boiler.

(iv) Application for any renewal alteration and modification in the boilers or pressure vessels

(v) Information for the leaving the job and joining at the new industrial unit

2. To the Owner / Manager

i) A demand letter for the purchase of any item.

ii) Inspection report of the purchased items received.

iii) A purchase proposal of any boiler or related equipment along with. payback calculations considering all the necessary factors.

8.

i) **Welding: - Introduction, types of welding.**

- Fusion or non-pressure welding...Gas welding, Arc welding, argon, TIG, MIG.
- Plastic or pressure welding..... Forge welding, resistance & spot welding. Filler metals, electrodes, welding defects, reasons, qualification of welder.

ii) **Engineering Estimation and costing:-**

- Estimating and costing, their difference, importance & advantages.
- Definitions: Organization, capital, administration, management, labor cost, material cost. Overheads...Fixed (Rent of building, insurance, depreciation, obsolescence, wages), Variable (Power or fuel consumed, repair & maintenance, wages, Payback calculation.
