**ANDHRA UNIVERSITY**
**Department of Engineering Chemistry, AU College of Engineering (A)**

**5 YEAR INTEGRATED M.Sc. CHEMISTRY**
**(Specialization: APPLIED CHEMISTRY)**
(With Effect from the Admitted Batch of 2016-2017 Academic Year)
**SCHEME OF INSTRUCTION AND EXAMINATION**
**SEMESTER VIII (15 Weeks Duration)**

| Code Number | Course | Teaching/ Lab hours per week | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|
| | | | External | Internal | | |
| 8T1/ Paper – I | Nano Chemistry | 4 | 70 | 30 | 100 | 4 |
| 8T2/ Paper – II | Engineering Chemistry | 4 | 70 | 30 | 100 | 4 |
| 8T3/ Paper – III | Green Chemistry | 4 | 70 | 30 | 100 | 4 |
| 8T4/ Paper – IV | Industries Based On Organic Raw Materials | 4 | 70 | 30 | 100 | 4 |
| 8T5/ Paper – V | Fine Chemicals | 4 | 70 | 30 | 100 | 4 |
| 8P1/ Practical- I | Physical Chemistry Practical | 6 | 100 | 50 | 150 | 4 |
| 8P2/ Practical- II | Applied Chemistry Practical | 6 | 100 | 50 | 150 | 4 |
| 8S1 | Seminar Presentation | -- | ----- | 50 | 50 | 2 |
| | | | | **Total** | **850** | **30** |

**Total Credits for VIII Semester**

**Theory : 20**
**Practical & Seminar : 10**
**Total : 30**

# ANDHRA UNIVERSITY
## Department of Engineering Chemistry, AU College of Engineering (A)
## 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)
(With Effect from the Admitted Batch of 2016-2017 Academic Year)
## SYLLABUS

## VIII Semester
## 8T1/ PAPER-I: NANO CHEMISTRY

**Introduction to the nano world** –various topical Ores that nano-technology promises to affect : In during production –in tagging of DNA and DNA chips –in information storage –chemical/ computers – in environmental green chemistry –in catalyst –in polymers –in paints in im prorrins natural security

**Differential anodes atoms /molecules** –nanoscale particles –condensed matter –A brief introduction to the techniques in the an dyes and characterisation nano materials; High Resolution Transmission Electron Microscopy. (HRTEM) : Scanning Probe Microscopy (SPM): Powder X-ray Diffraction (XRD) and differential Scanning Calorimetry (DSC) (Introduction in not needed) – Classification of nano materials .

**Nanomaterials** –Structure and bonding –Band theory of nanomaterials –Change in the general characters of metals by reducing the size of metals size dependent properties of nanometals melting in colors, catalyis, nano-electroprinciples of sol-gel technique in the preparation of metal oxides.

**Chemical and catalytic aspects of nano crystals :** Introduction –nanomaterials in catalysis : electronic and shape effects of a metal on catalysis lews acid catalysts –metal /metal halide catalyst process in photography –A brief introduction to carbon nanotubes

**Application of nano crystals**: Application of nano crystals in structural and mechanical materials –in colorants and pigments : Biomedical applications and in electronics and magnetics –

**Recommended Books :**


1. Nanoscale Materials in Chemistry : by Kenneth J.K/ labunde, A John wiley &sons , Inc., Publications
2. Nanochemistry : A Chemical Approch to Nanomaterials: by Geolfrey A.Zin and Andre d. Arsenault Chemistry Department Chemistry of Toronto, Canada RSC Publications .
3. Nanotechnology by Richard Booker and Barl Boysen :Wiley Publcations.INC

# 8T2/ PAPER-II: ENGINEERING CHEMISTRY

**Water Chemistry:** Sources of water –impurities –Hardness and its determination –W.H.O . limits . Boiler Troubles and their Removal - Water Softening methods –Lime-Soda, Zeolite and Ion-Exchange; Municipal water treatment – Break point chlorination - Desalination of sea water – Electrodialysis and Reverse Osmosis methods .

**Fuels:** Petroleum – Refining – Motor fuels – Petrol and Diesel oil –Knocking; Octane number; Cetane number - Synthetic Petrol: Fisher-Tropsch and Bergius methods .
LPG and CNG –Applications.
Rocket Fuels- Propellants –Classification.

**Lubricants:** Classification –Mechanism –properties of lubricating oils –selection of lubricants for Engineering Application .

**Polymers and Plastics:**
Definition – Types of Polymerisation – Preparation and Properties of Cellulose Derivatives – Vinyl resins – Nylon (6,6) – Bakelites – Polycarbonates – Epoxy Resins - Reinforced plastics . Conducting Polymers - Engineering applications of polymers.

**Building materials:**
**Portland Cement:** Classification of Cement - Manufacture of Portland cement - Dry and Wet Processes - Chemical constitution of Portland cement and its characteristics - Setting and hardening of cement. –special cements and their uses - Cement Concrete – RCC - Decay of Concrete

**Refractories:** Classifications - Properties - Engineering Applications.

**Recommended Books :**

1.Engineering Chemistry .P.C.Jain and M.Jain –Dhanapathi Rai & Sons ,Delhi

2.A text book of Engineering Chemistry .S.S.Dara –S.Chand & Co.New Delhi

3.A text book of Engineering Chemistry ,B.K.Sharma –Krishnaprakasan , Meerut

4.A text book of Engineerng Chemistry –Allied Publishers Balsubramanian el.al.

5.Materials science and Engineering V.Raghavan-prentice –Hall India Ltd

## 8T3/ PAPER-III: GREEN CHEMISTRY

**Basic Principles of Green Chemistry:** Prevention of Waste/By-Products, Maximum Incorporation of the Reactants into the Final Product, Prevention or Minimization of Hazardous Products, Designing Safer Chemicals, Energy Requirements for Synthesis, Selection of Appropriate Solvent, Selection of Starting Materials, Use of Protecting Groups, Use of Catalyst, Products Designed Should be Biodegradable, Designing of Manufacturing Plants, Strengthening of Analytical Techniques.

**Designing a Green Synthesis:** Choice of Starting Materials, Choice of Reagents, Choice of Catalysts, and Choice of Solvents.

**Green Chemistry in Day-to-Day Life:** Dry Cleaning of Clothes, Versatile Bleaching Agent.

**Green Reagents:** Dimethylcarbonate, Polymer Supported Reagents.

**Green Catalysts:** Acid Catalysts, Oxidation Catalysts, Basic Catalysts, Polymer Supported Catalysts.

**Phase Transfer Catalysis in Green Synthesis:** Introduction, Applications of PTC in Organic Synthesis, Oxidation Using Hydrogen Peroxide Under PTC Condition, Crown Ethers.

**Microwave Induced Green Synthesis:** Introduction, Applications – Microwave Assisted Reactions in Water, Microwave Assisted Reactions in Organic Solvents, Microwave Solvent Free Reactions (Solid State Reactions).

**Ultrasound Assisted Green Synthesis:** Introduction, Applications of Ultrasound.

**Biocatalysts in Organic Synthesis:** Introduction, Biochemical (Microbial) Oxidations, Biochemical (Microbial) Reductions, Enzymes Catalysed Hydrolytic Processes.

**Aqueous Phase Reactions:** Introduction, Diels-Alder Reaction, Claisen Rearrangement, Michael Reaction, Aldol Condensation, Knoevenagel Reaction, Pinacol Coupling, Benzoin Condensation, Claisen-Schmidt Condensation, Heck Reaction, Wurtz Reaction

**Organic Synthesis in Solid State:** Introduction, Solid Phase Organic Synthesis Without Using Any Solvent, Solid Supported Organic Synthesis.

**Versatile Ionic Liquids as Green Solvents:** Green Solvents, Reactions in Acidic Ionic, Liquids, Reactions in Neutral Ionic Liquids.

**Synthesis Involving Basic Principles of Green Chemistry:** Some Examples; Introduction, Synthesis of Styrene, Synthesis of Adipic Acid, Catechol and 3-dehydroshikirnic Acid (a potential replacement for BHT), Furfural from Biomass, Synthesis of (S)-metolachlor, an Optically Active Herbicide, Synthesis of Ibuprofen, Synthesis of Paracetamol,

**]**

**Recommended Books :**


1. P. Anastas and H. Williamson, Green chemistry frontiers in benign chemical Synthesis and processes, Oxford University Press.
2. Lerma and W. Straat, Chemical management: Reducing waste and cost through Innovative supply strategies, Willey Sons.
3. M.C. Cann and M. E. Connelly Real world cases in green chemistry, ACS Publications.
4. T. Clayton, Policies for cleaner Technologies, Earthscan
5. V. K. Ahluwalia and M. Kidwai, New Trends in Green Chemistry, Anamaya Publishers, New Delhi.

## 8T4/ PAPER-IV: INDUSTRIES BASED ON ORGANIC RAW MATERIALS

**Chemistry of Starch:** Structure, Chemical and Physical properties of mono, di, and polysaccharides. Manufacture and uses of unmodified starch: dextrin sugar syrup: Hydrolysis of starch to edible and industrial glucose, applications of starch in textile sizing and in the fermentation industries- Manufacture of Industrial Alcohol-Manufacture of Vitamin C from glucose.

**Chemistry of Cellulose:** Structure, Chemical and Physical properties. General reactions, major sources and uses of cellulose, Enzymatic and chemical hydrolysis of cellulose- conversion of cellulose to alcohol. Laboratory and commercial scale preparation of chemical cellulose. Cellulose derivatives like cellulose nitrate, cellulose acetate.

**Different methods of Wood pulping:** Manufacture and cases of different qualities of paper products like cardboard, newsprint, writing paper, tissue paper and filter paper.

**Oils, Fats and Waxes:** Classification of oils , Vegetable, animal and mineral oils – Manufacture of Vegetable oils, Chemical properties and uses – Animal fats and oils, processing, hydrogenation of oils- preparation, properties and uses of waxes.

**Soaps:** Manufacture, Raw material, Types of Soaps, Glycerin recovery from soap manufacture.

**Detergents:** Raw materials – Classification of Surfactants- Biodegradability of Detergents.

**Surface Protective Coatings:** Paints – Drying oils , Pigments , Pigment extenders - Water paints – Special paints – Varnishes , Lacquers and Enamels.

**Suggested Books:**


1. Chemical Process Iindustries by R N Shreeve
2. Engineering Chemistry by B. K. Sharma.
3. Engineering Chemistry by S S DARA

## 8T5/ PAPER-V: FINE CHEMICALS

**Dyes:** Introduction – Characteristics of a Dye - Colour and Chemical Constitution ( Witt's theory, Armstrong theory & Modern theory) - Classification of dyes. - Dye Intermediates - Unit processes in the preparation of dye intermediates - **Synthesis, Chemistry and Application of Selected Dyes** : Napthol Yellow S. Naphthol green Y. Methyl orange , Bismark Brown, Congo Red Phenolphthalein Fluorescein Rhodamines B. Indophenol blue, Phenylene blue . . Methylene blue, Quinoline blue, Alizarin, Indigo ( Indigotin ) Thio indigo - **Dye Degradation**

**Perfumes:** Theory of olfaction and mechanism, Relation between Perfumes and Phermones - Components of Perfumes - Classification of Perfumes, Chemistry, Manufacture and Isolation of the following compounds – Citral, Geraniol, Nerol, Linalool, Citronellol, Hydroxy citronillol Cincal, Jasmone, Civetone and Muskone, acetylcarane, acetyl Longifolene.

**Flavours:** The difference between perfumes and flavours - Classification of Flavour compounds , Chemistry of species and oleoresins - Pepper, Ginger, Aniseed, Cumin seed, Coriander, Cellery and Cardamom, Chemistry of some major flavours like Coffee, Tea, Cocoa, Onion. Assessment of Flavours and Blending of Flavours - Flavour compounds: Menthol, Pipertone, Vanillin, Eugenol, Monosodium glutamate (MSG) and Carvone

**Foods and Food Additives**: Carbohydrates, proteins, water and mineral substances, Vitamins. Sweetening Agents**:** Saccharine , Sodium Cyclamate.

**Chemistry of Agrochemicals :** Importance, Structure, Synthesis, Mode of Action of -
**Insecticides**: DDT, BHC, Aldrin, Endosulfon, Malathion, Parathion.
**Herbicides**: 2,4-dichloro phenoxy acetic acid, dalapon, paraquat,
**Fungicides**: Boardeaux mixture, Copper oxychloride, Zineb,, Benomyl (Benlate ).
**Rodenticides**: Warfarin, Sodium monofluoroacetate, Zinc phosphide.
**Plant-Growth Modifiers**: Growth Regulators, Second-Growth Inhibitors and Defoliants,Yield Stimulators

**Suggested books:**


1. Synthetic Organic Chemistry, O. P. Agarwal, $10^{th}$ Edition , Publishing House, Meerut, 1994.
2. Chemical Process Industries by R.N. Shreeve.
3. The Chemistry of Synthetic Dyes, Academic Press.
4. Chemistry of Herbicides, U.S. Sree Ramulu, Oxford & I.B.H. Publishing Co. 1985.

## 8P1/ PRACTICAL-I: PHYSICAL CHEMISTRY PRACTICAL

**List of Experiments:**

1. Determination of Critical Solution temperature of Phenol – water system.
2. Effect of an electrolyte (NaCl)on the miscibility temperature of Phenol-water system
3. Determination of the composition of cuprammonium cation
4. Determination of Heat of neutralization of NaOH and HCl.
5. Determination of partition coefficient of acetic acid between water and cyclohexane
6. Study of variation of solubility of $Ca(OH)_2$ in NaOH solution and determination of its solubility product
7. Determination of heat of precipitation of $BaSO_4$

**Recommended Books :** .


1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham,ELBS
2. Laboratory Manual of Engineering Chemistry by Dr Sudha rani
3. Advanced Physical Chemistry Experiments by Dr.J.N. Gurtu and Amit Gurtu

## 8P2/ PRACTICAL-II: APPLIED CHEMISTRY PRACTICAL

**Quantitative Determinations:**

1. Determination of saponification value, Iodine value and Acid value of an Oil.
2. Determination of Glucose.
3. Determination of Molecular Weight of a Polymer.
4. Determination of a Drug.

**Preparations**

5. Preparation of Soap.
6. Preparation of Cold cream.
7. Preparation of Shampoo.
8. Preparation of Phenol-formaldehyde Resin.
9. Preparation of Copper pigment .

**Analysis**

10. Analysis of Water
    a) $P^H$, Electrical Conductivity, Total Dissolved Solids (TDS).
    b) Total Hardness(Ca, Mg), Alkalinity.
    c) Chloride, Sulphate, Nitrite, Nitrate.
    d) Phosphate, Flouride, Sulphide.
    e) Dissolved Oxygen, Residual Chlorine, Trace Metals.
    f) Silica, Chlorine, Filter Bed Analysis, Health Effects.

**Suggested Books:**


1. A Text book of practical organic chemistry, A.I. Vogel, ELBS.
2. Laboratory Manual of Organic Chemistry by Raj K Bansal.
3. Sampling Analysis of Water and Sewage by Prof.T.Sivaji Rao.
4. Standard methods for the examination of water and waste water by Andrew D. Eaton, Lenore S.Clesceri, Arnold E.Greenberg.

**MODEL QUESTION PAPER**

# 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)

(With Effect from the Admitted Batch of 2016-2017 Academic Year)

**VIII SEMESTER**

**Paper I: NANO CHEMISTRY**

Time: 3 Hours Max. Marks: 70

*Answer any **FIVE** questions.*
*All questions carry equal marks*

1 (a) Explain the concept and importance nanotechnology in chemistry
(b) Explain the applications of nanotechnology for information storage and environmental green chemistry areas

2 (a) Briefly explain the application of XRD for nano material characterisation
(b) Explain the principle involved in HR-TEM for nano material characterisation

3 (a) Write a brief classification of nano materials
(b) Explain the structure and bonding in nano materials

4 (a) Explain the changes in the properties and characteristics of metals due to size reduction with suitable examples
(b) Explain the Sol-Gel method for the synthesis of nano materials

5 (a) Explain the catalytic application of nano materials
(b) Explain the band theory of nano materials

6 (a) Explain the structure and types of Carbon Nanotubes
(b) Write the important features of Scanning Probe Microscopy

7 (a) What are nano crystals? Write their application as colorants and pigments
(b) Explain the biomedical applications of nano crystals

**MODEL QUESTION PAPER**

# 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)

(With Effect from the Admitted Batch of 2016-2017 Academic Year)

**VIII SEMESTER**

**Paper II: ENGINEERING CHEMISTRY**

Time: 3 Hours Max. Marks: 70

*Answer any **FIVE** questions.*
*All questions carry equal marks*

1 (a) Explain the concept of Hardness of water and its determination
(b) Explain Zeolite method

2 (a) Explain boiler troubles and their remedies
(b) Explain the methods of desalination

3 (a) Explain the refining process of petroleum and the properties of various fractions
(b) Explain the Fischer-Tropsch method for the manufacture of synthetic petrol

4 (a) Give a brief classification of lubricants and their mechanism of action
(b) Explain any four important properties of lubricants

5 (a) Explain the mechanism of addition polymerisation
(b) Write the synthesis and applications of Nylon 6,6; Polycarbonates and Epoxy resins

6 (a) Briefly explain the manufacture of cement by wet process and its final composition
(b) Explain the composition and application of RCC

7 (a) Write the chemical structure and classification of refractory material
(b) Explain any four important properties of refractories

**MODEL QUESTION PAPER**

# 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)

(With Effect from the Admitted Batch of 2016-2017 Academic Year)

**VIII SEMESTER**

**Paper III: GREEN CHEMISTRY**

Time: 3 Hours Max. Marks: 70

*Answer any **FIVE** questions.*
*All questions carry equal marks*

1 (a) Briefly explain the basic principles of green chemistry
(b) Write about designing green synthesis with suitable example

2 (a) Briefly explain green chemistry in day-to-day life
(b) What are green reagents? How they are green?

3 (a) Explain the role of Phase Transfer Catalysis as a green process
(b) What are aqueous phase reactions? Give any four examples?

4 (a) Explain the Solid Phase Organic Synthesis with suitable examples
(b) Write a note on green catalysts

5 (a) Write a note on ionic liquids as green solvents
(b) Explain the importance of microwave assisted synthesis

6 (a) Explain the principle involved in ultrasound assisted green synthesis
(b) Briefly explain the use of biocatalysts

7 Explain the application of green chemistry principles in the synthesis of Adipic acid, furfural and Ibuprofen

**MODEL QUESTION PAPER**

# 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)

(With Effect from the Admitted Batch of 2016-2017 Academic Year)

**VIII SEMESTER**

**Paper IV: INDUSTRIES BASED ON ORGANIC RAW MATERIALS**

Time: 3 Hours Max. Marks: 70

*Answer any **FIVE** questions.*
*All questions carry equal marks*

1 (a) Explain polysaccharides and their physical properties. Write the uses of starch.
(b) Write the applications of starch in fermentation industries.

2 (a) Describe the structure and physical properties of cellulose.
(b) Write a note on derivatives of cellulose.

3 (a) What is wood pulp and how the cardboard is manufactured?
(b) Describe the preparation of tissue paper in industry?

4 (a) What are vegetable oils? Discuss its properties and uses.
(b) Discuss briefly about the Hydrogenation of oils.

5 (a) Write in detail the manufacture of bathing soaps.
(b) Explain the composition of bathing soap. What are the raw materials?

6 (a) Explain the classification and raw materials of surfactants.
(b) Explain the biodegradability of detergents.

7 (a) Write about the pigments and the water paints.
(b) How enamels are used as surface protective coatings?

**MODEL QUESTION PAPER**

# 5 YEAR INTEGRATED M.Sc. CHEMISTRY
## (Specialization: APPLIED CHEMISTRY)

(With Effect from the Admitted Batch of 2016-2017 Academic Year)

**VIII SEMESTER**

**Paper V: FINE CHEMICALS**

Time: 3 Hours Max. Marks: 70

*Answer any **FIVE** questions.*
*All questions carry equal marks*

1 (a) Briefly explain the structural features of a dye in relation to colour and chemical composition
(b) Explain the synthesis and properties of Naphthol Green Y and Quinoline blue

2 (a) Explain the classification of dyes
(b) Explain the synthesis and properties of Bismark Brown and Thioindigo

3 (a) Explain the theory of olfaction and classification of perfumes
(b) Explain the synthesis and isolation of Geraniol and Muskone

4 (a) Explain the chemistry and synthesis of Citronellal and Cincal
(b) Briefly explain the assessment and blending of flavours

5 (a) Explain the chemistry of pepper, aniseed and cellery
(b) Explain various sources of vitamins and their deficiency syndromes

6 (a) Explain the chemistry and flavour applications of Vanillin and Monosodium glutamate
(b) Explain the importance and application of insecticides and herbicides with an example each

7 (a) Explain the synthesis, chemistry and action of Copperoxychloride, warfarin and sodiummonosodiumacetate
(b) Briefly explain the chemistry and application of Growth regulators, defoliants and yield stimulators