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**2022-2023**

**Certificate Course in Advanced Nanotechnology**

**Duration of the course: 30 hours**

**Learning Objectives**:

1. **Understand Nanomaterials**: Develop a deep understanding of nanomaterials, including their properties, synthesis methods, and applications.
2. **Characterization Techniques**: Learn advanced techniques for characterizing nanomaterials at the atomic and molecular levels.
3. **Synthesis Skills**: Acquire hands-on skills in the synthesis of various nanomaterials, including nanoparticles, nanocomposites, and nanostructures.
4. **Safety and Ethics**: Understand the safety protocols and ethical considerations associated with working with nanomaterials.
5. **Research and Innovation**: Prepare students for careers in research and innovation in fields related to nanotechnology.

**Course Outcomes**:

Upon completion of the Certificate course in Advanced Nanotechnology, students can expect to achieve the following outcomes:

1. Proficiency in nanomaterials synthesis techniques.
2. Expertise in using advanced characterization tools and instruments.
3. Ability to design and conduct experiments related to nanomaterials.
4. Knowledge of the latest developments and trends in nanotechnology.
5. Awareness of safety protocols and ethical considerations in nanotechnology.
6. Enhanced communication and teamwork skills.
7. Potential for career advancement in research, development, or manufacturing sectors related to nanotechnology.

## SYLLABUS

**MODULE-1** Introduction to Nanomaterials 4 hours

Definition-Classification and Nomenclature of Nanomaterials: Zero-, one, two and three dimensional nanostructures. quantum dots, quantum wells, nanocomposites, Nanomachines and Devices.

**MODULE-2** Nanomaterials Synthesis Techniques 5 hours

Nano synthesis techniques -laser ablation, Sputtering. The study of wet chemical methods like sol-gel method, micro emulsion technique, reduction of metal salts, cryochemical synthesis etc. Green synthesis of nanoparticles.

**MODULE-3** Characterization of nanomaterials 5 hours

Techniques of characterization of size of nano powders/ particles by various spectroscopic techniques like optical spectroscopy. UV visible and Infrared spectroscopy. EDX analysis, X-ray Fluorescence (XRF), X-ray diffraction (XRD) and, Scanning electron Microscopy SEM, principles.

**MODULE-4** Environmental applications of nanomaterials 5 hours

Environmental applications of nanomaterials: Mechanism for remediation of aqueous contaminants, photocatalyst; nanomaterial based adsorbents for water and wastewater treatment

**MODULE-5** Nanomaterial toxicity 5 hours

Assessment of nanomaterial toxicity: In vitro toxicity assessment-cell viability, lactate dehydrogenase release, reactive oxygen species generation, change in mitochondrial membrane potential and nuclear fragmentation. In vivo toxicity assessment: inflammatory response, acute toxicity studies, LD50 determination.

**Practicals** 6 hours

1. Synthesis of silver nanoparticles and UV analysis
2. Synthesis of copper oxide nanoparticles and UV analysis.

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## CERTIFICATE COURSE

## ADVANCED NANOTECHNOLOGY

**Time: 90 mins** **max marks: 40**

## SECTION-A

**Answer any FOUR questions. Each question carries 4 marks. 4X4=16**

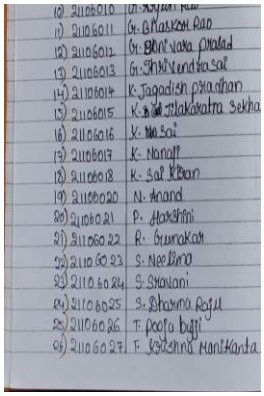
1. Describe sol-gel method.
2. Write about quantum dots.
3. Write about micro emulsion technique.
4. Explain green synthesis of nanomaterials
5. Write about toxicology of nanomaterials.
6. What is the laser ablation method?
7. Write about EDX analysis.

## SECTION-B

**Answer any THREE questions. Each question carries 8 marks. 8X3=24**

8. Explain classification of nanomaterials.
9. Explain SEM and XRD techniques of nanoparticles.
10. Write about applications of nanotechnology in waste water treatment.
11. Explain nanomaterial toxicity.

**Students Attendance**



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|---|---|---|
| 10) | 21106010 | G. [illegible] |
| 11) | 21106011 | G. Bhaskar Rao |
| 12) | 21106012 | G. Boni vara prasad |
| 13) | 21106013 | G. Thrivendra sai |
| 14) | 21106014 | K. Jagadish pradhan |
| 15) | 21106015 | K. Tilakaratna Sekha |
| 16) | 21106016 | K. Sai |
| 17) | 21106017 | K. Nanaji |
| 18) | 21106018 | K. Sai Kiran |
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| 21) | 21106022 | R. Gunakar |
| 22) | 21106023 | S. Neelima |
| 23) | 21106024 | S. Bhavani |
| 24) | 21106025 | S. Bhanna Raju |
| 25) | 21106026 | T. Pooja bijji |
| 26) | 21106027 | T. Krishna Manikanta |

| S.No | I.D.No | Name of the Student | 3/3 | 4/3 | 6/3 | 7/3 | 9/3 | 10/3 | 13/3 | 14/3 | 15/3 | 16/3 | 17/3 | 18/3 | 20/3 | 21/3 | 23/3 | 24/3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 21106028 | T. Manikanta | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 28 | 21106029 | T. Pavan | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 29 | 21106030 | V. Hymavathi | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 30 | 21106031 | P. Pradeep | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |

ATTENDANCE OF ADVANCED NANOTECHNOLOGY

| S.NO | I.D.NO | Names | 25/3/22 | 27/3/22 | 28/3/22 | 29/3/22 | 30/3/22 | 31/3/22 | 1/4/22 | 3/4/22 | 4/4/22 | 5/4/22 | 6/4/22 | 11/4/22 | 4/4/22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21106001 | B. Chaitahanya | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 2 | 21106002 | B. Sasi kumar | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 3 | 21106003 | B. Sai kiran | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 4 | 21106004 | B. Vennela | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 5 | 21106005 | Ch. Lokesh | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 6 | 21106006 | Ch. Lakshmi | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 7 | 21106007 | D. Gyana priya | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 8 | 21106008 | D. Vasu | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 9 | 21106009 | G. Vasanth | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 10 | 21106010 | G. Arjun Rao | P | P | P | P | P | P | P | P | P | P | P | P | P |
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| 12 | 21106012 | G. Boni vara Prasad | P | P | P | P | P | P | P | P | P | P | P | P | P |
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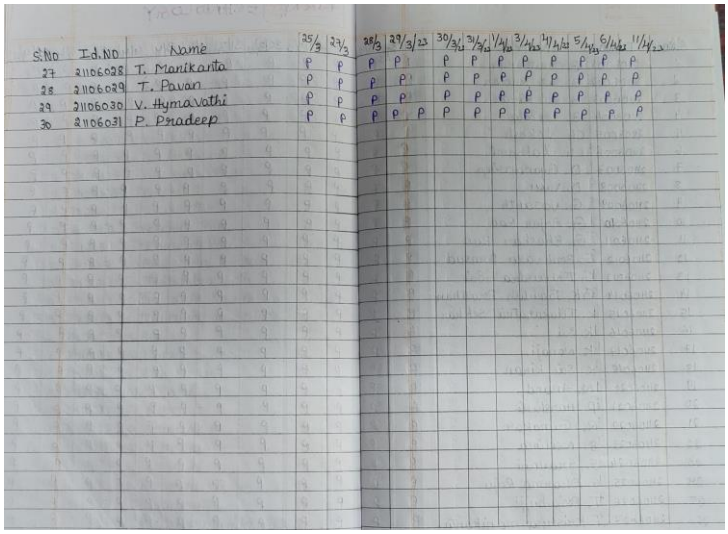
| 16 | 21106016 | K. Sai | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 17 | 21106017 | K. Nanaji | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 18 | 21106018 | K. Sai Kiran | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 19 | 21106020 | N. Anand | P | P | P | P | P | P | P | P | P | P | P | P | P |



| S.No | Id.NO | Name | 25/3 | 27/3 | 28/3 | 29/3/23 | 30/3/23 | 31/3/23 | 1/4/23 | 3/4/23 | 4/4/23 | 5/4/23 | 6/4/23 | 11/4/23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 21106028 | T. Manikanta | P | P | P | P | P | P | P | P | P | P | P | P |
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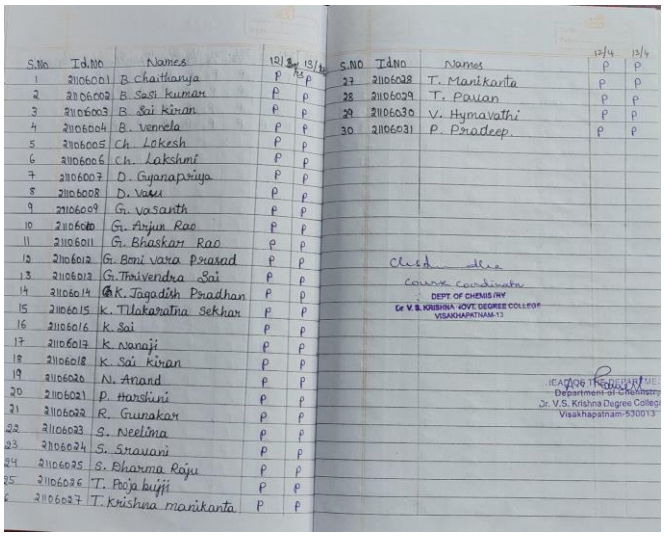
| 29 | 21106030 | V. Hymavathi | P | P | P | P | P | P | P | P | P | P | P | P |
| 30 | 21106031 | P. Pradeep | P | P | P | P | P | P | P | P | P | P | P | P |



| S.No | Id.NO | Names | 12/4 | 13/4 |
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| 1 | 21106001 | B. Chaithanya | P | P |
| 2 | 21106002 | B. Sasi kumar | P | P |
| 3 | 21106003 | B. Sai Kiran | P | P |
| 4 | 21106004 | B. Vennela | P | P |
| 5 | 21106005 | Ch. Lokesh | P | P |
| 6 | 21106006 | Ch. Lakshmi | P | P |
| 7 | 21106007 | D. Gyanapriya | P | P |
| 8 | 21106008 | D. Vasu | P | P |
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| 11 | 21106011 | G. Bhaskar Rao | P | P |
| 12 | 21106012 | G. Bani vara Prasad | P | P |
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| 18 | 21106018 | K. Sai Kiran | P | P |
| 19 | 21106020 | N. Anand | P | P |
| 20 | 21106021 | P. Harshini | P | P |
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| 22 | 21106023 | S. Neelima | P | P |
| 23 | 21106024 | S. Sravani | P | P |
| 24 | 21106025 | S. Bharma Raju | P | P |
| 25 | 21106026 | T. Poja bujji | P | P |
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Course coordinator
DEPT OF CHEMISTRY
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VISAKHAPATNAM-13

HEAD OF THE DEPARTMENT
Department of Chemistry
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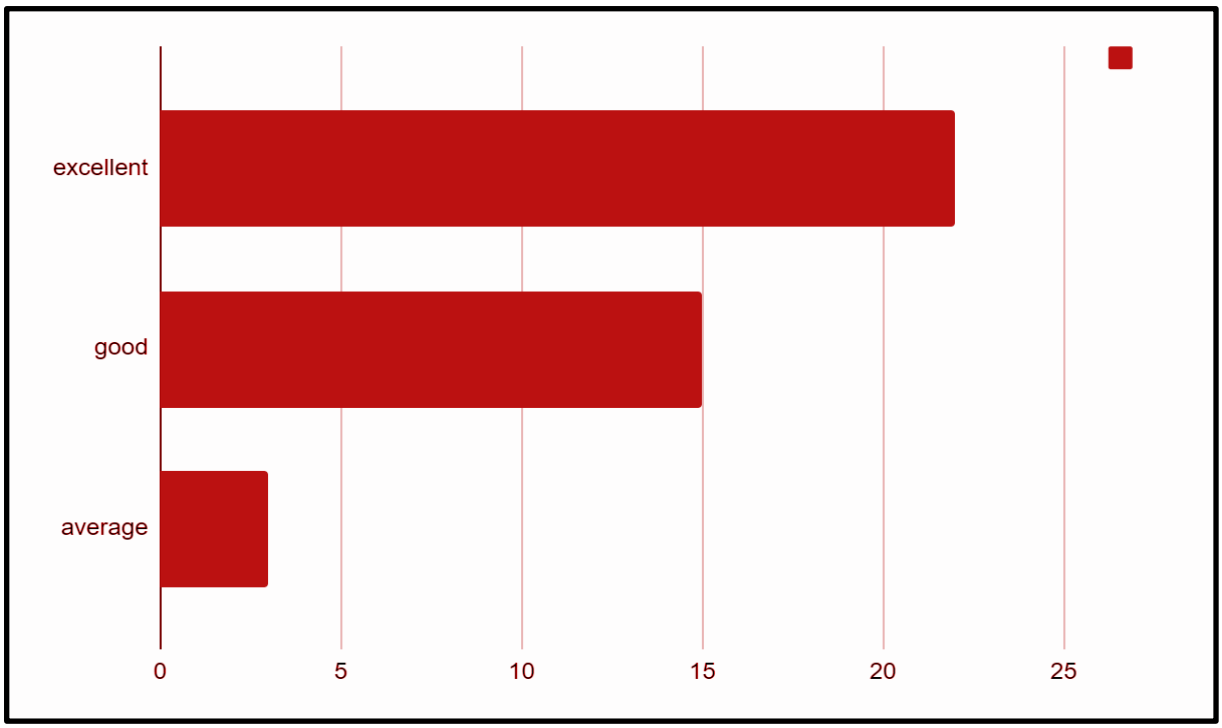
Visakhapatnam-530013

## STUDENT FEEDBACK ANALYSIS OF THE COURSE


excellent
good
average
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25

Dr. V.S. KRISHNA GOVERNMENT DEGREE & P.G. COLLEGE (A)
(An Autonomous institution Affiliated to Andhra University)
Reaccredited by NAAC with "A" Grade (3rd Cycle)
Nodal Resource Center & Research and Development Cell
Maddilapalem, Visakhapatnam - 530013, Andhra Pradesh

# CERTIFICATE OF COMPLETION

This is to certify that Mr./Mrs./Kum _____ _____has successfully completed *Advanced Nanotechnology* course conducted by Department of Chemistry, at Dr V S Krishna Government Degree College(A) Visakhapatnam during the academic year 2022-23.

Dr Ch S Anuradha
Course Coordinator

Dr I Vijaya Babu
Principal

# ATTENDANCE REGISTER

# ADVANCED NANOTECHNOLOGY

| S.No | I.DNO | Name of the Student | 3/3/23 | 4/3/23 | 6/3/23 | 7/3 | 9/3 | 10/3 | 13/3 | 14/3 | 15/3 | 16/3 | 17/3 | 18/3 | 20/3 | 21/3 | 22/3 | 24/3 |
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| 15) | 21106015 | K. Jaya Tilakaratna Sekhar | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 16) | 21106016 | K. Na Sai | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
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| 22) | 21106023 | S. Neelima | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
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| 24) | 21106025 | S. Dharma Raju | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 25) | 21106026 | T. Pooja bujji | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 26) | 21106027 | T. Krishna Manikanta | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |

| S.NO | ID.NO | Name of the student | 3/3 | 4/3 | 6/3 | 7/3 | 9/3 | 10/3 | 13/3 | 14/3 | 15/3 | 16/3 | 17/3 | 18/3 | 20/3 | 21/3 | 22/3 | 24/3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 21106028 | T. Manikanta | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
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| 29 | 21106030 | V. Hymavathi | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 30 | 21106031 | P. Pradeep | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |

# ATTENDANCE OF ADVANCED NANOTECHNOLOGY

| S.NO. | I.DNO | Names | 25/3/23 | 27/3/23 | 28/3/23 | 29/3/23 | 30/3/23 | 31/3/23 | 1/4/23 | 3/4/23 | 4/4/23 | 5/4/23 | 6/4/23 | 12/4/23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 18 | 21106018 | K. Sai Kiran | P | P | P | P | P | P | P | P | P | P | P | P |
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| 21 | 21106022 | R. Gunakar | P | P | P | P | P | P | P | P | P | P | P | P |
| 22 | 21106023 | S. Neelima | P | P | P | P | P | P | P | P | P | P | P | P |
| 23 | 21106024 | S. Sravani | P | P | P | P | P | P | P | P | P | P | P | P |
| 24 | 21106025 | S. Dharma Raju | P | P | P | P | P | P | P | P | P | P | P | P |
| 25 | 21106026 | T. Pooja bujji | P | P | P | P | P | P | P | P | P | P | P | P |
| 26 | 21106027 | T. Krishna Manikanta | P | P | P | P | P | P | P | P | P | P | P | P |

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| 25 | 21106026 | T. Pooja bujji | P | P |
| 26 | 21106027 | T. Krishna manikanta | P | P |
| 27 | 21106028 | T. Manikanta | P | P |
| 28 | 21106029 | T. Pavan | P | P |
| 29 | 21106030 | V. Hymavathi | P | P |
| 30 | 21106031 | P. Pradeep. | P | P |

Course coordinator

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HEAD OF THE DEPARTMENT
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Visakhapatnam-530013

# AWARD LIST OF ADVANCED NANOTECHNOLOGY COURSE

| Regd id NO | Name of the student | (30) Marks (written exam) | 00) Marks (Viva) | Total (40m) |
|---|---|---|---|---|
| 21106001 | B. Chaitanya | 29 | 8 | 37 |
| 21106002 | B. Sasi kumar | 30 | 9 | 39 |
| 21106003 | B. Sai kiran | 30 | 9 | 39 |
| 21106004 | B. Vennela | 30 | 10 | 40 |
| 21106005 | Ch. Lokesh | 29 | 8 | 37 |
| 21106006 | Ch. Lakshmi | 29 | 9 | 38 |
| 21106007 | D. Gyana priya | 30 | 9 | 39 |
| 21106008 | D. Vasu | 30 | 9 | 39 |
| 21106009 | G. Vasanth | 30 | 9 | 39 |
| 21106010 | G. Arjun Rao | 28 | 8 | 36 |
| 21106011 | G. Bhaskar Rao | 28 | 8 | 36 |
| 21106012 | G. Bori vara prasad | 28 | 8 | 35 |
| 21106013 | G. Thrivendra sai | 30 | 9 | 39 |
| 21106014 | K. Jagadish pradhan | 27 | 8 | 35 |
| 21106015 | K. T. R Sekhar | 29 | 9 | 38 |
| 21106016 | K. Sai | 28 | 8 | 36 |
| 21106017 | K. Nanaji | 29 | 8 | 37 |
| 21106018 | K. Sai Kiran | 30 | 8 | 38 |
| 21106020 | N. Anand | 30 | 8 | 38 |
| 21106021 | P. Harshini | 30 | 8 | 38 |
| 21106022 | R. Gunakar | 30 | 9 | 39 |
| 21106023 | S. Neelima | 29 | 9 | 38 |
| 21106024 | S. Sravani | 28 | 8 | 36 |
| 21106025 | S. Dharma Raju | 30 | 9 | 39 |
| 21106026 | T. Pooja Bujji | 27 | 9 | 36 |

| Regd id NO | Name of the Student | Marks (30) written | Marks (10) viva | Total (40M) |
|---|---|---|---|---|
| 21106027 | T. Krishna Manikanta | 28 | 8 | 36 |
| 21106028 | T. Mani Kanta | 28 | 8 | 36 |
| 21106029 | T. Pavan. | 28 | 8 | 36 |
| 21106030 | V. Hymavathi | 30 | 9 | 39 |
| 21106031 | P. Pradeep | 28 | 7 | 35 |

Dr. CH. S. ANURADHA
M.Sc., BEd., PhD.
Lecturer in Chemistry
Dr. V.S. Krishna Govt. Degree & P.G. College (Autonomous)
Visakhapatnam-530 013