ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM
SCHOOL OF CHEMICAL SCIENCES
DEPARTMENT OF CHEMISTRY
SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION

Name of the Research Guide : **Prof. Dr. B. JAGAN MOHAN REDDY**

Name of the Candidate: **R Linga Reddy Mallampati (UGC-NSQF)**

Title of the Research: A STUDY ON THE ANALYSISS OF BIOLOGICALLY POTENT HETEROCYCLIC COMPOUNDS BY USING VARIOUS ANALYTICAL TECHNIQUES.

PAPER-1: RECENT ADVANCES IN CHEMICAL SCIENCES.

Unit – I Named reactions and their mechanisms:

1) Birch Reduction 2) Prins Reaction 3) Diels-Alder Reaction 4) Barton Reaction 5) Wittig Reaction 6) Bayer Villager Oxidation.

Unit – II Organic reagents and their applications:

1.Sodium Borohydride($NaBH_4$) 2. Lithium aluminium hydride($LiAlH_4$) 3. Di-isobutyl aluminium hydride(DIBAL-H) 4) Selenium dioxide(SeO_2) 5. Osmium Tetraoxide (OsO_4) 6. Pyridinium Chloro Chromate (PCC).

Unit – III Green Chemistry

Introduction to Green Chemistry: What is Green Chemistry, need for Green Chemistry, Goals of Green Chemistry, Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples, Examples of Green Synthesis: Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid.

Unit-IV Retro Synthetic Analysis:

a) Disconnection b) Target Molecule c) Synthon d) Synthetic Equivalent

e) Functional Group Interconversion (FGI) f) Functional Group Addition (FGA)

g) Convergent synthesis and Linear synthesis

Unit-V Chromatography

Chromatography: Thin layer Chromatography, Column Chromatography, Principle and instrumentation of HPLC and Gas Chromatography

Basic principles and applications of LC-MS and GCMS

Books for References:

1) Advances in Organic chemistry: Jerry March, Wiley Eastern Limited.

2) Some modern methodologies in organic synthesis, W. Caruthers, Cambridge.

3) Photochemistry by C W J Wells

4) Organic Photochemistry by Turro

5) Inorganic Chemistry by Pearson

6) A textbook of Chromatography-Rajbir Singh

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Pre-PhD Examination Model Question Paper

PAPER-1: RECENT ADVANCES IN CHEMICAL SCIENCES.

Time: 3 hrs. **Max. Marks: 100**

Answer any Five of the following
All questions carry equal marks

Each Question carries 20 Marks

1. Explain the following reactions with Suitable examples and their mechanisms:
a) Diels-Alder Reaction c) Bayer Villager Oxidation

(OR)

2. Describe the following reactions with suitable examples and their mechanisms:
a) Barton reaction b) Wittig reaction.

3. Write the synthetic applications of the following reagents with suitable mechanism:
a) Di-isobutyl aluminium hydride (DIBAL-H) b) Lithium aluminium hydride ($LiAlH_4$)

(OR)

4. Illustrate the synthetic applications of the following reagents with suitable mechanism:
a) PyridiniumChloroChromate (PCC) b) Selenium dioxide (SeO_2)

5. Discuss the Twelve principles of Green Chemistry with their explanations and examples

(OR)

6. Differentiate the following a) Goals of Green Chemistry b) Green Synthesis with suitable examples.

7. Explain the following terms
a) Retro Synthetic Analysis b) Disconnection c) Target Molecule d) Functional Group Interconversion (FGI) and Functional Group Addition (FGA)

(OR)

8. Demonstrate the Linear and Convergent synthesis

9. Write note on Principle involved in thin layer Chromatography, Column Chromatography with suitable examples.

(OR)

10. Discuss the instrumentation and applications of HPLC, GCMS.

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Name of the Research Guide : **Prof. Dr. B. JAGAN MOHAN REDDY**

Name of the Candidate :**R Linga Reddy Mallampati (UGC-NSQF)**

Paper II: Research Methodology & Chromatography Techniques

Title of the Research: A STUDY ON THE ANALYSISS OF BIOLOGICALLY POTENT HETEROCYCLIC COMPOUNDS BY USING VARIOUS ANALYTICAL TECHNIQUES.

Unit-I Definition of Research:

Research process, problem identification, research designs, Nature and importance of Research, Aims and Objectives of Research, Selection of area of research, Design of experimental program, Applications of research and types.

Unit-II Searching the Chemical literature:

Search for existing literature, Review the literature selected, Develop a theoretical and conceptual framework, writing up the review, Selection of literature, collection of literature, Manual collection from Library, usage of E-library, collection of literature from web, collection of literature from Scopus, Science direct, Scifinder etc.,

Unit-III Thesis and report writing:

General format, title page, abstract, Tables and figures, experimental details, spacing and alignment, abbreviations and special symbols acknowledgements, results and discussions, references, journal publications, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report, text processing and printing.

Unit IV Chromatography Techniques

Thin layer chromatography: Principle, activation of adsorbent, development of chromatoplate, visualization methods, applications.

Paper Chromatography (PC): Definitions, theory and principle, techniques; one, two-dimensional and circular PC, mechanism of separation, methodology preparation of sample, choice of solvents, location of spots and measurement of RF value, factors affecting RF values, advantages and applications

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Unit V HPLC and Analysis of hetero cyclic compounds by using chromatography techniques

High Pressure Liquid Chromatography(HPLC): Principles, instrumentation, peak shapes, capacity factor, selectivity, plate number, plate height, resolution, band broadening, pumps, injector, detectors, columns, column problems, gradient HPLC, HPLC solvents, trouble shooting, sample preparation, method development, new HPLC method developments for the analysis of brinzolamide, timolol maleate.

Books and References:

- March: Advanced Organic chemistry : 6th edition ,wiley, Madras
- Research Methodology- A Step- Jerry By-Step Guide for Beginners by Ranjit Kumar.
- Instrumental Methods of Chemical Analysis by B.K. Sharma.
- "Instrumental Methods of Chemical Analysis" by G.Chatwal & S.Anand.
- A Text book of Pharmaceutical Analysis by Kerrenth A.Connors.
- Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi.

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DEPARTMENT OF CHEMISTRY

Pre-PhD Examination Model Question Paper

Title of the Research: A STUDY ON THE ANALYSISS OF BIOLOGICALLY POTENT HETEROCYCLIC COMPOUNDS BY USING VARIOUS ANALYTICAL TECHNIQUES.

PAPER-II: Research Methodology & Chromatography Techniques

Time: 3 hrs **Max.Marks:100**

Answer any Five of the following
All questions carry equal marks

1. Demonstrate the types and applications of research.

(OR)

2. Differentiate the following: i) Nature and importance of Research ii) Aims and Objectives of Research

3. Discuss about research review and literature search.

(OR)

4. Analyse the collection of literature.

5. Describe the general formatting of Thesis.

(OR)

6. Explain the various factors to be taken into account while writing a thesis.

7. Write about the principle of Thin Layer Chromatography. Write about various methods of visualization in TLC. Write the applications of TLC.

(OR)

8. Write about the principle of paper chromatography. Write about two-dimensional and circular paper chromatography. Write about the factors effecting Rf value.

9. Explain the principle of HPLC and write its instrumentation. Write about gradient HPLC and method development by using HPLC.

(OR)

10. Write about new HPLC method developments for the analysis of brinzolamide, timolol maleate.

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SCHOOL OF CHEMICAL SCIENCES

DEPARTMENT OF CHEMISTRY

SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION

Paper-III

Name of the Research Guide : **Prof. Dr. B. JAGAN MOHAN REDDY**

Name of the Candidate : **R Linga Reddy Mallampati (UGC-NSQF)**

Title of the Research : **A STUDY ON THE ANALYSISS OF BIOLOGICALLY POTENT HETEROCYCLIC COMPOUNDS BY USING VARIOUS ANALYTICAL TECHNIQUES**

• **ORALPRESENTATION (Seminar)**

Research Supervisor

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RECENT ADVANCES IN CHEMICAL SCIENCES

Name of the research guide: Dr.B. JAGAN MOHAN REDDY

Name of the Candidate: K. V.S.R. SESHU KUMAR

Title of the Research: Synthesis of haloaryl methyl sulfone and preparation of 2,4- Diamino butyric acid, its application in synthesis of Ectoine, an anti-aging / sunscreen cream.

Unit – I Named reactions and their mechanisms:

1) Birch Reduction 2) Prins Reaction 3) Diels-Alder Reaction 4) Barton Reaction 5) Wittig Reaction 6) Bayer Villager Oxidation.

Unit – II Organic reagents and their applications:

1.Sodium Borohydride($NaBH_4$) 2. Lithium aluminium hydride($LiAlH_4$) 3. Di-isobutyl aluminium hydride(DIBAL-H) 4) Selenium dioxide (SeO_2) 5. Osmium Tetraoxide (OsO_4) 6. Pyridinium Chloro Chromate (PCC).

Unit – III Green Chemistry

Introduction to Green Chemistry: What is Green Chemistry, need for Green Chemistry, Goals of Green Chemistry, Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples, Examples of Green Synthesis: Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid.

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a) Disconnection b) Target Molecule c) Synthon d) Synthetic Equivalent

e) Functional Group Interconversion (FGI) f) Functional Group Addition (FGA)

g) Convergent synthesis and Linear synthesis

Unit-V Chromatography

Chromatography: Thin layer Chromatography, Column Chromatography, Principle and instrumentation of HPLC and Gas Chromatography

Basic principles and applications of LC-MS and GCMS

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DEPARTMENT OF CHEMISTRY
Pre-PhD Examination Model Question Paper

PAPER-I

Time: 3 hrs. **Max. Marks: 100**

Answer any Five of the following
All questions carry equal marks

Each Question carries 20 Marks

1. Explain the following reactions with Suitable examples and their mechanisms:
a) Diels-Alder Reaction c) Bayer Villager Oxidation

(OR)

2. Describe the following reactions with suitable examples and their mechanisms:
a) Barton reaction b) Wittig reaction.

3. Write the synthetic applications of the following reagents with suitable mechanism:
a) Di-isobutyl aluminium hydride (DIBAL-H) b) Lithium aluminium hydride ($LiAlH_4$)

(OR)

4. Illustrate the synthetic applications of the following reagents with suitable mechanism:
a) Pyridinium Chloro Chromate (PCC) b) Selenium dioxide (SeO_2)

5. Discuss the Twelve principles of Green Chemistry with their explanations and examples.

(OR)

6. Differentiate the following a) Goals of Green Chemistry b) Green Synthesis with suitable examples.

7. Explain the following terms:
a) Retro Synthetic Analysis b) Disconnection c) Target Molecule d) Functional Group Interconversion (FGI) and Functional Group Addition (FGA)

(OR)

8. Demonstrate the Linear and Convergent synthesis.

9. Write note on Principle involved in thin layer Chromatography, Column Chromatography with suitable examples.

(OR)

10. Discuss the instrumentation and applications of HPLC, GCMS.

Research Supervisor

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DEPARTMENT OF CHEMISTRY
SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION
Paper-II; Research Methodology & Organic Synthesis

Topic/Title of Paper

Name of the Research Guide : **Dr .B.Jagan Mohan Reddy**

Name of the Candidate : **K. V.S.R. SESHU KUMAR**

Title of the Research: Synthesis of haloaryl methyl sulfone and preparation of 2,4-Diamino butyric acid, its application in synthesis of Ectoine, an anti-aging / sunscreen cream.

Unit-I Definition of Research:

Research process, problem identification, research designs, Nature and importance of Research, Aims and Objectives of Research, Selection of area of research, Design of experimental program, Applications of research and types.

Unit-II Searching the Chemical literature:

Search for existing literature, Review the literature selected, Develop a theoretical and conceptual framework, writing up the review, Selection of literature, collection of literature, Manual collection from Library, usage of E-library, collection of literature from web, collection of literature from Scopus, Science direct, Scifinder etc.,

Unit-III Thesis and report writing:

General format, title page, abstract, Tables and figures, experimental details, spacing and alignment, abbreviations and special symbols acknowledgements, results and discussions, references, journal publications, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report, text processing and printing.

Unit-IV Aromaticity

Huckle`s rule and aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene,1,3,5,7- Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, anti-aromaticity and homo-aromaticity.

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Unit-V Five and six membered heterocyclics with one and two hetero atoms

Synthesis, reactivity and biological significance of the following heterocycles:

Pyrazole, Imidazole, Isoxazole, Pyridazine, Pyrimidine.

Books and References:

1. Research Methodology- A Step-By-Step Guide for Beginners by Ranjit Kumar.
2. Research Methods by Trochim,William M
3. A text book of Organic Chemistry, Raj K Bansal.
4. Organic Chemistry, Volume 1, Sixth Edition, I. L. Finar

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DEPARTMENT OF CHEMISTRY
Pre-PhD Examination Model Question Paper

PAPER-II: Research Methodology & Organic Synthesis

Model question paper

Time: 3 hrs **Max.Marks:100**

Answer any Five of the following
All questions carry equal marks

1. Demonstrate the types and applications of research.

(OR)

2. Differentiate the following: i) Nature and importance of Research ii) Aims and Objectives of Research

3. Discuss about research review and literature search.

(OR)

4. Analyse the collection of literature.

5. Describe the general formatting of Thesis.

(OR)

6. Explain the various factors to be taken into account while writing a thesis.

7. Huckle`s rule and aromaticity in benzenoid and non-benzenoid compounds.

(OR)

8. Write about anti-aromaticity, homo-aromaticity and annulenes.

9. Illustrate the synthesis and reactivity of Pyrimidine.

(OR)

10. Write a note on preparation of imidazole with neat reaction mechanism.

Research Supervisor

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SCHOOL OF CHEMICAL SCIENCES

DEPARTMENT OF CHEMISTRY

SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION

Paper-III

Name of the Research Guide : **Dr. B. Jagan Mohan Reddy**

Name of the Candidate : **K. V.S.R. SESHU KUMAR**

Title of the Research: Synthesis of haloaryl methyl sulfone and preparation of 2,4- Diamino butyric acid, its application in synthesis of Ectoine, an anti-aging / sunscreen cream.

• **ORALPRESENTATION (Seminar)**

Research Supervisor

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SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION

Name of the research guide: Dr .B.Jagan Mohan Reddy

Name of the Candidate: K. V. B. Ranjitha

Title of the Research: Design, Synthesis of New pathways of Aromatic compounds and Heterocycles and their biological Evaluation.

Paper I: RECENT ADVANCES IN CHEMICAL SCIENCES

Unit – I Named reactions and their mechanisms:

1) Birch Reduction 2) Prins Reaction 3) Diels-Alder Reaction 4) Barton Reaction 5) Wittig Reaction 6) Bayer Villager Oxidation.

Unit – II Organic reagents and their applications:

1.Sodium Borohydride($NaBH_4$) 2. Lithium aluminium hydride($LiAlH_4$) 3. Di-isobutyl aluminium hydride(DIBAL-H) 4) Selenium dioxide(SeO_2) 5. Osmium Tetraoxide (OsO_4) 6. Pyridinium Chloro Chromate (PCC).

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Introduction to Green Chemistry: What is Green Chemistry, need for Green Chemistry, Goals of Green Chemistry, Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples, Examples of Green Synthesis: Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid.

Unit-IV Retro Synthetic Analysis:

a) Disconnection b) Target Molecule c) Synthon d) Synthetic Equivalent

e) Functional Group Interconversion (FGI) f) Functional Group Addition (FGA)

g) Convergent synthesis and Linear synthesis

Unit-V Chromatography

Chromatography: Thin layer Chromatography, Column Chromatography, Principle and instrumentation of HPLC and Gas Chromatography

Basic principles and applications of LC-MS and GCMS

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5) Inorganic Chemistry by Pearson
6) A textbook of Chromatography-Rajbir Singh

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Pre-PhD Examination Model Question Paper

Paper I: RECENT ADVANCES IN CHEMICAL SCIENCES

Time: 3 hrs. **Max. Marks: 100**

Answer any Five of the following
All questions carry equal marks

Each Question carries 20 Marks

1. Explain the following reactions with Suitable examples and their mechanisms:
a) Diels-Alder Reaction c) Bayer Villager Oxidation

(OR)

2. Describe the following reactions with suitable examples and their mechanisms:
a) Barton reaction b) Wittig reaction.

3. Write the synthetic applications of the following reagents with suitable mechanism:
a) Di-isobutyl aluminium hydride (DIBAL-H) b) Lithium aluminium hydride ($LiAlH_4$)

(OR)

4. Illustrate the synthetic applications of the following reagents with suitable mechanism:
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5. Discuss the Twelve principles of Green Chemistry with their explanations and examples

(OR)

6. Differentiate the following a) Goals of Green Chemistry b) Green Synthesis with suitable examples.

7. Explain the following terms
a) Retro Synthetic Analysis b) Disconnection c) Target Molecule d) Functional Group Interconversion (FGI) and Functional Group Addition (FGA)

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8. Demonstrate the Linear and Convergent synthesis

9. Write note on Principle involved in thin layer Chromatography, Column Chromatography with suitable examples.

(OR)

10. Discuss the instrumentation and applications of HPLC, GCMS.

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DEPARTMENT OF CHEMISTRY
SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION
Paper-II:

Research Methodology & Organic Synthesis

Name of the Research Guide : Dr .B.Jagan Mohan Reddy

Name of the Candidate : K. V. B. Ranjitha

Title of the Research: Design, Synthesis of New pathways of Aromatic compounds and Heterocycles and their biological Evaluation.

Unit-I Definition of Research:

Research process, problem identification, research designs, nature and importance of research, aims and objectives of research, selection of area of research, design of experimental program, applications of research and types.

Unit-II Searching the Chemical literature:

Primary sources – journals – periodicals – patents – abstracts; secondary sources including list of titles – reviews – annual reviews– serials – monographs and text books – encyclopedia – catalogues – index of tabulated data – science citation index – searching the chemical literature – location of journal article – materials on a given topic – information about specific compound – choosing a problem – Abstract of a research paper. Literature searching online Popular websites in Chemistry usage of E-library, collection of literature from web, collection of literature from Scopus, Science direct, Scifinder etc.,

Unit-III Thesis and report writing:

General format, title page, abstract, Tables and figures, experimental details, spacing and alignment, abbreviations and special symbols acknowledgements, results and discussions, references, journal publications, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report, text processing and printing.

Unit-IV Aromaticity

Huckle`s rule and aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene,1,3,5,7- Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, anti-aromaticity and homo-aromaticity.

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Unit-V Five and six membered heterocyclics with one and two hetero atoms

Synthesis, reactivity and biological significance of the following heterocycles: Pyrazole, Imidazole, Isoxazole, Pyridazine, Pyrimidine.

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ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARM
SCHOOL OF CHEMICAL SCIENCES
DEPARTMENT OF CHEMISTRY
Pre-PhD Examination Model Question Paper

PAPER-II: Research Methodology & Organic Synthesis

Model question paper

Time: 3 hrs **Max.Marks:100**

Answer any Five of the following
All questions carry equal marks

1. Demonstrate the types and applications of research.

(OR)

2. Differentiate the following: i) Nature and importance of Research ii) Aims and Objectives of Research

3. Discuss about research review and literature search.

(OR)

4. Analyse the collection of literature.

5. Describe the general formatting of Thesis.

(OR)

6. Explain the various factors to be taken into account while writing a thesis.

7. Huckle`s rule and aromaticity in benzenoid and non-benzenoid compounds.

(OR)

8. Write about anti-aromaticity, homo-aromaticity and annulenes.

9. Illustrate the synthesis and reactivity of Pyrimidine.

(OR)

10. Write a note on preparation of imidazole with neat reaction mechanism.

Research Supervisor

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ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM

SCHOOL OF CHEMICAL SCIENCES

DEPARTMENT OF CHEMISTRY

SYLLABUS FOR Pre-PhD WRITTEN EXAMINATION

Paper-III

Name of the Research Guide : Dr. B. Jagan Mohan Reddy

Name of the Candidate : K. V. B. Ranjitha

Title of the Research : Design, Synthesis of New pathways of Aromatic compounds and Heterocycles and their biological Evaluation.

• ORALPRESENTATION (Seminar)

Research Supervisor

Prof. Dr.B.JAGAN MOHAN REDDY
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Adikavi Nannaya University :: Rajahmundry
Department of Chemistry
Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. SVVS Durga Prasad**

Title of the proposed research: ***"Green synthesis of Carbon nano dots and their applications as catalysts"***

Paper-I Recent advances in chemical sciences

Unit – 1

Treatment of analytical data: Errors, types of errors, methods to minimize errors - accuracy and precision - gaussian distribution of random errors - calculation of mean, median, standard deviation, relative standard deviation, variance, coefficient of variance, standard error of the mean - criteria for rejection of an observation, *Q-test* and *4d rule*.

Unit – 2

Catalysis: Homogeneous and heterogeneous catalysis – advantages and disadvantages – Catalysis by Organometallic compounds – Alkene hydrogenation, Wilkinson's catalyst, Tolman catalytic loops – Hydroformylation – Photocatalysis – Properties of semiconductors- Kinetics of Photocatalysis - TiO_2 and its doped compounds as a versatile photocatalysts.

Unit – 3

Spectroscopic techniques for qualitative and quantitative analysis-I:

a) IR and Raman spectroscopy – Instrumentation, detectors- sampling techniques - characteristic frequencies of organic molecules - qualitative and quantitative analysis - Principle of FTIR spectroscopy – Theory of Raman effect – comparison of Raman and IR spectra - instrumentation, applications.

b) UV-visible spectroscopy - laws of absorption - deviation from Beer's law - single and double beam spectrophotometers-instrumentation, sources of radiation, detectors - qualitative analysis by absorption measurements

Unit – 4

Spectroscopic techniques for qualitative and quantitative analysis-III:

a) X-ray spectroscopy- Production of X-rays and X-ray spectra, instrumentation, Detectors, X-ray diffraction, Bragg's law, Powder techniques, Chemical analysis by X-ray diffraction techniques.

b) Scanning electron microscopy (SEM), Transmission electron microscopy (TEM)- Instrumentation, Signal detectors, and applications.

Unit – 5

Chromatography: classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

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Principles of various chromatographic techniques viz, GC, LC, HPLC etc. different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Reference/Textbooks

1. *"Instrumental methods of Analysis"*, 7th edition, Willard, Merritt, Dean, Settle, CBS Publishers and Distributors, New Delhi.
2. *"Vogel's Textbook of quantitative Chemical Analysis"*, 5th edition, G.H. Jeffery, J. Bassett, J. Mendham, R C Denney, Longman Scientific & Technical publishers, New York.
3. *"Inorganic Chemistry: Principle of Structure and Reactivity"*, 5th edition, Huheey, Keiter, Keiter, Medhi, Pearson Publishers, New Delhi.
4. *"Basics of X-ray diffraction and its applications"*, K Ramakanth Hebbar, I.K. International Publishing House, New Delhi.
5. *"Analytical Transmission Electron Microscopy"*, A.D. Romig, Sandia National Laboratories.
6. *"Scanning Electron Microscopy"*, John D. Verhoeven, Department of Metallurgy, Iowa State University.
7. *"Heterogeneous photocatalysis"*, Vittorio Loddo, Maraiana Bellardita, University of Palermo, Palermo, Italy, Research Gate Publishers.
8. *"Techniques and practice of Chromatography"*, R.P.W Scott, Marel Dekker Inc., New York
9. *"Separation methods"*, M.N Sastri, Himalaya Publishing Company, Mumbai

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Adikavi Nannaya University :: Rajahmundry
Department of Chemistry
Pre-Ph.D. Examinations
Model question paper
Paper – I: Recent advances in chemical sciences
Name the guide : Dr. K. Deepthi
Name of the scholar : Mr. SVVS Durga Prasad

Time: 3 hrs *Maximum marks: 100*

Answer ALL questions

UNIT – 1

1. A) i) What are determinate and indeterminate errors? Explain the methods to minimize determinate errors. (15M)
ii) Discuss the distribution of random errors by Gaussian distribution. (5M)

OR

B. i) Explain Accuracy and Precision with an example. (10 M)
ii) Write the criteria for rejection of an observation. (10 M)

UNIT – 2

2. A. i). What are homogeneous and heterogeneous catalysis? Give their advantages and disadvantages. (10 M)
ii) Explain the role of Wilkinson's catalyst in the hydrogenation of alkene. (10 M)

OR

B. i) What is photocatalysis? Which type of materials are suitable as photocatalysts? (10 M)
ii) Explain how TiO_2 and its related materials are versatile photocatalysts. (10 M)

UNIT – 3

4. A. i) Explain the instrumentation of IR spectroscopy. (10 M)
ii) What is Raman effect? Give the applications of Raman spectroscopy. (10 M)

OR

B. i) How Beer's law forms the basis for spectrophotometry? (5M)
ii) Discuss the instrumentation of double beam spectrophotometer with a focus on detectors. (15 M)

UNIT – 4

5. A. i). Give the construction of X-ray tube for the generation of X-rays. (5 M)
ii) Explain the instrumentation of X-ray spectroscopy and role of the components in it. (15 M)

OR

B. i) Explain the principle and instrumentation of Scanning Electron Microscopy with diagram. (15 M)
ii) What are the applications of Transmission Electron Microscopy. (5 M)

UNIT – 5

3. A. i) Explain the principle and instrumentation of column and Gas chromatographic techniques and their applications. (20 M)

OR

B. Explain in detail the instrumentation of High Performance liquid Chromatography and its applications. (20 M)

***

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Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. SVVS Durga Prasad**

Title of the proposed research: ***"Green synthesis of Carbon nano dots and their applications as catalysts "***

Paper-II Research methodology and applied Nanotechnology

Unit – 1

Philosophy and Ethics of Research and Scientific Conduct

Introduction to Philosophy: definition, nature and scope, concept, nature, and importance of research, aims and objectives of research, selection of area of research, design of experimental program, applications of research and types.

Ethics: Definition, moral philosophy, nature of moral judgments and reactions.

Scientific conduct: Falsification, Fabrication and Plagiarism (FFP), duplicate and overlapping publications, Violation of publication ethics, authorship and contributor ship and Predatory publishers and journals.

Unit – 2

Thesis and report writing

General format, title page, dedication, abstract, table of contents, Introduction, background information, acknowledgements, preface, theory, results, discussions, materials and methods, list of tables and list of figures, experimental details, pagination, spacing and alignment, number schemes, spacing, margins, appendixes, bibliography, abbreviations, special symbols, conclusions, recommendations, and references. Literature cited, publications by the candidate and setting, text processing and printing.

Unit – 3

Introduction to nanomaterials

History, classification of nanomaterials- zero-, one-, two- and three-dimensional nanomaterials, Metal, metal oxide and polymer nanostructures.

Carbon based nanostructures: Carbon nanodots and nanotubes, Graphene, Fullerenes, Carbon clusters, Nanoporous carbon and Carbon aerogels.

Size dependent properties: mechanical, physical and chemical properties.

Unit – 4

Methods of synthesis of nanomaterials

Bottom-Up and Top-Down approaches with examples, Chemical precipitation methods, sol-gel method, chemical reduction, Sonochemical synthesis, Hydrothermal, Solvothermal and combustion processes.

Physical methods: Ball milling, Physical Vapour deposition (PVD), Chemical Vapour deposition (CVD), Sputter deposition, electric arc deposition.

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Green synthesis approach: Using microorganisms, plant extracts, amino acids, peptide and DNA templates, Synthesis in ionic liquids.

Unit – 5

Characterization techniques of nanomaterials and applications

X-ray diffraction: Principle of X-ray diffraction, powder diffraction, single crystal XRD, thin film analyses, determination of lattice parameters, phase identification, particle size determination using Scherer's formula.

Imaging Techniques: Scanning electron microscopy (SEM), Energy dispersive X-ray analysis (EDAX), Transmission electron microscopy (TEM).

Applications

Nanocatalysts, degradation and removal of waterborne pollutants, light emitting diodes, solar cells, nanofertilizers and nanofinishing smart textiles.

Nanomedicine: Diagnosis and therapeutic applications, targeted drug delivery systems (with reference to targeted gold nanoparticles for imaging therapy).

Reference books/Textbooks

1. *"Thesis and Assignment writing"*, Anderson. J., Durston. B.H., and People. M, Wiley Easter. 1977.
2. *"Preparing thesis and other manuscripts"*, Billet. R.O., Wiley Easter 1966.
3. *"The use of Chemical literature"*, Bottle. R.T. Butterworths, 1960.
4. *"Nano Materials"* B. Viswanadhan, Narosa Publishing House, New Delhi.
5. *"Nanostructures and Nanomaterials: Synthesis, Properties & Applications"*, Guozhong Cao, Imperial College Press, London.

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Department of Chemistry
Pre-Ph.D. Examinations
Model question paper
Paper – II: Research methodology and Applied Nanotechnology
Name the guide: Dr. K. Deepthi
Name of the scholar: Mr. SVVS Durga Prasad

Time: 3 hrs *Maximum marks: 100*

Answer ALL questions

UNIT – 1

1. A) Define philosophy. How to set aims and ambitions for a good research work? Also explain the steps involved in it. (20 M)

OR

B. i) What is scientific conduct? How to achieve a good scientific conduct? (10 M)
ii) How to be aware of predatory publishers and journals? (10 M)

UNIT – 2

2. A. Write note on the following: (20 M)
i) General format for thesis writing
ii) Tables, figures and bibliography
iii) Abbreviations and symbols

OR

B. i) Explain various factors to be considered while writing a thesis or publishing a paper. (20 M)

UNIT – 3

3. A. i) Discuss classification of nanomaterials with example. (10 M)
ii) Write a note on Carbon based nanomaterials. (10 M)

OR

B. Explain how mechanical, chemical and physical properties of nanomaterials are affected by size of particles. (20 M)

UNIT – 4

4. A. Write a note on i) hydrothermal synthesis ii) Chemical vapour deposition for the synthesis of nanomaterials. (20 M)

OR

B. i) What is the difference between top-down and bottom-up approaches for the synthesis of nanomaterials. (10 M)
ii) Write an essay on green synthesis of nanomaterials. (10 M)

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UNIT – 5

5. A. i) How X-ray diffraction technique is useful in phase identification of materials? (10 M)
ii) What are the applications of XRD technique? (10 M)

OR

B. i) Explain the principle and applications of Scanning electron microscopy in analyzing nanomaterials. (20 M)

***

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Department of Chemistry

Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. SVVS Durga Prasad**

Title of the proposed research: ***"Green synthesis of Carbon nano dots and their applications as catalysts "***

Paper-III Seminar on proposed research work

"Green synthesis of Carbon nano dots and their applications as catalysts "

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Department of Chemistry

Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. Ch. Venkata Rao**

Title of the proposed research: **"Synthesis of metal oxides nanoparticles and their applications"**

Paper-I Recent advances in chemical sciences

Unit – 1

Treatment of analytical data: Errors, types of errors, methods to minimize errors - accuracy and precision - gaussian distribution of random errors - calculation of mean, median, standard deviation, relative standard deviation, variance, coefficient of variance, standard error of the mean - criteria for rejection of an observation, *Q-test* and *4d rule*.

Unit – 2

Catalysis: Homogeneous and heterogeneous catalysis – advantages and disadvantages – Catalysis by Organometallic compounds – Alkene hydrogenation, Wilkinson's catalyst, Tolman catalytic loops – Hydroformylation – Photocatalysis – Properties of semiconductors- Kinetics of Photocatalysis - TiO_2 and its doped compounds as a versatile photocatalysts.

Unit – 3

Spectroscopic techniques for qualitative and quantitative analysis-I:

a) IR and Raman spectroscopy – Instrumentation, detectors- sampling techniques - characteristic frequencies of organic molecules - qualitative and quantitative analysis - Principle of FTIR spectroscopy – Theory of Raman effect – comparison of Raman and IR spectra - instrumentation, applications.

b) UV-visible spectroscopy - laws of absorption - deviation from Beer's law - single and double beam spectrophotometers-instrumentation, sources of radiation, detectors - qualitative analysis by absorption measurements

Unit – 4

Spectroscopic techniques for qualitative and quantitative analysis-III:

a) X-ray spectroscopy- Production of X-rays and X-ray spectra, instrumentation, Detectors, X-ray diffraction, Bragg's law, Powder techniques, Chemical analysis by X-ray diffraction techniques.

b) Scanning electron microscopy (SEM), Transmission electron microscopy (TEM)- Instrumentation, Signal detectors, and applications.

Unit – 5

Chromatography: classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

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Principles of various chromatographic techniques viz, GC, LC, HPLC etc. different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Reference/Textbooks

1. *"Instrumental methods of Analysis"*, 7th edition, Willard, Merritt, Dean, Settle, CBS Publishers and Distributors, New Delhi.
2. *"Vogel's Textbook of quantitative Chemical Analysis"*, 5th edition, G.H. Jeffery, J. Bassett, J. Mendham, R C Denney, Longman Scientific & Technical publishers, New York.
3. *"Inorganic Chemistry: Principle of Structure and Reactivity"*, 5th edition, Huheey, Keiter, Keiter, Medhi, Pearson Publishers, New Delhi.
4. *"Basics of X-ray diffraction and its applications"*, K Ramakanth Hebbar, I.K. International Publishing House, New Delhi.
5. *"Analytical Transmission Electron Microscopy"*, A.D. Romig, Sandia National Laboratories.
6. *"Scanning Electron Microscopy"*, John D. Verhoeven, Department of Metallurgy, Iowa State University.
7. *"Heterogeneous photocatalysis"*, Vittorio Loddo, Maraiana Bellardita, University of Palermo, Palermo, Italy, Research Gate Publishers.
8. *"Techniques and practice of Chromatography"*, R.P.W Scott, Marel Dekker Inc., New York
9. *"Separation methods"*, M.N Sastri, Himalaya Publishing Company, Mumbai

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Adikavi Nannaya University :: Rajahmundry
Department of Chemistry
Pre-Ph.D. Examinations
Model question paper
Paper – I: Recent advances in chemical sciences

Name the guide : Dr. K. Deepthi
Name of the scholar : Mr. Ch. Venkata Rao

Time: 3 hrs *Maximum marks: 100*

Answer ALL questions

UNIT – 1

1. A) i) What are determinate and indeterminate errors? Explain the methods to minimize determinate errors. (15M)
ii) Discuss the distribution of random errors by Gaussian distribution. (5M)

OR

B. i) Explain Accuracy and Precision with an example. (10 M)
ii) Write the criteria for rejection of an observation. (10 M)

UNIT – 2

2. A. i). What are homogeneous and heterogeneous catalysis? Give their advantages and disadvantages. (10 M)
ii) Explain the role of Wilkinson's catalyst in the hydrogenation of alkene. (10 M)

OR

B. i) What is photocatalysis? Which type of materials are suitable as photocatalysts? (10 M)
ii) Explain how TiO_2 and its related materials are versatile photocatalysts. (10 M)

UNIT – 3

4. A. i) Explain the instrumentation of IR spectroscopy. (10 M)
ii) What is Raman effect? Give the applications of Raman spectroscopy. (10 M)

OR

B. i) How Beer's law forms the basis for spectrophotometry? (5M)
ii) Discuss the instrumentation of double beam spectrophotometer with a focus on detectors. (15 M)

UNIT – 4

5. A. i). Give the construction of X-ray tube for the generation of X-rays. (5 M)
ii) Explain the instrumentation of X-ray spectroscopy and role of the components in it. (15 M)

OR

B. i) Explain the principle and instrumentation of Scanning Electron Microscopy with diagram. (15 M)
ii) What are the applications of Transmission Electron Microscopy. (5 M)

UNIT – 5

3. A. i) Explain the principle and instrumentation of column and Gas chromatographic techniques and their applications. (20 M)

OR

B. Explain in detail the instrumentation of High-Performance liquid Chromatography and its applications. (20 M)

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Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. Ch. Venkata Rao**

Title of the proposed research: **"Synthesis of metal oxides nanoparticles and their applications"**

Paper-II Research methodology and applied Nanotechnology

Unit – 1

Philosophy and Ethics of Research and Scientific Conduct

Introduction to Philosophy: definition, nature and scope, concept, nature, and importance of research, aims and objectives of research, selection of area of research, design of experimental program, applications of research and types.

Ethics: Definition, moral philosophy, nature of moral judgments and reactions.

Scientific conduct: Falsification, Fabrication and Plagiarism (FFP), duplicate and overlapping publications, Violation of publication ethics, authorship and contributor ship and Predatory publishers and journals.

Unit – 2

Thesis and report writing

General format, title page, dedication, abstract, table of contents, Introduction, background information, acknowledgements, preface, theory, results, discussions, materials and methods, list of tables and list of figures, experimental details, pagination, spacing and alignment, number schemes, spacing, margins, appendixes, bibliography, abbreviations, special symbols, conclusions, recommendations, and references. Literature cited, publications by the candidate and setting, text processing and printing.

Unit – 3

Introduction to nanomaterials

History, classification of nanomaterials- zero-, one-, two- and three-dimensional nanomaterials, Metal, metal oxide and polymer nanostructures.

Carbon based nanostructures: Carbon nanotubes (CNTs), Graphene, Fullerenes, Carbon clusters.

Size dependent properties: mechanical, physical and chemical properties.

Unit – 4

Methods of synthesis of nanomaterials

Bottom-Up and Top-Down approaches with examples, Chemical precipitation methods, sol-gel method, chemical reduction, Sonochemical synthesis, Hydrothermal, Solvothermal and combustion processes.

Physical methods: Ball milling, Physical Vapour deposition (PVD), Chemical Vapour deposition (CVD), Sputter deposition, electric arc deposition.

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Green synthesis approach: Using microorganisms, plant extracts, amino acids, peptide and DNA templates, Synthesis in ionic liquids.

Unit – 5

Characterization techniques of nanomaterials and applications

X-ray diffraction: Principle of X-ray diffraction, powder diffraction, single crystal XRD, thin film analyses, determination of lattice parameters, phase identification, particle size determination using Scherer's formula.

Imaging Techniques: Scanning electron microscopy (SEM), Energy dispersive X-ray analysis (EDAX), Transmission electron microscopy (TEM).

Applications

Nanocatalysts, degradation and removal of waterborne pollutants, light emitting diodes, solar cells, nanofertilizers and nanofinishing smart textiles.

Nanomedicine: Diagnosis and therapeutic applications, targeted drug delivery systems (with reference to targeted gold nanoparticles for imaging therapy).

Reference books/Textbooks

1. *"Thesis and Assignment writing"*, Anderson. J., Durston. B.H., and People. M, Wiley Easter. 1977.
2. *"Preparing thesis and other manuscripts"*, Billet. R.O., Wiley Easter 1966.
3. *"The use of Chemical literature"*, Bottle. R.T. Butterworths, 1960.
4. *"Nano Materials"* B. Viswanadhan, Narosa Publishing House, New Delhi.
5. *"Nanostructures and Nanomaterials: Synthesis, Properties & Applications"*, Guozhong Cao, Imperial College Press, London.

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Adikavi Nannaya University :: Rajahmundry
Department of Chemistry
Pre-Ph.D. Examinations
Model question paper
Paper – II: Research methodology and Applied Nanotechnology
Name the guide: Dr. K. Deepthi
Name of the scholar: Mr. Ch. Venkata Rao

Time: 3 hrs *Maximum marks: 100*

Answer ALL questions

UNIT – 1

1. A) Define philosophy. How to set aims and ambitions for a good research work? Also explain the steps involved in it. (20 M)

OR

B. i) What is scientific conduct? How to achieve a good scientific conduct? (10 M)
ii) How to be aware of predatory publishers and journals? (10 M)

UNIT – 2

2. A. Write note on the following: (20 M)
i) General format for thesis writing
ii) Tables, figures and bibliography
iii) Abbreviations and symbols

OR

B. i) Explain various factors to be considered while writing a thesis or publishing a paper. (20 M)

UNIT – 3

3. A. i) Discuss classification of nanomaterials with example. (10 M)
ii) Write a note on Carbon based nanomaterials. (10 M)

OR

B. Explain how mechanical, chemical and physical properties of nanomaterials are affected by size of particles. (20 M)

UNIT – 4

4. A. Write a note on i) hydrothermal synthesis ii) Chemical vapour deposition for the synthesis of nanomaterials. (20 M)

OR

B. i) What is the difference between top-down and bottom-up approaches for the synthesis of nanomaterials. (10 M)
ii) Write an essay on green synthesis of nanomaterials. (10 M)

UNIT – 5

5. A. i) How X-ray diffraction technique is useful in phase identification of materials? (10 M)
ii) What are the applications of XRD technique? (10 M)

OR

B. i) Explain the principle and applications of Scanning electron microscopy in analyzing nanomaterials. (20 M)

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Syllabus for Pre-Ph.D. written examination

Name of the research guide: **Dr. K. Deepthi**

Name of the candidate: **Mr. Ch. Venkata Rao**

Title of the proposed research: **"Synthesis of metal oxides nanoparticles and their applications"**

Paper-III Seminar on proposed research work

"Synthesis of metal oxides nanoparticles and their applications"

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