IE 752: Analytical Instruments

L T P
(3 1 0)
Theory Marks=100
Sessional Marks=75

Sampling techniques- Sampling system for liquids & gases, Gas analysis- Gas chromatography, Sampling system, fractionating column, thermal conductivity gas analyzer, heat of reaction method, estimation of O_2, H_2, CH_4, CO etc. in binary or complex gas mixtures, electro- chemical reaction method, Bailey oxygen analyzers, paramagnetic oxygen analysis, gas analysis by chemical absorption, Orsat apparatus, CO_2 and Hydrogen measurement, Gravitimetric method of gas analysis, methanometers.

Measurement of humidity- Dry & wet bulb psychrometers, hair hygrometer, dew point meter.

Measurement of moisture- laboratory method and on-line measurement techniques: Electrical methods, radio isotopes method, IR techniques, moisture in gases.
Chemical composition analysis- measurement of viscosity, laboratory and on-line methods, capillary tube viscometer, Efflux type, rotating cylinder type viscometer, vibrating reed, ultrasonic and plastometer type industrial viscometer, applications in paper & petrochemical industries, temperature effect on viscosity.

Acidity/ alkalinity- definition of pH, methods of measurement, pH electrodes, optical-fiber pH sensors.

Measurement with Radio-Isotopes- Nuclear radiation transducer, Geiger Muller Counter, Scintillation counters, Radioactive Vaccum, Thickness & Level gauges.

Spectro-chemical analysis- mass spectrometry & its application to analysis of solids, liquids and gases, absorption spectrometry, emission spectrometry. Electromagnetic radiation spectrum, UV, IR analysis.

Books:

1. Basic Instrumentation in Industrial Measurement: O' Higgins, PJ.
2. The Measurement Instrumentation and Sensors Handbook: Webster, John G.
3. Principles of Industrial Instrumentation: Patranabis.

L T P
(3 1 0)

EE 742: Communication Engineering

Full marks: Theory=100
Sessional=75
Time=3 Hrs.

1. **Properties of Fourier transform:**

Response of LTI systems – transfer functions and frequency responses. Correlation and spectral density – correlation of power signals, correlation of energy signals.

2. **Random signal theory :**

Random variable – cumulative distribution function, probability distribution function, statistical averages, standard deviation, Gaussian and Rayleigh PDF. Random processes – ensemble averages and correlation, stationary and ergodic process.

3. **Noise:**

Sources and characteristics of different noise, thermal and shot noise, concept of white Gaussian noise. Noise temperature, noise bandwidth and noise figure.

4. **Analog communication :**

Linear CW modulation –AM-DSB ,AM –DSB /SC,AM-SSB/SC signals and spectra , generation and detection of AM , Exponential CW modulation –PM and FM signals , generation and detection of AM , and FM , Super heterodyne receivers .Frequency division multiplexing.

5. **Signal to noise ratio for different analog communication schemes:**

6. **Pulse Coded Modulation:**

PCM generation and reconstruction, quantization noise, non uniform quantization and compounding, signal to quantizing noise power ratio, Time Division Multiplexing.

7. **Digital Communication:**

ASK, PSK, FSK

IE 751: Instrumentation Systems Components - II

L T P
(3 1 0)
Theory Marks =100
Sessional. Marks= 75

Synchros – transmitter- transformer – receiver, construction, working principle, application as error detector and angular displacement transducer.

DC and AC servomotors- construction, theory of operation, applications.

PD, PI and PID controllers – principles, transfer functions, physical realization, applications.

Tachogenerators – AC and DC: construction, principle of operation, position and speed regulator, and transducer.

Stepper motors- construction, method of operation, torque equation, driver circuit, logic translator, applications

Feedback transducers- negative feedback principle, advantages and typical schemes.

Hydraulic systems – different types of valves, construction and principles of operation, pitot valve, flapper valve, slide valve, two-stage valve.

Pneumatic control system – equivalent circuit of pneumatic valve and transfer function, pneumatic servo in jet engine application.

BOOKS:

1. Transducers and Instrumentation : Murthy, DVS, PHI
2. Principles of Industrial Instrumentation: Patranabis, TMH
3. Control System Components: Gibson and Tutor,
4. Electromechanical Devices for Energy Conversion and Control System : Vincent Del Toro
5. Electromechanical Components for Servo-mechanism : Davies, SA and Ledgerwood, BK
6. .Automatic Control Systems : Raven

EE 743: Operations Research

L T P
3 1 0

Max. Marks = 100
Sessional Marks= 75

1. **Introduction and history of OR**:

Definition, Characteristics and limitations of OR, phases of OR.

2. **Concepts in probability and statistics:**

Continuous and discrete variables. Arithmetic mean, median, mode, Concepts of different types of probability distributions & their applications.

3. **Fields of application of linear programming**:

Mathematical formulation of LP. Graphical and Simplex method of solution of LP problems. Duality in LP. Sensitivity analysis.

4. **Transportation problem**:

Initial solution, optimal solution, degeneracy, alternate solution; North-West corner method. Vogel's approximation method.

5. **Assignment problem-**:

6. Integer programming problem:

7. **Waiting line models:**

Introduction & history. Basic structure & classification of waiting line problems, Queuing models. Assembly line balancing problem.

8. **Dynamic programming:**

Structure and characteristics of dynamic programming; principles of optimality, dynamic programming models- probabilistic and deterministic.

9. **PERT/CPM:**

Books:

1. Introduction to Operations Research- Hiller & Liberman.
2. Operations Research- Askhedkar % Gupta.
3. -----Do----------Hira & Gupta.
4. Introduction to OR- Gillett.
5. Operations Research- H.A. Taha

IE 756: Project-I (0-6-0)

Max Marks: 100, pass Marks: 40

In this subject, a project work has to be taken up on a relevant topic to be decided by the student in consultation with the supervisor. The project is to be done in a group, which may consist of two, three or four students. The project may be a software, a hardware or a study type one.

The students have to submit a project proposal and/or justify the relevance of the topic in a project proposal seminar at the beginning of the semester, after approval of which only a student can take up that project. The students also have to give a presentation of their progress in a seminar. At the end, the students have to submit a report and present their works in a seminar. A viva-voce examination will also be held at the end of the semester.

The distribution of marks for the project is as follows:

Seminar: 25 Viva: 25 Report: 50

E 755: Training (0-2-2)
Max Marks: 50

In this, every student has to undergo industrial training during summer vacation just after sixth semester) for a period of 4 weeks. For this, the student has to get prior approval from the department. At the end of the training, a student has to submit a report to the department, which will be evaluated by the faculty members of the department.

IE753: Acoustic Engineering (Elective)

Theory Marks: 100 **L- T- P**
Sessional: 75 4 – 0 - 0

Basic Acoustics Theory, Sound Generation & Propagation, Impedance, Absorbing Materials, Industrial Noise Sources, Isolation Methods of Noise Control, Enclosures, Instrumentation & Measurement, Frequency Analysis, Noise Regulations, Computational Methods of Acoustics.

Books:

1) Bies and Hansen , Engineering Noise Contro, Allen & Unwin, 1988
2) Hassall and Zaveri, Acoustic Noise Measurement, Bruel & Kjaer, 1988

EE 745/IE 753: Computer Networking (Elective)

Theory Marks: 100 **L- T- P**
Sessional/Lab: 75 **4 – 0 - 1**

Introduction to computer networks and layered architecture overview, Packet switching and fast packet switching.

Point to point protocols and Links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard data link control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks.

Multi-access communication & multiple access protocols: ALOHA, slotted ALOHA, CSMA, CSMD/CD, Performance modeling & analysis.

Local area networks: Ethernet, Token ring, and FDDI. Design & analysis.

Internetworking issues: Bridges, Routers and Switched networks. Routing & Flow Control Algorithms in data networks.

Broadband Networks: ATM, Frame relay & gigabit Ethernet, Traffic management in ATM networks.

Security & reliability of Networks.

Books:

1) Data Networks, R G Gallager, PHI
2) Data & Computer Communication, W stallings, PHI.
3) Multiple Access Protocols, R Rom & M Sidi, Springer verlag.

EE 746/IE 754: Modeling & Simulation (Elective)

Max Marks: 100
Sessional: 75
Time: 3 hours

System models-entities, attributes, states, activities. Types of models. Static & Dynamic Models.

Deterministic & stochastic activities. Principles used in modeling. System simulation-continuous & discrete event simulation languages_GPSS, GIMULA, CSMP, DYNAMO. Probability concepts in simulation-random number & random variate generation stochastic processes, Birth – Death process, parameter estimation & input-output validation, Queuing systems_M/M/1 and M/M/C queues. Bulk arrival & Bulk service system. Inventory control & forecasting. Evaluation & Validation of simulation experiments.

Books:

1) Payer, T.A. : Introduction to Simulation, McgrawHill.
2) Gordon, G : System Simulation, PHI.
3) Law, A.M & W.D. Kelton : Simulation Modelling & Analysis, McgrawHill.

IE 746/IE 754: Microprocessor Based Instrumentation (Elective)

(4-0-2)

Max. Marks=100

SessionalLab = 75

Microprocessor interfacing, methods of data transfer, DMA, synchronization, polling and interrupt, LSI support chips for micro-processor, IEEE-488 interface, RS-232 interface, dedicated I/O controllers, programmable peripheral controllers, transducer interfacing, actuator interfacing, micro-processor based measurement of pulse width, frequency, voltage, rpm, pH, pressure, temperature etc., obtaining device characteristics(semiconductor devices) with micro-processor, micro-processor based scanner, data-logger, alarm enunciators, PID controller, programmable controller, analytical instruments such as gas chromatograph, Sequential control and interlock control, micro-processor based diagnostic systems.