

## COMPUTER CONTROLLED PACKED BED (EE-1648 C)

### DESCRIPTION

The set-up must be made of a glass column packed with packing materials i.e. Raschig rings, Berl saddles, spherical glass beads, etc. stainless steel mesh to support the packing and with calming section. Pressure drop across the packed bed must be measured by a manometer and DPT for data logging for different flow rates. The apparatus must be closed circuit type provided with tank, pump, necessary piping, valves and digital flow meter to measure the flow rate of fluid. BOTH manual and sensor-based data logging and control by computer interface is required to perform the experiment. The set-up must be fitted on a steel (corrosion resistive grade) support with wheels and painted with good quality corrosion resistant paint. The set-up must facilitate to interface the system with computer which enables to log the experimental data using computer. This software package must provide a comprehensive educational software environment within which the investigations can be performed. This software must be capable to tabulate the sample readings according to the requirement of experiment under study and results obtained can be compared. The real time data acquisition must be done by interfacing the set-up with computer using software. Software must allow the user to have control on data logging, printing the stored data, preparing spread sheets in Excel etc.

### EXPERIMENTATION

- To study relationship between velocity of fluid (flow rate) and pressure drop per unit length of bed for different types of packings (at least three types as mentioned in the description).
- To conduct an experiment on flow of water through a packed bed and determine the effect of superficial mass velocity on pressure drop across the bed in both laminar and turbulent flow regimes.
- To verify Ergun's equation. To compare the modified friction factor obtained from Leva's correlation with those obtained by Ergun's equation.
- To determine the effect of modified Reynolds number on modified friction factor

### UTILITIES REQUIRED

- Electricity 500 watts, 220 V, 1 Phase.
- Floor Area 0.75 m x 0.75 m.
- Manometric Fluid : 250 ml.

### TECHNICAL DETAILS

- Packed Column : Borosilicate Glass with both end made of Stainless Steel 304 (Nominal diameter: 50 – 80 mm).



- Length : 750 – 1000 mm for a particular packing material.  
Three separate columns or a single column (with three partitions for three types of packings) may be used for packing each type of packing material.
- Packing Material : Borosilicate Glass Rasching rings, Berl saddles, glass beads (suitable sizes say 5 -10 mm).
  - Water Tank : Material Stainless Steel, Capacity 30 Ltrs.
  - Water Circulation : FHP Pump, Crompton/Sharp make
  - Flow Measurement : Both Rotameter (manual) and Digital mass flow meter (digital/data logging)
  - Pressure Drop Measurement : by both Manometer (manual)/ Differential Pressure Transducer (digital) with output of 4 to 20 mA
  - Control panel consists of : Standard make ON/OFF switch, Mains indicator
  - An ENGLISH instructional manual with sample calculation and line diagram will be provided.
  - The whole set-up should be well designed and arranged on a rigid structure made of MS and painted with good quality paint.
  - The experimental set-up must be provided with a suitable Desktop computer (for data logging/analysis of data via software).
  - A computer with a LED monitor with suitable configurations should be included in the bid. Intel core i7 processor, 16 GB RAM DDR4, suitable intel chip set and graphics card, 1 TB hard disk Windows Operation System with perpetual licence (or) Better configuration is preferable.
  - Data acquisition electronic box, with connectors for the different sensors for monitoring, collecting data and controlling the experimental unit.
  - All the variables like flowrates of water, pressure/pressure difference measurement, etc. should be measured and controlled by integrating it with computer using Control interface box with Advanced Real-Time Control.
  - National Instruments Data Acquisition board standards. There should have a provision of calibration of a sensor and check the accuracy of the sensors before taking measurements. (Calibration certificate of sensors must be provided by the supplier). It must include a suitable data acquisition software
  - The data acquisition system must be able to perform the following but not limited to.
    - To represent the system responses curves in real time.
    - To record all the measurement values and results in a file and export through USB to external storage devices.
    - To plot the characteristic curves or user defined plots.
    - To calibrate the sensors that take part in the process.
    - Automatic calculation, recording, charting and data export for efficient use of students' and lecturers' time
    - Real-time traces, data capture, monitoring and display of your experiment readings on a computer (PC)