List of Laboratory Experiments

The Institution of Engineers (India)
8 GOKHALE ROAD, KOLKATA 700 020

CONTENTS

CHEMICAL ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group)]

Chemical Process Principles

1. Testing of Coal

   Objective

   Proximate and ultimate analysis of coal.

2. Humidity of Air

   Objective

   To determine humidity of air.

3. Distribution Coefficient of Acetic Aid

   Objective

   To determine the distribution coefficient of acetic acid between water and ether.

4. Solubility of an Inorganic Salt

   Objective

   Determination of solubility of an inorganic salt in water at different temperatures and plot a solubility curve.

5. Heat of SolutionObjectiveTo determine heat of solution using dewar flask.

Transport Phenomena

6. Mass Transfer Coefficient

   Objective

   To determine mass transfer coefficient of solid in water using an agitated vessel.

7. Diffusion Coefficient

   Objective

   To determine diffusion coefficient of liquid in air by Stefan's method and verification of Gilliland's equation.

8. Heat Transfer Coefficient

   Objective

   To determine overall heat transfer coefficient of a heat exchanger.

9. Thermal Conductance

   Objective

   To study temperature distribution across a composite wall and determination of overall thermal conductance.

10. Measurement of Flow Rate

    Objective

    To measure flow rate through a pipe using orifice and venturi meters and determination of coefficients of discharge

Chemical Engineering Thermodynamics

11. Calorific Values

    Objective

    To determine calorific values of solid, liquid and gaseous fuels.

12. T-x-y Diagram

    Objective

    Investigation of T-x-y diagram of binary system at atmospheric pressure.

13. Equilibrium Constant

    Objective

    To determine equilibrium constant of a reaction by application of distribution law.

14. Mutual Solubility Curve and Critical Solution Temperature

    Objective

    To plot a mutual solubility curve for liquid-in-liquid and to determine the critical solution temperature.

15. Refrigeration

    Objective

    To determine the coefficient of performance and other parameters of a refrigerator.

Chemical Reaction Engineering

16. Kinetics of Decomposition

    Objective

    To study kinetics of decomposition of solid in aqueous solution.

17. Reaction Velocity Constant

    Objective

    To determine reaction velocity constant of hydrolysis of ethyl acetate with sodium hydroxide.

18. Reaction Equilibrium Constant

    Objective

    To determine reaction equilibrium constant of reaction of acetic acid with ethanol.

19. Energy of Activation

    Objective

    To determine energy of activation of reaction of ethyl acetate with sodium hydroxide.

20. Thermodynamic Functions

    Objective

    To determine changes in free energy, enthalpy and entropy for the reaction of potassium iodide with iodine.

CIVIL ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group)]

Materials and Construction Practices

1. Tests for Bricks

   Objective

   To determine size, absorption, efflorescence, and strength of bricks.

2. Tests for Cement

   Objective

   To determine standard consistency, initial and final setting time, fineness, soundness, and compressive strength.

3. Tests for Coarse and Fine Aggregates

   Objective

   To determine particle size distribution, fineness modulus, water absorption, bulk density, specific gravity, and mechanical properties.

4. Tests for Concrete/Mortar

   Objective

   To study the effect of water content, water-cement ratio and sand aggregate ratio on the slump and strength of concrete.

5. Reinforcing Bars

   Objective

   To determine stress-strength curve of reinforcing bars.

Geotechnical and Foundation Engineering

6. Attenberg Limits Tests

   Objective

   To determine liquid, plastic and shrinkage limits of soil samples using casagrande apparatus of Fall Cone Method.

7. Compaction Test

   Objective

   To determine optimum water content and maximum dry unit weight of soil using the Proctor compaction test.

8. Direct Shear Test

   Objective

   To determine Mohr-Coulomb shear strength parameters of soil in a small shear box for particle size limited to 4.75 mm.

9. Permeability Tests

   Objective

   To conduct both constant and variable permeability tests on coarse and fine-grained soils to determine the coefficient of permeability of the soil.

10. Oedometer/Consolidation Test

    Objective

    To determine the compressibility and consolidation characteristics of soil sample from the field.

Water Resources Systems

11. Measurement of Flow

Objective

To measure flow by venturi meter, orifice meter, and bend meter. The aim is to measure the pressure between test section and far stream and relate the pressure difference with the geometry of the meter and discharge.

12. Study of Pipe Friction and Determination of Friction Effect

    Objective

    To measure the head loss between two sections of the pipeline and relate this in the form of dimensionless quantity, as friction coefficient, with Reynolds number of the flow and relative roughness of the pipe.

13. Boundary Layer

    Objective

    To measure boundary layer using pitot tube or by any other device in water flowed flume or in wind tunnel.

14. Hydraulic Jump

    Objective

    To study about hydraulic jump and its energy dissipating capacity in a small flume.

15. Measurements in Open Channel Flow

    Objective

    To measure discharge of liquids like water, oil, etc, in open channel flow using weirs and notches. The head over the weir or notch is measured.

Principles of Geoinformatics

16. Chain and Compass Survey

    Objective

    To measure a small area, having details like building, roads, etc, enclosed in a triangle, and the length of each side by a steel tape. The bearings of the lines are measured by a compass. The chaining of each line shall be done along with the offsets to various details. The data obtained are then plotted to get the map of the surveyed area.

17. Levelling

    Objective

    To study different types of levels, levelling staff, temporary adjustment of levels, booking and reduction of data by two methods, and practice for fly levelling to establish bench marks.

18. Longitudinal and Gross-sectioning and Plotting of Contours

    Objective

    A chain tape shall be laid along the center line of an existing road (e.g. 120 m long) and levels at, say 10 m interval, shall be obtained to plot the profile of the road. Simultaneously, at every 30 m, levels will also be found out of point at every 2 m, 4 m and 6 m on both sides, left and right, of the center line of the road for cross-sections. Cross-sections data will be used to plot the contours of that area.

19. Theodolite

    Objective

    To study different types of theodolites, temporary adjustments and methods of measuring horizontal and vertical angles, and booking of data.

20. Plane Tabling

    Objective

    To plot a small area with a plane table and its accessories, and solve three-point problem to precede the actual plotting work.

COMPUTER SCIENCE & ENGINEERING

[(10 (Ten) experiments are to be undertaken, taking minimum two from each group)]

Pulse and Digital Circuits

1. Synchronous Counter

   Objective

   To design a 4-bit synchronous counter and study its function.

2. A synchronous Counter

   Objective

   To design a 4-bit asynchronous counter and study its function.

3. Self-stopping Asynchronous Binary Up Counter

   Objective

   To design a self-stopping asynchronous binary up counter which can be set to stop at various binary numbers. A 4-bit switch register will set the maximum number the counter will read. If a switch is set 'LO' the corresponding bit in the number will be '1' at the maximum count. If the switch is set 'HI', the corresponding bit in the number will be 'O' at the maximum count.

4. Astable Multivibrator

   Objective

   To design an astable multivibrator using 555 times chip with variable frequency.

5. Monostable Multivibrator

   Objective

   To design a monostable multivibrator using 555 timer chip with variable timing facility.

Data Structures and Programming

Data Structures

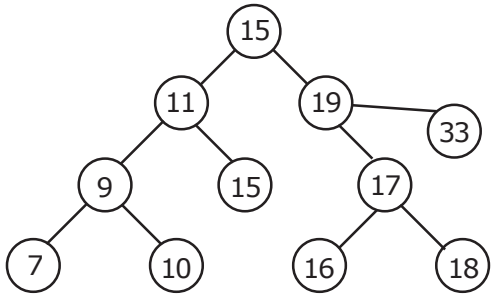
6. Determination of Passes, Comparisons and Exchanges for Bubble SortObjective To find expected number of passes, comparisons and exchanges for bubble sort when n=12 and compare them with actual number of these operations when the given sequence is as follows:

   8, 6, 4, 3, 7, 9, 5, 12, 1, 11, 10, 2

7. Tree-type Structure

   Objective

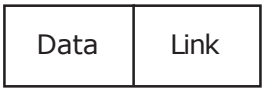
   To obtain the following tree-type using a suitable structure:



8. Defining a Node with Given Structure

   Objective

   To define a node with the following structure:



Read n elements, allocate them into n nodes in a linked list:

a) Insert a node after a given node;

b) Delete a node containing some elements; and

c) Search a node for a given element.

Programming

9. Program in High Level Language

   Objective :To write a program in any high level language to sort a given file on two keys (a,b), where a is the major key and b, the minor key.

10. Implement of an Array, Its Initialisation and Content Display

    Objective

    To maintain an array whose size can be known during the execution time of the program only. Implement such an array, initialize it, and display its content.

11. Develop a Function on 'C'

    Objective

    To develop a function on 'C' that splits a list into two other lists so that the entries that were in odd-numbered positions are now in one list (in the same relative order as before) and those from even-numbered position are in another new list.

12. 'C' Program-I

    Objective

    To write a 'C' program that will encrypt a given text in the following manner. For each line of text-

    a) convert each character to ASCII equivalents;

    b) generate a positive random integer (using library function);

    c) add the integer to ASCII value of each character;

    d) let A1 denotes lowest permissible value in ASCII code and A2 denotes highest permissible value in ASCII code. If the integer generated in step (iii) exceeds A2 then subtract A2 from the integer and add A1 to the remainder ensuring that the number will remain between A1 and A2; and

    e) write out the encrypted character

13. 'C' Program-II

    Objective

    To write a 'C' program that will decrypt the cipher text produced by the encryption algorithm described in experiment 12.

14. 'C' Program-III

    A graph of n vertices is represented by its adjacency matrix A.

    A= [aij] is defined as

    aij = 1, if there is an edge between vertices i and j

    = 0, otherwise

    Write a 'C' program which will determine whether a path exists between any two vertices of a given graph.

15. 'C' Program-IV

    Objective

    To write a 'C' program to print the day for an input of date, month and year.

Computer Architecture

16. Design a Barrel Shifter

Objective

To design on paper a full 18 x 16 barrel shifter.

17. Design a Arithmetic Unit

Objective

To design a 4-bit, 8 function arithmetic unit that will meet the following specifications:

S_2	S_1	S_0	Function
0	0	0	2A
0	0	1	A+B
0	1	0	A+B
0	1	1	A-1
1	0	0	2A+1
1	0	1	A+B+1
1	1	0	A+B+1
1	1	1	A

18. Diagram for a Pipeline Multiplier

Objective

To draw a neat schematic diagram for a pipeline multiplier using carry-save adders and carry look ahead address to multiply a stream of inputs X0, X1, X2 by a fixed number Y. Assume all Xs and Ys are 6-bit numbers.The output should be a stream of 12-bit products Yx0, Yx1,Yx2,Yx3.

Systems Analysis

19. System Flow Chart-IObjectiveTo draw the system flow-chart showing the following steps in processing customers sales order.

a) Open the mail

b) Make an entry in an 'Order log' recording the receipt of each order

c) Edit the order for missing or erroneous information; if no error go to (e), else go to (d)

d) Add any needed information

e) Check the customer's credit rating

f) Forward orders from customers with bad credit ratings to the credit manager. If he rejects it, the party is to be intimated; otherwise go to (g)

g) Forward orders from customers to the Key punch department

h) Place the sales order in a file

i) Sort the sales order cards using computer into item number sequence

j) Process the sales order cards against the inventory master file producing an updated master file and a printed listing of each transaction.

20. System Flow Chart-II

Objective

To describe in detail a pay roll data processing application giving inputs, outputs and files required. Draw a system flow-chart and show the structure of input documents and output reports.

ELECTRICAL ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group]

Circuits and Field Theory

1. Characteristics of Single Phase a.c. Series and Parallel Circuits

   Objective

   To obtain relations between current and voltage with different elements in a circuit comprising of resistance, inductance and capacitance.

2. Measurement of Power Consumed by a Fluorescent Lamp

   Objective

   To obtain power consumed and power factor of a fluorescent lamp, operated at different voltages.

3. Verification of Thevein's and Norton's Theorems

   Objective

   To determine experimentally Thevein's and Norton's equivalent for a given network and hence to verify the validity of the theorems by comparing measured currents with the values calculated using the equivalent circuits.

4. Balanced Three-phase Circuit

   Objective

   To measure active and reactive powers via balanced three-phase circuit by two wattmeter method.

5. Determination of Phase-sequence of a Given Three-phase Supply

   Objective

   To determine the phase sequence of a three-phase line by using resistance and capacitance in two ways.

6. Study of Constant Current Source

   Objective

   To develop a circuit which provides substantially constant current using a low voltage input source.

Electrical Machines

7. Coil Connection and Ratings of a Single-phase Transformer

   Objective

   To connect the coils of a single-phase transformer in series and parallel and also to examine the loading of the transformer both as a two winding transformer and an auto transformer.

8. Study of a d.c. Motor Starter and Speed Control of Shunt Motor

   Objective

   To acquaint with constructional details of a d.c. motor starter and to study the methods of speed variation of a d.c. shunt motor.

9. D C Shunt Motor Speed Control

   Objective

   To control the d.c. shunt motor speed at constant torque mode at different load conditions using different controller, e.g., PI, PD and PID.

10. Circle Diagram of a Three-phase Induction Motor

    Objective

    To determine the performance characteristics such as torque, speed, current, pf, and

efficiency from the circle diagram and to compare the values obtained for full load with the actual test values.

Power Systems

11. Parallel Operation of Three-phase Transformers

    Objective

    To test the phase or groups of the given transformers and then connect them in parallel. Also, to study the sharing of load by the transformers.

12. Over Current Relay

    Objective

    To study different plug setting and time setting facilities and to verify the current time characteristic of an IDMT type over current relay.

13. Measurement of Generalised Constants A B C D of a Long Transmission Line

    Objective

    To measure voltages and currents along with the phase angle between them at two ends of transmission line under open circuit and short circuit conditions and to compute the A B C D constants of the transmission line under test.

14. Synchronous Generator and Motor

    Objective

    To study methods of synchronizing a generator, methods of adjusting active and reactive loads on generators operated in parallel. Also, to obtain the no-load and full load V-curves of the synchronous machine.

Measurements and Control

15. Measurement of Low Resistance by Kelvin Double Bridge

    Objective

    To study the Kelvin bridge and its use in the measurement of low resistance.

16. Measurement of Resistance by Voltmeter and Ammeter Method

    Objective

    To measure the resistance of (i) the field, (ii) the armature (with and without brushes of shunt type d.c. machine).

17. Measurement by Schering Bridge

    Objective

    To measure capacitance and power factor of a capacitor by Schering bridge network.

18. Study of a Simple on-off Control System

    Objective

    To study the operation of a feedback, on-off temperature control system.

19. Measurement of Strain

    Objective

    Measurement of strain of a beam by straingauge.

20. Calibration of Three-phase Watthour Meter

    Objective

    To calibrate a two-element three-phase three-wire inductive watthour meter with reference to laboratory standard wattmeter and a stop watch.

LABORATORY EXPERIMENTS - ELECTRONICS & COMMUNICATION ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group)]

Circuit Theory and Control

Circuit Theory

1. Determination of Characteristics of a Single R C Network and of a cascaded two identical RC networks.

   Objective

   (a) Measurement of frequency response of a given low pass RC network;

   (b) Find the 3 dB cut off frequency of the given network;

   (c) Determine the rise time of the network using a square wave signal;

   (d) Repeat (a) to (c) for a cascaded RC network of two identical units; and

   (e) Find the effects of cascading of two networks.

2. Maximum Power Transfer Theorem

   Objective

   (a) Study the maximum power transfer theorem for a resistive load;

   (b) A voltage source with complex impedance delivers power to a complex load; Measure and plot the power delivered to load for various frequencies. Determine the frequency at which the maximum power transfer takes place and verify the Maximum Power Transfer Theorem;

   (c) For a series combination of variable inductive and capacitive load impedances, determine the maximum power transfer for a load inductance and a load capacitance at two operating frequencies;

   (d) Verify experimentally maximum power transfer theorem for a transformer coupled load; and

   (e) Discuss the results obtained.

3. Twin T Bridge Notch Filter

   Objective

   (a) Design a twin T bridge notch filter and experimentally obtain its frequency response curve;

   (b) Couple the twin T bridge with an OP AMP and determine the frequency response characteristics. Find the notch frequency and the notch dB drop;

   (c) Compare the frequencies at which minimum gain is obtained from theoretical calculations and experimental observations; and

   (d) Discuss the results.

4. Determination of Z, Y and h Parameters of a Two-port Resistive Network and Verification of Reciprocity Theorem

   Objective

   (a) Obtain a two port resistive network;

   (b) Measure the terminal voltage and currents of the network. From the definitions of Z, Y and h parameters in terms of terminal voltages and currents, determine the corresponding parameters of the matrices;

   (c) From the measured values of the parameters establish the Reciprocity Theorem;

   (d) Comparing the measured values with the theoretical data, present the error analysis of the experiment;

   (e) Obtain the characteristic impedance of the network for a symmetrical case; and

   (f) Discuss the results.

5. Low Pass and Band Pass Filters

Objective

(a) Design and construct one low pass and another band pass filter as per the specifications given. Use only inductance and capacitance;

(b) Obtain experimentally the frequency response of both the filters. Find the cut-off frequencies; and

(c) Find the nominal impedances of filters over their pass bands.

Control

6. Study of Synchros

Objective

(a) Identification of different types of synchros (selsyns), e.g. synchro transmitter or generator (CX), synchro control transformer (CT), synchro differential transmitter (CDT), and synchro repeater or motor (CR);

(b) To determine synchro parameters: Zeroing of synchros, measurement of residual voltage and determination of input and output impedances; and

(c) Applications of synchros as error detector, adder and an indicator of position.

7. Study of an ac or a dc Position Control SystemObjective

(a) Study the system and identify each functional unit like the error detector, the plant, the servomotor, the controller and the feedback unit;

(b) Determine transfer function of individual components and hence derive the overall transfer function; and

(c) Study the time response for a step input.

Electronic Circuits

Linear Circuits

8. Determination of Characteristics of a Common Emitter (CE) Amplifier

Objective

(a) Design a common emitter amplifier for given specifications such as voltage gain, bandwidth, and input and output impedances. Hook up the amplifier;

(b) Measure the DC conditions, signal handling capacity, frequency response and bandwidth, and input/output impedances; and

(c) Discuss the results.

9. Determination of Characteristics of a CE – CB Cascaded Amplifier

Objective

(a) Design the cascaded amplifier with given specifications and build the amplifier stage;

(b) Measure the DC conditions, signal handling capacity, frequency response and bandwidth, and input and output impedances; and

(c) Discuss the results.

10. Study of a Wein Bridge Oscillator

Objective

(a) Design and build a Wein bridge oscillator to generate a sinusoidal output waveform for given specifications;

(b) Determine the conditions of oscillation;

(c) Verify the waveform if it is sinusoidal;

(d) Measure its output frequency and amplitude; and

(e) Discuss the results.

11. Study of a Class B Push–Pull Amplifier

Objective

(a) Design and build a Class B push – pull amplifier for a given set of specifications;

(b) Measure the power gain;

(c) Verify the presence of harmonics at the output;

(d) Measure the distortion at the output; and

(e) Discuss the results.

12. Study of a Differential Amplifier

Objective

(a) Design and build a differential amplifier with the required design parameters;

(b) Measure DC conditions, signal handling capacity and single sided gain;

(c) Determine the frequency response of common mode configuration and differential mode configuration;

(d) Determine CMRR and input / output impedances; and

(e) Discuss the results.

Digital Circuits

13. Study of Truth Table for Adder Circuits.

Objective

(a) Design a full–and a half–adder circuit using gates 7483;and

(b) Verify the truth table for both the adder circuits.

14. Studies on J – K Master Slave Flip - Flop and CountersObjective

(a) Identify the pin diagram of a dual TTL J–K Master Slave Flip–Flop IC 7476;

(b) Obtain the truth table and verify;

(c) Realize the connections for a divide by two counter. Observe the input and output waveforms applying a square wave signal to the clock input of the Flip–Flop; and

(d) Discuss the results.

Communication Engineering

Analogue Devices

15. Study of Amplitude Modulation and Demodulation

Objective

To provide understanding of the basics of amplitude modulation anddemodulation.

(a) Familiarize with the operation of an amplitude modulator and an amplitude demodulator;

(b) Study modulated, demodulated and other important waveforms generated by the circuit;

(c) Study the linearity response of the modulator-demodulator circuit;

(d) Study the frequency response of the modulator-demodulator circuit; and

(e) Study of a square law device.

16. Study of Frequency Modulation and Demodulation

Objective

To provide understanding of the basics of the operation of a Voltage Controlled Oscillator (VCO), a Phase Locked Loop (PLL) and a frequency modulation-demodulation system employing the VCO for modulation and the PLL for demodulation.

(a) Familiarize with the operation of a VCO and study its linearity;

(b) Familiarize with the operation of a PLL and determine its lock range and capture range;

(c) Familiarize with the operation of a frequency modulator and a frequency demodulator;

(d) Study the modulated, demodulated and other important waveforms generated by the circuit;

(e) Study the linearity response of the modulator–demodulator circuit; and

(f) Study the frequency response of the modulator–demodulator circuit.

17. Study of Pulse Width Modulation and Demodulation

Objective

(a) Study the principle and function of an analogue pulse width modulation (PWM) scheme;

(b) Study the corresponding demodulation scheme by using a low pass filter;

(c) Study the linearity response of the modulator–demodulator unit;

(d) Study the frequency response of the modulator–demodulator unit;

(e) Study the effect of duty cycle on the pulse width modulation; and

(f) Study the second order Butterworth filter.

Digital Devices

18. Study of A/D Conversion, D/A Conversion and Pulse Code Modulation (PCM)

Objective

To provide understanding of analogue to digital conversion and pulse code modulation scheme.

(a) Test the signal conversion and functions of 8–bit A/D and D/A converters separately and together;

(b) Study the function of a PCM; and

(c) Study the linearity characteristics of the PCM system.

19. Study of Digital Modulation Schemes:

(a) Amplitude Shift Keying (ASK);

(b) Frequency Shift Keying (FSK); and

(c) Binary Shift Keying (BPSK)

ObjectiveTo provide understanding of the ASK, FSK and BPSK modems for various binary and carrier input signals

(a) Study the functions of ASK, FSK and BPSK modems;

(b) Study the bit–error–rate measurement of all the modems; and

(c) Other experiments related to the use of modems.

20. Microprocessors

Objective

To study functions of an 8-bit microprocessor.

MECHANICAL ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group)]

Mechanics of Solids

1. Strain Gauge Technique

   Objective

   Bonding of a strain gauge on a cantilever beam and measuring the flexural (bending) strain and comparing the experimental values with theoretical predictions.

2. Photo-elasticity Technique

   Objective

   Some simple experiments to demonstrate the capabilities of this technique as a tool for stress analysis.

3. Tension/Compression Tests

   Objective

   Tension/compression tests on testing machines to obtain the stress-strain relationship for the material and evaluation of its yield stress, ultimate stress and fracture stress.

4. Hardness and Impact Tests

   Objective

   Rockwell/Brinell/Vickers hardness tests on three different materials andimpact tests on testing machine using plain and notched specimens.

5. Periodic Phenomena

   Objective

   Experiments on some simple oscillatory systems for measurement of cyclic frequency and amplitude, and evaluation of natural frequency at which resonance occurs.

Manufacturing Technology

6. Orthogonal Cutting

   Objective

   Measurement of cutting forces using a force dynamometer and evaluation of shear angle from chip-length ratio during turning of a tubular section under orthogonal cutting conditions.

7. Tool Life Testing

   Objective

   Determination of Taylor tool life equation for a given tool-workpiece combination through variation of flank wear at three different cutting speeds.

8. Measurement of Thread Dimensions

   Objective

   Measurement of pitch diameter and other dimensions of threads using two different methods.

9. Metal Forming

   Objective

   To study the effects of input parameters on dimensional accuracy, surface finish, etc in cold rolling or forging or wire drawing.

Mechanics of Fluids

10. Measurement of Flow

    Objective

    To measure flow by venturi meter, orifice meter, and bend meter.

11. Study of Pipe Friction and Determination of Friction Effect

    Objective

    To measure the head loss between two sections of the pipeline and relate this in form of dimensionless quantity, as friction coefficient, with Reynolds number of the flow and relative roughness of the pipe.

12. Boundary Layer

    Objective

    To measure boundary layer using pitot tube, or by any other device, in water flowed flume or in wind tunnel.

Thermal Science and Engineering

13. Conductivity Measurement

    Objective

    Measurement of conductivity of plates of three different metals using Guarded hot plate method and comparison of experimental results with standard data.

14. Emissivity Measurement

    Objective

    Measurement of emissivity of a gray surface at various temperature and comparison of results with available data for gray surface.

15. Measurement of Free Convection Heat Transfer

    Objective

    Measurement of free convection heat transfer coefficient and temperature for a vertical pipe, and comparison with theoretically predicted data.

16. Performance Study of Heat Exchanger

    Objective

    Performance study of a heat exchanger in parallel flow and counter flow conditions.

17. Performance Study of Vapour-Compression Cycle

    Objective

    Performance study of vapour-compression system to obtain COP and performance index.

18. Performance Characteristics of Petrol Engine

    Objective

    Performance characteristics of a multi-cylinder petrol engine to obtain IHP using Morse test.

19. Trial Test for Petrol Engine

    Objective

    Trial test of a petrol engine to prepare heat balance under rated conditions of the engine.

20. Performance Study of Kaplan Turbine

    Objective

    Performance study of a Kaplan turbine at various fixed angle positions and rotor blade angles.

MATERIALS & METALLURGICAL ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group]

Metallurgical Thermodynamics and Kinetics

1. Partial Molal Volume

   Objective

   To estimate partial molal volume of each molecular specy in a binary solution.

2. Phase Equilibrium

   Objective

   To investigate the equilibrium of C-CO-CO_2 system.

3. Equilibrium Decomposition Pressure

   Objective

   To measure equilibrium decomposition pressure of limestone under reduced pressure condition.

4. Kinetics of Reduction

   Objective

   To study kinetics of reduction of iron ore with carbon.

5. Fusion Characteristics

   Objective

   To study fusion characteristics of some metals and alloys.

Physical Metallurgy

6. Microstructure of Metals

   Objective

   To study microstructure of any three metals.

7. Microstructure of Alloys

   Objective

   To study microstructure of any three alloys.

8. Phase Diagram

   Objective

   To determine phase diagram by resistivity method.

Extractive Metallurgy

9. Tumbler Test

   Objective

   To carry out tumbler test of iron ore.

10. Micum Test

    Objective

    To carry out micum test of coke.

11. Pelletisation

    Objective

    Pelletisation of iron ore fines.

12. Reduction

    Objective

    To study alumino-thermic reduction of lead sulphate.

13. Inclusion

Objective

To study inclusions in steel by image analyser.

Mechanical Behaviour of Materials

14. Hardness and Impact Tests by Testing Machines

Objective

Rockwell/Brinell/Vickers hardness tests on three different materials andusing plain and notched specimens.

15. Periodic Phenomena

Objective

Experiments on some simple oscillatory systems for measurement of cyclic frequency and amplitude, and evaluation of natural frequency at which resonance occurs.

16. Instrument Analysis-I

Objective

To study the material characteristics by polarography and colorometre.

17. Instrument Analysis-II

Objective

To study the material characteristics by absorption spectrometre and spectroscope.

18. Heat Treatment of Metals

Objective

To study heat treatment procedures and resulting changes in microstructure of two different metals.

19. Heat Treatment of Alloys

Objective

To study heat treatment procedures and resulting changes in microstructure of two different alloys.

20. Fatigue and Creep Testing

Objective

To study fatigue and creep properties of a metal.

MINING ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group]

Mining Geology and Development of Mineral Deposits

1. Geological Maps

   Objective

   To study and interpretation of geological maps.

2. Visual Inspection of Rocks and Minerals

   Objective

   To study characteristics of rocks and minerals by visual inspection (hand specimen).

3. Microscopic Study

   Objective

   Identification of minerals under petrological microscope.

4. Rock Mineral Bed

   Objective

   To determine amount and direction of true dip of a rock/mineral bed.

Mine Surveying

5. Levels and Profile Levelling

   Objective

   To determine levels and profile levelling.

6. Angle Measurement

   Objective

   To measure angle by repetition and reiteration methods using a Vernier theodolite.

7. Techeometric Distance Measurement

   Objective

   Techeometric distance measurement using microptic theodolite.

8. Correlation

   Objective

   Correlation by Weissback Triangle method.

Mine Machinery and Material Handling

9. Friction of Conveyor Belt

   Objective

   To study friction of conveyor belt using Euler's approach.

10. Study of Wire Ropes and Rope Capel

    Objective

    To study different types of wire ropes and rope capel.

11. Rock Drilling

    Objective

    To study performance using jack hammer drills during drilling of different rocks.

Mine Ventilation and Environmental Hazards

12. Airflow Measurement

    Objective

    Measurement of airflow using vane anemometer.

13. Bend Shock Loss

    Objective

    To determine bend shock loss using wind tunnel.

14. Respirable Dust Concentration

    Objective

    Determination of respirable dust concentration using MRE 113A gravimetric dust sampler.

15. Crossing Point Temperature of Coal

    Objective

    To determine crossing point temperature of coal.

16. Flame Safety Lamp and Methanometer

    Objective

    Detection of CH_4 in methane air mixture using flame safety lamp and methanometer.

Geomechanics and Mine Design

17. Tensile/Compressive Test

    Objective

    To determine compressive strength, tensile strength, modulus of elasticity and poison's ratio of a rock sample.

18. Shear Test

    Objective

    To determine shear strength of rock samples.

19. Protodyakonev Test

    Objective

    To determine protodyakonov strength index of different rock samples.

20. Triaxial Test

    Objective

    To determine angle of internal friction Ø and cohesion (C) from triaxial test.

PRODUCTION ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group]

Mechanics of Solids

1. Strain Gauge Technique

   Objective

   Bonding of a strain gauge on a cantilever beam and measuring the flexural (bending) strain and comparing the experimental values with theoretical predictions.

2. Photo-elasticity Technique

   Objective

   Some simple experiments to demonstrate the capabilities of this technique as a tool for stress analysis.

3. Tension/Compression Tests

   Objective

   Tension/compression tests on testing machines to obtain the stress-strain relationship for the material and evaluation of its yield stress, ultimate stress and fracture stress.

4. Hardness and Impact Tests

   Objective

   Rockwell/Brinell/Vickers hardness tests on three different materials and impact tests on testing machine using plain and notched specimens.

5. Periodic Phenomena

   Objective

   Experiments on some simple oscillatory systems for measurement of cyclic frequency and amplitude, and evaluation of natural frequency at which resonance occurs.

Manufacturing Technology

6. Orthogonal Cutting

   Objective

   Measurement of cutting forces using a force dynamometer and evaluation of shear angle from chip-length ratio during turning of a tubular section under orthogonal cutting conditions.

7. Tool Life Testing

   Objective

   Determination of Taylor tool life equation for a given tool-workpiece combination through variation of flank wear at three different cutting speeds.

8. Measurement of Thread Dimensions

   Objective

   Measurement of pitch diameter and other dimensions of threads using two different methods.

9. Metal Forming

   Objective

   To study the effects of input parameters on dimensional accuracy, surface finish, etc in cold rolling or forging or wire drawing.

10. Electric Arc Welding

    Objective

    To study the effects of input parameters on weld quality.

11. Testing of Sand Castings

    Objective

    To examine casting defects using some of the non-destructive testing equipment.

Manufacturing Automation

12. CNC Machine Tool

    Objective

    To write a programme to generate a given profile through a NC machine tool.

13. Coordinate Measuring Machine

    Objective

    To measure different dimensions of a job.

14. Pick and Place Robot

    Objective

    To programme the robot to pick an object from a given location and to place it in another location.

15. Robot Movements

    Objective

    To list down physical configurations of the robot and study the degree of freedom of arm and wrist of the robot. Also, calculate the work volume of the robot.

16. Quality Control Chart

    Objective

    Considering a lot of 20 cylindrical jobs with some nominal outside diameter produced on a particular centre lathe and observe their variation and construct a relevant control chart.

Production Management

17. Plant Layout

    Objective

    To design and draw the plant layout for production machines for a given job.

18. Sequencing

    Objective

    To determine the optimum sequence to produce a given lot of jobs, each requiring several operations in two machines.

19. Material Handling Operation

    Objective

    To ascertain and specify specific material handling system to suit the given nature and volume of material to be handled.

20. Process Chart

    Objective

    Preparation of a two-hand process chart for an specified job listing the operations to be done by the specific workman and preparation of process charts for both left and right hands.

    Or

    Simulation Application for solving Queing/Inventory Problem.

TEXTILE ENGINEERING

[10 (Ten) experiments are to be undertaken, taking minimum two from each group]

Textile Fibres and Testing

1. Identification of Fibres

   Objective

   Identification of fibres by physical test methods.

2. Testing of Fibres

   Objective

   To determine moisture, trash content, length and its variability by baer Sorter/Fibrograph, bundle strength and fineness.

3. Testing of Yarns

   Objective

   Determination of (a) count of yarns by wrap reel and balance; and (b) single thread strength and lea CSP.

4. Evenness of Sliver, Rovins and Yarns

   Objective

   (a) Determination of evenness of slivers and rovings by Evenness tester; and

   (b) Determination of evenness and imperfections by Evenness tester.

5. Testing of Fabrics

   Objective

   Determination of (a) ends and picks (dm), fabric weight (sq.metre), etc; and (b) fabric strength (warp and weft).

Yarn Manufacture

6. Opening and Cleaning Action of a Blow Room Line

   Objective

   To study the mechanism of different openers and beaters, fibre transportations, settings, lap weight uniformity, lap formation/chute feed, calculations. Waste control. Cleaning efficiency.

7. Performance of Card

   Objective

   To study the mechanism of different zones such as feed-licker-in, licker-in cylinder, cylinder-flat and cylinder-doffer, fibre transfer in different zones, settings, calculations. Waste control. Cleaning efficiency.

8. Draw Frame

   Objective

   To study the mechanism of drafting and coiling, stop motions, calculations, etc.

9. Speed Frame

   Objective

   To study the mechanism of drafting, twist and winding by flyer, building and differential motions, stop motions, stretch control, calculations, etc.

10. Ring Spinning Frame

    Objective

    To study the mechanism of drafting, twist insertion, ring and traveller, building motion, doffing operation, calculations, control of end breaks, etc.

Fabric Manufacture and Design

11. Winding (Warp and Weft) Machines

    Objective

    To study driving mechanism, traverse motion, stop motions, yarn tensioners and clearers, calculations.

12. Mechanism of a Warping Machine

    Objective

    To study driving mechanism of a warping machine in detail.

13. Mechanism of a Sizing Machine

    Objective

    To study size control, sizing ingredients, stretch control, drying, etc.

14. Conventional Shuttle Looms

    Objective

    To study the shedding and picking mechanisms, beat up, let off and take up, warp protector, weft stop motions, shuttle box, calculations, etc.

15. Mechanisms in Shuttleless Loom

    Objective

    To study different mechanisms in shuttleless loom.

Chemical Processing and Finishing

16. Scouring, Desizing and Bleaching of Cotton and other Textiles

    Objective

    To study scouring, desizing and bleaching of cotton and other textiles in detail.

17. Dyeing of Different Fibres with Common Dye Classes

    Objective

    To study dyeing of different fibres with common dye classes and their light, wash and rubbing fastness, and to analyses the results obtained.

18. Printing of Cellulosics Materials

    Objective

    To conduct different experiments on (a) printing of cellulosics with dyes and pigments colours; and (b) white and coloured resist and discharge printing of cellulosics.

19. Dyeing of Common Blends

    Objective

    To give common blends and analysis of the results obtained.

20. Shade Matching

    Objective

    To conduct different experiments on shade matching and analyse the results obtained.