

Academic Course Description

BHARATH UNIVERSITY
 Faculty of SCIENCE AND HUMANITIES
 Department of Electrical and Electronics Engineering
BCH201 - ENGINEERING CHEMISTRY II
Second Semester (Even Semester)

Course (catalog) description

The purpose of this course is to develop a strong foundation in the principles and methods to understand the properties in of the surface phenomenon, phase rule and alloys, advanced Engineering materials, fuels and analytical techniques.

Compulsory/Elective course : Compulsory for all branch students

Credit & Contact hours : 3 and 45 hours

Course Coordinator : Dr.Rajenderan

Instructors : Dr.Rajenderan

| Name of the instructor | Class handling | Office location | Office phone | Email (domain:@bharathuniv.ac.in) | Consultation |
|------------------------|--------------------------------|---------------------|--------------------|-----------------------------------|-------------------|
| Dr.Rajenderan | First Year B.Tech, Students | First year Block | 04422290125 | rajendran1317@gmail.com | 9.00 - 9.50 AM |

Relationship to other courses:

Pre –requisites : BCH101 Engineering Chemistry – I

Assumed knowledge : The students will have a chemistry, physics and mathematics background obtained at a higher secondary (or equivalent) level.

Syllabus Contents**UNIT I - SURFACE CHEMISTRY****9**

INTRODUCTION : Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) - Differences between adsorption and absorption - Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms – Freundlich

adsorption isotherm and Langmuir adsorption isotherm - Role of adsorbents in catalysis (in heterogeneous catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II - PHASE RULE AND ALLOYS

9

INTRODUCTION : Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead - Alloys : Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing –hardening – tempering - normalizing – carburizing - nitriding - Non- ferrous alloys: Brass and Bronze

UNIT III - ANALYTICAL TECHNIQUES

9

INTRODUCTION: Types of spectroscopy - Atomic spectroscopy – molecular spectroscopy – Explanation – differences between Atomic spectra – molecular spectra, Absorption spectrum and Emission spectrum, Photo physical laws - Lambert's law - Beer-Lambert's law –applications (determination of unknown concentration) - IR spectroscopy: Principle – instrumentation (block diagram only) – working - finger print region: UV-visible spectroscopy - Principle – instrumentation (block diagram only) – working – estimation of iron by colorimetry Beer-Lambert's law - Flame photometry– principles – instrumentation (block diagram only) – working - estimation of sodium ion by Flame photometry

UNIT IV - FUELS

9

INTRODUCTION : Calorific value – types of Calorific value - gross calorific value – net calorific value; Analysis of Coal – Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method - Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) - Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) - Flue gas analysis – importance - Orsat apparatus

UNIT V - ENGINEERING MATERIALS

9

INTRODUCTION : Refractories ; Definition - characteristics - classification – acidic, basic and neutral Refractories – properties - refractoriness- measurement of refractoriness (Segar Cone Test) ,refractoriness under load measurement of refractoriness under load , dimensional stability- reversible and irreversible dimension stability - porosity, thermal spalling – definition – reason for spalling – points to decrease the spalling) - Manufacture of Refractories : alumina bricks and Magnesite bricks, Lubricants: haracteristics - Classification - Liquid lubricants - Properties – viscosity index (definition , determination), flash and fire points, cloud and pour points, oilyness) - Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

Computer usage: Yes

Professional component

| | | |
|---------------------------------------|---|------|
| General | - | 0% |
| Basic Sciences | - | 100% |
| Engineering sciences & Technical arts | - | 0% |
| Professional subject | - | 0% |

Broad area: Surface Chemistry, Phase Rule And Alloys, Analytical Techniques, Fuels, Engineering Materials

Test Schedule

| S. No. | Test | Tentative Date | Portions | Duration |
|--------|------------------------|-------------------------------|----------------------|-----------|
| 1 | Cycle Test-1 | February 1 st week | Session 1 to 18 | 2 Periods |
| 2 | Cycle Test-2 | March 1 st week | Session 19 to 35 | 2 Periods |
| 3 | Model Test | April 2 nd week | Session 1 to 45 | 3 Hrs |
| 4 | University Examination | TBA | All sessions / Units | 3 Hrs. |

Mapping of Instructional Objectives with Program Outcome

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|---|-------------------------------|-----|-----|
| To enhance the fundamental knowledge in Chemistry and its applications relevant to various streams of Engineering and Technology. This course emphasizes: | Correlates to program outcome | | |
| | H | M | L |
| Understand about the gaseous properties in solid of the surface phenomenon. | a,e | g,i | k |
| Understand the principle and properties of the phase rule and alloys. | c | e,j | b,h |
| Acquire Knowledge on instruments involved in the analytical techniques | d | b | i |
| Acquire Knowledge on fuels | a | c,m | d,f |
| To Understand the impact of Advanced Engineering materials in technical uses | | g | b,c |

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

| Session | Topics | Problem solving (Yes/No) | Text / Chapter |
|------------------------------------|------------------------------------|--------------------------|----------------|
| UNIT -I : SURFACE CHEMISTRY | | | |
| 1. | Adsorption- Types of adsorption | No | [T1, R2] |
| 2. | Adsorption of gases on solids | No | |
| 3. | Adsorption isotherms | YES | |
| 4. | Frendlich and Langmuir Isotherms | Yes | |
| 5. | Adsorption of solute from solution | Yes | |
| 6. | Applications of Adsorptions | No | |
| 7. | Role of adsorbents in catalysis | Yes | |

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|---|--|-----|-----------|
| 8. | Ion exchange adsorption | Yes | |
| 9. | Pollution abatement | Yes | |
| UNIT II: PHASE RULE AND ALLOYS - 9 HRS | | | |
| 10. | Statement and explanation of terms involved in one component system | No | [T2, R2] |
| 11. | Water system, condensed phase rule | Yes | |
| 12. | Construction of phase diagram by thermal analysis | Yes | |
| 13. | Simple eutectic system – Pb – Ag System | No | |
| 14. | Alloys- importance of alloys | Yes | |
| 15. | Ferrous alloys, Nichrome and Stainless steel | YES | |
| 16. | Heat treatment of steel | YES | |
| 17. | Non- ferrous alloys | No | |
| 18. | Brass and Bronze | No | |
| UNIT III: ANALYTICAL TECHNIQUES - 9 HRS | | | |
| 19. | Analytical techniques , introduction and Beer-Lambert’s law | No | [T3, R32] |
| 20. | UV- Visible Spectroscopy - Principles , Instrumentation and Applications | No | |
| 21. | IR Spectroscopy - Principles , instrumentation and Applications | No | |
| 22. | Explanation of Finger – Print Region | No | |
| 23. | Estimation of Iron by Colorimetry (Block diagram only) | No | |
| 24. | Flame Photometry- Principle, Instrumentation (Block diagram only) | Yes | |
| 25. | Estimation of Sodium by Flame Photometry | No | |

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|--|---|-----|--------------|
| 26. | Atomic Absorption Spectroscopy- Principle, instrumentation (Block diagram only) | No | |
| 27. | Estimation of Nickel by Atomic Absorption Spectroscopy | No | |
| UNIT IV: FUELS - 9 HRS | | | |
| 28. | FUELS - CLASSIFICATION | No | [T2, R3] |
| 29. | ANALYSIS OF COAL - PROXIMATE | YES | |
| 30. | ULTIMATE ANALYSIS OF COAL | YES | |
| 31. | MANUFACTURE OF COKE | No | |
| 32. | LIQUID FUELS | Yes | |
| 33. | CATALYTIC CRACKING AND METHODS | Yes | |
| 34. | SYNTHETIC PETROL | No | |
| 35. | GASEOUS FUELS | No | |
| UNIT V: ENGINEERING MATERIALS - 9 HRS | | | |
| 36. | Refractories- Classification – Properties | No | [T1, T2, R3] |
| 37. | Manufacture of Refractories - Alumina and Magnesite | No | |
| 38. | Abrasives- Natural and - Quartz , Garnet , Diamond, Emery , Corundum | No | |
| 39. | Synthetic Abrasives - Silicon Carbide and Boron Carbide | No | |
| 40. | Lubricants- Mechanism of Lubrication, Liquid Lubricants | No | |
| 41. | Properties- Viscosity index, Flash and Fire points , Cloud and Pour points, Oiliness, | No | |
| 42. | Solid Lubricants - Graphite and Molybdenum | No | |

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| | Sulphide | | |
| 43. | Nanomaterials- Introduction to nanochemistry | No | |
| 45. | Carbon nanotubes and their applications | No | |

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- ☐ Formal face-to-face lectures
- ☐ Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- ☐ Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and brainstorming skills.
- ☐ Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Evaluation Strategies

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|-----------------|---|-----|
| Cycle Test – I | - | 5% |
| Cycle Test – II | - | 5% |
| Model Test | - | 10% |
| Assignment | - | 5% |
| Attendance | - | 5% |
| Final exam | - | 70% |

Prepared by:

Dated:

Dr.Rajenderan , Associate Professor , Department of Chemistry

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

- a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) An ability to identify, formulate, and solve engineering problems.
- c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) An ability to design and conduct experiments, as well as to analyze and interpret data.
- e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) An ability to apply reasoning informed by the knowledge of contemporary issues.
- g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) An ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) An ability to function on multidisciplinary teams.
- j) An ability to communicate effectively with the engineering community and with society at large.
- k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) An ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION

Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE

Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM

Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL

Electrical Engineering Graduates have better opportunity to become a future researchers/scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS

Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

BCH201 - ENGINEERING CHEMISTRY II

| Course Teacher | Signature |
|-----------------------|------------------|
| Dr.Rajenderan | |

Course Coordinator

(Dr.Rajenderan)

HOD/EEE

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