

2007-2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

B.TECH. CHEMICAL ENGINEERING

III YEAR I SEMESTER  
COURSE STRUCTURE

<b>Subject</b>	<b>T</b>	<b>P</b>	<b>C</b>
Data Base management Systems	4+1*	0	4
Material Science for Chemical Engineers	4+1*	0	4
Chemical Engineering Thermodynamics-II	4+1*	0	4
Chemical Reaction Engineering-I	4+1*	0	4
Mass Transfer Operations-I	4+1*	0	4
Process Instrumentation	4+1*	0	4
Advanced English Communication Skills Lab	0	3	2
Process Heat Transfer Lab	0	3	2
Total	30	6	28

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<b>4+1*</b>	<b>0</b>	<b>4</b>

**Data Base Management Systems**

**UNIT – I**

Data base System Applications, data base System VS file System – View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor

**UNIT – II**

History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

**UNIT – III**

Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

**UNIT – IV**

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

**UNIT – V**

Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.

**UNIT – VI**

Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock – Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity.

**UNIT – VII**

Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

**UNIT – VIII**

Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure.

**TEXT BOOKS :**

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition.

**REFERENCES :**

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education

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**MATERIALS SCIENCE FOR CHEMICAL ENGINEERS**

**UNIT-I**

**INTRODUCTION:** Engineering Materials – Classification – levels of structure, A brief review by atomic Structure and chemical bonding: ionization potential, electron affinity and electro negativity. Chemical bonding: ionic, covalent, metallic and secondary bonding. Property relation to bond characteristics.

**UNIT-II**

**CRYSTAL GOEMETRY AND STRUCTURE DETERMINATION:**

Space lattice and Unit cell. Bravais lattices, crystal systems with examples. Lattice coordinates, Miller indices, Bravais indices for directions and planes: crystalline and non crystalline solids; ionic, covalent and metallic solids; packing efficiency, ligancy and coordination number; structure determination by Bragg's X-ray diffraction and powder methods.

**UNIT-III**

**CRYSTAL IMPERFECTION:**

Point defects, line defects-edge and screw dislocation, Berger's circuit and Berger's vectors, dislocation reaction, dislocation motion, multiplication of dislocations during deformation, role of dislocation on crystal properties; surface defects, dislocation density and stress required to move dislocations.

**UNIT-IV**

Basic thermodynamic functions; phase diagrams and phase transformation: Primary and binary systems-general types with examples; tie line & lever rules, non equilibrium cooling; phase diagrams of Fe-Fe<sub>3</sub>C, Pb-Sn Cu-Ni systems.

**UNIT-V**

Phase transformations in Fe-Fe<sub>3</sub>C steels, Time-Temperature-Transformation (TTT) curves for eutectoid steels and plain carbon steels; effect of alloying elements on properties of steels; types of steels, alloys and other metals used in chemical industry.

**UNIT-VI**

Elastic, an elastic and plastic deformations in solid materials; rubber like elasticity, viscoelastic behaviour (models); shear strength of real and perfect crystals work hardening mechanisms cold working, hot working; dynamic recovery, recrystallisation, grain growth, grain size and yield stress Brief description of heat treatment in steels.

**UNIT-VII**

Fracture in ductile and brittle materials creep: mechanism of creep and methods to reduce creeping in materials, creep rates and relations. Fatigue-mechanisms and methods to improve fatigue resistance in materials. Composite materials: types; stress-strain relations in composite materials, applications.

**UNIT-VIII**

**OXIDATION AND CORROSION:**

Mechanisms; types of corrosion; methods to combat corrosion.

**TEXT BOOK:**

1. Materials Science and Engineering; V. Raghavan.; Prentice Hall of India Pvt. Ltd.,

**REFERENCES:**

1. Science of Engineering Materials Vol. 1 & 2; Manas chanda; McMillan Company of India Ltd.
2. Elements of materials science, Van Vlack, L.R.

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CHEMICAL ENGINEERING THERMODYNAMICS –II

**Unit -I:**

**Heat effects:** Sensible heat effects, Internal energy of ideal gases: Microscopic view, Latent heats of pure substances, heat effects of industrial reactions, heat effects of mixing processes.

**Unit-II:**

Standard heat of reaction, Standard heat of formation, Standard heat of combustion, temperature dependence of heat of reaction

**Unit-III:**

**Solution thermodynamics: Theory:** Fundamental property relation, chemical potential as a criterion for phase equilibrium, partial properties, ideal gas mixtures, fugacity and fugacity coefficient for pure species, fugacity and fugacity coefficient for species in solutions, generalized correlations for Fugacity coefficient, The ideal solutions, excess properties.

**Unit –IV:**

**Solution thermodynamics: applications:** the liquid phase properties from VLE data, models for the excess Gibbs energy, property changes of mixing

**Unit -V:**

**VLE at low to moderate pressures:** The nature of equilibrium, the phase rule, Duhems theorem, VLE: Qualitative behavior, the gamma /Phi formulation of VLE, Dew point and bubble point calculations, flash calculations, solute (1)/solvent (2) systems

**Unit -VI:**

**Thermodynamic properties and VLE from equations of state:** properties of fluids from the virial equations of state, properties of fluids from cubic equations of state, fluid properties from correlations of the Pitzer type, VLE from cubic equations of state

**Unit –VII:**

**Topics in phase Equilibria:** Equilibrium and stability, liquid-liquid equilibrium (LLE), vapor- liquid–liquid equilibrium (VLLE), solid-liquid equilibrium (SLE), solid vapor equilibrium (SVE), equilibrium absorption of gases on solids

**Unit –VIII:**

**Chemical reaction equilibria:** The reaction coordinate, application equilibrium criterion to chemical reactions, the standard Gibb's energy change and the equilibrium constant, effect of temperature on equilibrium constants, relation of equilibrium constants to composition, equilibrium conversion for single reactions, Phase rule and Duhem's theorem for reacting systems.

**Text book:**

1. Introduction to chemical engineering thermodynamics by J.M. Smith, H.C. Van Ness and M.M. Abbott, 5th ed. Mc Graw Hill 1996

**Reference:**

1. Chemical and Process Thermodynamics, BG Kyle, 3<sup>rd</sup> Edition, Pearson Education
2. A Text book of chemical engineering thermodynamics by K.V. Narayanan. PHI, 2001.

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CHEMICAL REACTION ENGINEERING – I

**Unit-I**

Overview of chemical reaction engineering- classification of reactions, variables affecting the rate of reaction definition of reaction rate. Kinetics of homogenous reactions- concentration dependent term of rate equation, Temperature dependent term of rate equation, searching for a mechanism, predictability of reaction rate from theory.

**Unit-II**

Interpretation of batch reactor data- constant volume batch reactor:- Analysis of total pressure data obtained in a constant-volume system, the conversion, Integral method of analysis of data- general procedure, irreversible unimolecular type first order reactions, irreversible bimolecular type second order reactions, irreversible trimolecular type third order reactions, empirical reactions of nth order, zero-order reactions, overall order of irreversible reactions from the half-life, fractional life method, irreversible reactions in parallel, homogenous catalyzed reactions, autocatalytic reactions, irreversible reactions in series.

**Unit-III**

Constant volume batch reactor- first order reversible reactions, second order reversible reactions, reversible reactions in general, reactions of shifting order, Differential method of analysis of data. Varying volume batch reactor-differential method of analysis, integral method of analysis, zero order, first order, second order, nth order reactions, temperature and reaction rate, the search for a rate equation.

**Unit-IV**

Introduction to reactor design- general discussion, symbols and relationship between  $C_A$  and  $X_A$ . Ideal reactors for a single reaction- Ideal batch reactor, Steady-state mixed flow reactor, Steady-state plug reactors.

**Unit-V**

Design for single reactions- Size comparison of single reactors, Multiple- reactor systems, Recycle reactor, Autocatalytic reactions.

**Unit-VI**

Design for parallel reactions- introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size.

**Unit-VII**

Irreversible first order reactions in series, quantitative discussion about product distribution, quantitative treatment, plug flow or batch reactor, quantitative treatment, mixed flow reactor, first-order followed by zero-order reaction, zero order followed by first order reaction.

**Unit-VIII**

Temperature and Pressure effects- single reactions- heats of reaction from thermodynamics, heats of reaction and temperature, equilibrium constants from thermodynamics, equilibrium conversion, general graphical design procedure, optimum temperature progression, heat effects, adiabatic operations, non adiabatic operations, comments and extensions. Exothermic reactions in mixed flow reactors-A special problem, multiple reactions.

**TEXT BOOK :**

1. Chemical Reaction Engineering by Octave Levenspiel, 3rd ed. John Wiley & Sons, 1999.

**REFERENCES:**

1. Elements of chemical reaction engineering by H.S. Fogler, 2nd ed. PHI, 1992.
2. Chemical engineering kinetics by J.M. Smith, 3rd ed. Mc Graw Hill, 1981.

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MASS TRANSFER OPERATIONS-1

**UNIT- I**

The Mass Transfer Operations: Classification of the Mass-Transfer Operations, Choice of Separation Method, Methods of Conducting the Mass-Transfer Operations, Design Principles, Molecular Diffusion In Fluids: Molecular Diffusion, Equation of Continuity, binary solutions, Steady State Molecular Diffusion in Fluids at Rest and in Laminar Flow, estimation of diffusivity of gases and liquids,

**UNIT- II**

Momentum and Heat Transfer in Laminar flow Diffusion: Diffusion in Solids, Fick's Diffusion, Unsteady State Diffusion, Types of Solid Diffusion, diffusion through polymers, diffusion through crystalline solids, Diffusion through porous solids & hydrodynamic flow of gases.

**UNIT-III**

Mass Transfer Coefficients: Mass Transfer Coefficients, Mass Transfer Coefficients in Laminar Flow (Explanation of equations only and no derivation), Mass Transfer Coefficients in Turbulent Flow, eddy diffusion, Film Theory, Penetration theory, Surface-renewal Theory, Combination Film-Surface-renewal theory, Surface-Stretch Theory, Mass, Heat and Momentum Transfer Analogies, Turbulent Flow in Circular Pipes. Mass transfer data for simple situations.

**UNIT-IV**

Inter phase Mass Transfer: Concept of Equilibrium, Diffusion between Phases, Material Balances in steady state co-current and counter current stage processes, Stages, Cascades, Kremser – Brown equations ( No derivation)

**UNIT-V**

Equipment For Gas-Liquid Operations: Gas Dispersed, Sparged vessels (Bubble Columns), Mechanical agitated equipments(Brief description),Tray towers, General characteristics, Sieve design for absorption and distillation (Qualitative Treatment), Different types of Tray Efficiencies, Liquid Dispersed venturi Scrubbers, Wetted-Wall Towers, Packed Towers, Counter current flow of Liquid & Gas through packing, Mass transfer coefficients for packed towers, End effects and Axial Mixing Tray tower vs Packed towers.

**UNIT-VI**

Absorption And Stripping: Absorption equilibrium, ideal and non ideal solutions selection of a solvent for absorption, one component transferred: material balances. Determination of number of Plates (Graphical), Absorption Factors, estimation of number of plates by Kremser Brown equation, Continuous contact equipment; HETP, Absorption of one component, Determination of number of Transfer Units and Height of the Continuous Absorber, overall coefficients and transfer units, dilute solutions, overall height of transfer units.

**UNIT-VII**

Humidification Operations: Vapor-Pressure Curve, Definitions, Psychometric Charts, Enthalpy of gas-vapor Mixtures, Humidification and Dehumidification, Operating lines and Design of Packed Humidifiers, Dehumidifiers and Cooling towers, Spray Chambers

**UNIT-VIII**

Drying: Equilibrium, Definitions, Drying Conditions- Rate of Batch Drying under constant drying conditions, Mechanisms of batch drying, Drying time Through Circulation Drying, Classification of Drying Operations: Batch and Continuous Drying Equipment, Material and Energy Balances of Continuous Driers,

**Text book:**

1. Mass transfer operations by R.E. Treybal, 3<sup>rd</sup> ed. Mc Graw Hill, 1980.

**Reference:**

1. Diffusion: mass transfer in fluid system by E. L. Cussler.
2. Transport processes and unit operations by Christie J. Geankoplis
3. Principles of mass transfer and separation processes, B.K. Dutta, PHI, India

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PROCESS INSTRUMENTATION

**Unit -I:**

Elements of instruments, static and dynamic characteristics, basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometers.

**Unit-II:**

Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells and response of thermocouples.

**Unit -III:**

Thermal coefficient of resistance, industrial resistance thermometer bulbs and circuits, radiation receiving elements, radiation, photoelectric and optical pyrometers.

**Unit-IV:**

Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer.

**Unit-V:**

Pressure vacuum and head: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids, static accuracy and response of pressure gauges.

**Unit -VI**

Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels, measurement of interface level, density measurement, and level of dry materials.

**Unit -VII**

Head flow meters, area flow meters, open channel meters, viscosity meters, quantity meters, flow of dry materials, viscosity measurements.

**Unit -VIII**

Recording instruments, indicating and signaling instruments, transmission of instrument readings, control center, instrumentation diagram, process analysis.

**Text Book:**

1. Industrial instrumentation by Donald P.Eckman, Wiley eastern, 1950.

**REFERENCE:**

1. Principles of industrial instrumentation by Patra Nabis, TMH.
2. Instruments for measurements and control by Holbrock W.C. Van Nostrand East West.
3. Hand book Instrumentation, Considine, McGraw Hill,
4. Instrumentation for Process measurement and Control, Norman A. Anderson, 3<sup>rd</sup> Edition, CRC press

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ADVANCED ENGLISH COMMUNICATION SKILLS LAB

### 1. Introduction

The introduction of the English Language Lab is considered essential at 3<sup>rd</sup> year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organise ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

### 2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

### 3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Vocabulary building – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.
- Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.
- Technical Report writing – Types of formats and styles, subject matter – organization, clarity, coherence and style, planning, data-collection, tools, analysis.

### 4. Minimum Requirement:

The English Language Lab shall have two parts:

- i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
- ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

**System Requirement ( Hardware component):**

*Computer network with Lan with minimum 60 multimedia systems with the following specifications:*

- i) P – IV Processor
  - a) Speed – 2.8 GHZ
  - b) RAM – 512 MB Minimum
  - c) Hard Disk – 80 GB
- ii) Headphones of High quality

### 5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.



#### **Suggested Software:**

- **Clarity Pronunciation Power** – part II
- **Oxford Advanced Learner's Compass**, 7<sup>th</sup> Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed,**
  - **Positive Thinking,**
  - **Interviewing Skills,**
  - **Telephone Skills,**
  - **Time Management**
  - **Team Building,**
  - **Decision making**
  
- **English in Mind**, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

#### **6. Books Recommended:**

1. **Effective Technical Communication**, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. **A Course in English communication** by Madhavi Apte, Prentice-Hall of India, 2007.
3. **Communication Skills** by Leena Sen, Prentice-Hall of India, 2005.
4. **Academic Writing- A Practical guide for students** by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
5. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
6. **Body Language- Your Success Mantra** by Dr. Shalini Verma, S. Chand, 2006.
7. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice**, New Age International (P) Ltd., Publishers, New Delhi.
8. Books on **TOEFL/GRE/GMAT/CAT** by Barron's/cup
9. **IELTS series with CDs** by Cambridge University Press.
10. **Technical Report Writing Today** by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
11. **Basic Communication Skills for Technology** by Andra J. Rutherford, 2<sup>nd</sup> Edition, Pearson Education, 2007.
12. **Communication Skills for Engineers** by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
13. **Objective English** by Edgar Thorpe & Showick Thorpe, 2<sup>nd</sup> edition, Pearson Education, 2007.
14. **Cambridge Preparation for the TOEFL Test** by Jolene Gear & Robert Gear, 4<sup>th</sup> Edition.
15. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

#### **DISTRIBUTION AND WEIGHTAGE OF MARKS:**

##### ***Advanced Communication Skills Lab Practicals:***

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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PROCESS HEAT TRANSFER LAB

1. Determination of total thermal resistance and thermal conductivity of composite wall.  
Major equipment - Composite wall Assembly
2. Determination of thermal conductivity of a metal rod.  
Major equipment - Thermal Conductivity apparatus
3. Determination of natural convective heat transfer coefficient for a vertical tube.  
Major equipment - Natural convection heat transfer apparatus
4. Determination of critical heat flux point for pool boiling of water.  
Major equipment- Pool boiling apparatus
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe  
Major equipment – Forced convection heat transfer apparatus
6. Determination of overall heat transfer coefficient in double pipe heat exchanger.  
Major equipment - Double pipe heat exchanger apparatus
7. Study of the temperature distribution along the length of a pin-fin under natural and forced convection conditions  
Major equipment - Pin fin apparatus
8. Estimation of un-steady state film heat transfer coefficient between the medium in which the body is cooled.  
Major equipment - Heat transfer coefficient determination apparatus
9. Determination of Stefan – Boltzmann constant.  
Major equipment - Stefan Boltzmann apparatus
10. Determination of emissivity of a given plate at various temperatures.  
Major equipment - Emissivity determination apparatus
11. Determination of radiation constant of a given surface.  
Major equipment - Emissivity determination apparatus.