# ANNEXURE 1

**Course Folder -**

1. List of all the documents in the Course Folder
2. Syllabus prescribed by the University.
3. Pre-requisites.
4. Course Objectives, Course Outcomes, Program Outcomes, Program Educational Objectives and Program Specific Objectives.
5. Curriculum (Theory and practical) with Augmentation (Use of Questionnaires to collect info from all stakeholders).
6. *Modes of delivery of the concepts / courses.*
7. Personal Time Table.
8. Lesson plan (Theory, Laboratory, Students, Slow learners and Fast learners).
9. List of prescribed text books from syllabus / Augmentation.
10. List of Reference books / Journals / Articles / URLs / Blogs / other sources.
11. Question bank.
12. Assignment bank.
13. Map of course outcome to assessment methodology.
14. Question Papers (along with their Scheme of valuation) – Theory and Practicals
15. Assessment methodologies and their scores (of all the students).
16. Classification of students (based on all the information).
17. Intervention for Slow / Fast learners.

**Signature of Faculty** **Signature of Principal**

**Syllabus prescribed by the University** (To be given as is)

**Lectures : 2 Hrs**

**Examination Time : 3 Hrs Maximum Marks: 50(20+30)**

**Subject: Statistical Mechanics** **Paper Code: PHY – 202**

**Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer type's questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.**

**UNIT – I**

**Microstates and macrostates – classical description in terms of phase space and quantum description in terms of wave functions, idea of ensemble, hypothesis of equal a priori probability for microstates of an isolated system in equilibrium**

**UNIT – II**

**Micro-canonical ensemble, canonical and grand canonical ensemble, partition function of a system in thermal equilibrium with heat bath, law of equipartition of energy, its limit of validity and application**

**UNIT – III**

**Quantum statistics, Gibbs' paradox, identical particle and symmetry requirement, derivation of Fermi – Dirac and Bose – Einstein statistics as the most probable distributions (micro – canonical ensemble), Classical limit of quantum statistics**

**UNIT – IV**

**Bose – Einstein distribution law, derivation, application of Bose – Einstein statistics to derive Planck's law, Rayleigh Jean's and Wien's law as limiting cases of Planck's law, phonons and lattice, specific heat of solids, Einstein and Debye's theory, Bose- Einstein condensation**

**Books Recommended:**


1. **Statistical Physics, F. Mandle**
2. **Fundamentals of Statistical and Thermal Physics, F. Reif**
3. **Statistical Mechanics by R. K. Patharia**
4. **Statistical Mechanics by K. Huang**


**Theory (provide the number of hours of teaching) 36**

**Course Prerequisites: Physics and Mathematics in 12$^{th}$ class**

## Course Objectives,

1. Creating an environment to make teaching more learning centric rather than curriculum centric.
2. To train students in basic science.
3. To develop industry institute interface for collaborative research, internship and fellowship for UG and PG Programme.
4. To focus undergraduate students on the application of established methods to the design and analyze of Scientific solutions for day to day problems in society.

## Course Outcomes, (CO):

CO 1 : Analyze data, understand Concepts of gradient, Divergence and curl ;line, surface and volume integrals

CO 2 : Distinguish inertial, non-inertial and rotational frames of reference. Also able understand and distinguish real, fictitious and Coriolis force and its importance in real life.

.

CO 3 : Distinguish Galilean, Lorentz transformation and their applications .Understand special theory of relativity by studying variation of length, mass and time with relativistic velocity

CO 4 : Understanding Lorentz transformations, Length contraction, Time dilation, Simultaneity in relativity theory.

.CO 5: Find Young's modulus, rigidity modulus and their importance in understanding materials and applications.

CO 6 : Understand concept of surface tension and viscosity of liquids and their experimental Determination, properties of fluids and fluid dynamics

## Program Outcomes,

**Programme Specific Outcome (PSO):**

On completion of the 03/ 04 years Degree in PHYSICS students will be able to:

PSO 1 : Culminate in depth knowledge of almost all basic branches of physics such as mechanics, properties of matter, relativity, electricity and magnetism, wave motion, optics, thermal physics, electronics, classical mechanics, quantum mechanics, spectroscopy, nuclear physics, condensed matter physics and also advanced areas like Nanoscience, energy science, astrophysics, instrumentation.

PSO 2 :Communicate effectively physics concepts with examples related to day to day life. Acquire ability of recognizing and distinguishing various aspects of physics found in real life.

PSO 3 : Learn, perform and design experiments in the laboratory to demonstrate the concepts principles, laws of physics, theories learnt in the class rooms.

PSO 4 : Acquire ability of critical thinking and logical reasoning in physics problems and their solutions

PSO 5 : Appreciate the importance of physics subjects and its application for pursuing interdisciplinary and multidisciplinary higher education and research in these areas.Pursue advanced studies and research in varied areas of physical science

PSO 6 Develop ability to apply the knowledge and skill acquired through experiments of physics in

laboratories to solve real life problems

## Program Educational Objectives

PEO 1. Develop ability to analyze physics problem including simple to thought provoking problems and apply the acquired knowledge to solve real life problems.
PEO 2 Appreciate the importance of physics subjects and its application for pursuing interdisciplinary
and multidisciplinary higher education and research in these areas.

PEO 3 Understand the vast scope of physics as theoretical and experimental science with application
in finding solution of problems in nature spanning from smallest dimension 10-15 m to highest
dimension 1026 m in space, covering energy ranges from 10-10 eV to 1025 eV.

PEO 4 think independently and develop algorithm and program using programming techniques for
solving real world physics problems.

PEO 5 develop ability of working independently and to make in-depth study of various notions of
physics.

## Program Specific Objectives

PSO1. Understanding and Exploration of various disciplines of Physics

PSO2. Focus and Immersion in the discipline and gaining perspective of context.

PSO3. In depth learning of major and minor disciplines, Skill sets for employability.

PSO4. Deeper and Advanced Learning of Major Discipline Foundation to pursue Doctoral Studies & Developing Research competencies

PSO5. Deeper and Advanced Learning of the Major Discipline towards gaining proficiency

## LESSON PLAN THEORY

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Planned | Engaged | (code) | (code) | (code) | Correctly Responded | Not Responded correctly | Total Assessed | Enrolled | |
| 1 | Microstates and | 1 | 1 | 1 | | | a,b,c | I, IV | A,C,D | 5 | 13 | 18 | 23 | |
| | macrostates – | 1 | 2 | 1 | | | a,b,c | I, IV | A,C,D | 6 | 14 | 20 | 23 | |
| | classical description in terms of phase space | 1 | 5 | 1 | | | a,b,c | I, IV | A,C,D | 4 | 16 | 20 | 23 | |
| | and quantum description in terms of wave functions, | 1 | 6 | 1 | | | c, b,d | III,I | A,C,D | 5 | 12 | 17 | 23 | |
| | idea of ensemble, | 1 | 1 | 2 | | | a,b,c | I, IV | A,C,D | 5 | 14 | 19 | 23 | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | 1 | 3 | 3 | | | a,b,c | I, IV | A,C,D | 6 | 13 | 19 | 23 | |
| | Quiz | 1 | 1 | 2 | | | a,c,e | I, II | A,C,D | 5 | 15 | 20 | 23 | |
| | Problem solving | 1 | 2 | 2 | | | b,c | I | A,C,D | 3 | 14 | 17 | 23 | |
| | Problem solving | 1 | 3 | 2 | | | g,n,e | I,II ,IV | A,C,D | 6 | 12 | 18 | 23 | |
| 2 | Micro-canonical ensemble, | 1 | 6 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 6 | 14 | 20 | 23 | |
| | canonical | 1 | 1 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 7 | 9 | 16 | 23 | |
| | and grand canonical ensemble, | 1 | 4 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 7 | 11 | 18 | 23 | |
| | partition function of a system in thermal | 1 | 5 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 3 | 16 | 19 | 23 | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | equilibrium with heat bath | | | | | | | | | | | | | |
| | , law of equipartition of energy, | 1 | 1 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 4 | 15 | 19 | 23 | |
| | its limit of validity and application–, | 1 | 2 | 6 | | | b,d,g | I,III,V | A,C,D | 4 | 14 | 18 | 23 | |
| 3 | Quantum statistics | 1 | 4 | 5 | | | a,b,c | I,V,VI | A,C,G | 8 | 8 | 16 | 23 | |
| | , Gibbs' paradox | 1 | 5 | 5 | | | a,b,c | I,V,VI | A,C,G | 6 | 12 | 18 | 23 | |
| | , identical particle and symmetry requirement, | 1 | 2 | 5 | | | a,b,c | I,V,VI | A,C,G | 7 | 13 | 20 | 23 | |
| | derivation of Fermi – Dirac statistics | 1 | 4 | 5 | | | a,b,c | I,V,VI | A,C,G | 3 | 14 | 17 | 23 | |
| | derivation of Bose – Einstein statistics most | 1 | 5 | 5 | | | a, b,e | I,II,V | A,C,G | 3 | 14 | 17 | 23 | |
| | probable distributions (micro – canonical ensemble), | 1 | 6 | 5 | | | a, b,e | I,II,V | A,C,G | 2 | 14 | 16 | 23 | |
| | Classical limit of quantum statistics | 1 | 1 | 5 | | | a, b,e | I,II,V | A,C,G | 0 | 15 | 15 | 23 | |
| | Quiz | 1 | 2 | 5 | | | b,c | I,II | A,C,G | 5 | 12 | 17 | 23 | |
| 4 | Bose – Einstein distribution law, | 1 | 3 | 3 | | | a, b,e | I,II,V | A,C,G | 4 | 14 | 18 | 23 | |
| | derivation, application of Bose – Einstein statistics | 1 | 6 | 3 | | | a, b,e | I,II,V | A,C,G | 3 | 13 | 16 | 23 | |
| | to derive Planck's law, | 1 | 1 | 4 | | | a, b,e | I,II,V | A,C,G | 3 | 15 | 18 | 23 | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rayleigh Jean's and Wien's law as limiting cases of Planck's law, | 1 | 4 | 4 | | | b,e | I.II | A,C,G | 1 | 14 | 15 | 23 | |
| | phonons and lattice, specific heat of solids, | 1 | 5 | 4 | | | b,e | I,II | A,C,G | 1 | 16 | 17 | 23 | |
| | Einstein theory, | 1 | 2 | 4 | | | b,c | I,V | A,C,G | 4 | 16 | 20 | 23 | |
| | and Debye's theory, | 1 | 6 | 4 | | | b,c | I,V | A,C,G | 5 | 13 | 18 | 23 | |
| | Bose- Einstein condensation | 1 | 2 | 4 | | | b,c | I,V | A,C,G | 4 | 16 | 20 | 23 | |

## Portions for Sessionals examination

| I -Sessional Exam | II- Sessional Exam | III- Sessional Exam | Re-Sessional Exam |
|---|---|---|---|
| Unit – 1<br>Unit – 2 | NA | NA | NA |

## PRACTICAL

| | Title & Contents of the chapter | After completion of the practical the student shall be able to | Skills and Competency Developed | Course Outcome |
|---|---|---|---|---|
| 1. | **To determine the height of terrestrial object using sextant.** | Estimate the heights of distant objects scientifically | Analytical skills and error estimation | 1 |
| 2. | **Determination of Stefan's Constant.** | Power radiated by a black body | Scientific temperament | 2 |
| **3.** | **To study the variation of semiconductor resistance with temperature and hence to Determinethe Band Gap of semiconductor in the form of reverse biased P-N junction.** | Energy gap of semiconductors | Applications of semiconductors | 3 |
| **4.** | **Moment of Inertia of a fly-wheel.** | Moment of inertia of circular objects | Conservation of energy, working of turbines | 4 |
| **5.** | **'g' by Bar pendulum.** | Determine Acceleration due to gravity | SHM and its applications Scientific temperament | 5 |
| **6.** | **M.I. of an irregular body using a torsion pendulum.** | Role of stress and strain, SHM | Importance of MI | 5 |

**Portions for sessional examination**

| I- Sessional Exam | II- Sessional Exam | III- Sessional Exam | Re-Sessional Exam |
|---|---|---|---|
| | | | |

# RAFFLES UNIVERSITY, NEEMRANA
## SCHOOL OF BASIC AND APPLIED SCIENCES

**TIME TABLE**

**FACULTY NAME: Dr. N. RAKESH CHANDRA** **ACADEMIC YEAR - 2021 – 2022**

**EVEN SEMESTER**

| DAY↓ /TIME→ | 9:30-10:20 | 10:20-11:10 | 11:10-12:00 | 12:00-12:50 | 12:50-1:50 | 1:50-2:40 | 2:40-3:30 | 3:30-4:20 |
|---|---|---|---|---|---|---|---|---|
| MONDAY | PHY - 102 | PHY – 202 | | PHY – 302 | LUNCH | ENGG. PHYSICS | PHY – 108 | PHY – 108 |
| TUESDAY | PHY – 304 | PHY – 204 | PHY – 102 | | | ENGG. PHY LAB | ENGG. PHY LAB | |
| WEDNESDAY | PHY – 106 | PHY – 206A | PHY – 306B | | | ENGG. PHY LAB | ENGG.PHY LAB | |
| THURSDAY | PHY – 302 | PHY – 202 | PHY – 106 | | | ENGG. PHYSICS | PHY – 208 | PHY – 208 |
| FRIDAY | PHY – 104 | PHY – 204 | PHY – 306B | | | ENGG.PHY LAB | ENGG. PHY LAB | |
| SATURDAY | PHY – 304 | PHY – 206A | PHY – 104 | | | ENGG. PHYSICS | PHY – 308 | PHY – 308 |

**Convener** **Co-convener** **HOD** **Dean**

**Assessment of course outcomes:**

| Assessment method | Course outcomes in Percentage | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
| Unit Test | 30 | 10 | 30 | | | 30 |
| Sessional Examination | | | | | | |
| Pre-final Exam | NA | NA | NA | NA | NA | NA |
| Assignment | 18 | 18 | 18 | 18 | 14 | 14 |
| Others Specify | | | | | | |

**Course Outcomes-Program Outcomes mapping**

| COs | Program Outcomes | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| CO1 | x | x | | | x | x | 4 |
| CO2 | x | | x | x | x | | 4 |
| CO3 | | x | | x | x | x | 4 |
| CO4 | x | x | x | | | x | 4 |
| CO5 | x | | x | x | x | | 4 |
| CO6 | | x | x | x | | x | 4 |
| Total | 4 | 4 | 4 | 4 | 4 | 4 | |

| Teaching Methodology | Code | % of Delivery |
|---|---|---|
| Lecturing | a | 20% |
| Discussion | b | 6% |
| Group discussion | c | 5% |
| Demonstration | d | 10% |
| Power point presentation | e | 15% |
| Tutorial class | f | 5% |
| Assignment | g | 10% |
| Seminar | h | 5% |
| Remedial class | i | 10% |
| Project work | j | |
| Industrial visit | k | |
| Role play | l | 8% |
| Quiz | m | 4% |
| Mind mapping | n | 2% |
| Others specify | o | |

**Modes of delivery of courses**

| Teaching Aids used | Code |
|---|---|
| Chalkboard | I |
| Power point | II |
| Videos | III |
| Posters | IV |
| Charts | V |
| Models | VI |
| Flash cards | VII |
| Others specify | VIII |

| Assessment Method | Code | % of Scheme of evaluation |
|---|---|---|
| Viva | A | 10% |
| Synopsis | B | |
| Continuous assessment | C | 5% |
| Unit test | D | 20% |
| End Semester exam | E | 60% |
| Prefinal exam | F | |
| Assignments | G | 5% |
| Others specify | H | |

**List of prescribed text books from UniversitySyllabus**

| Sl No | Title of the book | Author/s | Edition, Year of Publication | Publisher | No.of copies available in the library |
|---|---|---|---|---|---|
| 1 | Berkely Physics Course. Vol. 1.<br>Mechanics | E.M.Purcell | | | Nill |
| 2 | Concepts of Modern Physics | Arthur Beiser | | | Nill |
| 3 | Properties of Matter | D.S. Mathur. | | | Nill |
| 4 | Engineering Physics | V. Rajendran | | | Nill |
| 5 | Mechanics (VI-Edition) | J. C. Upadhyay – Ramprasad & Sons | 2005. | Agra | |
| 6 | Mechanics (XX-Edition) . | D. S. Mathur | 2007 | S. Chand & Company Ltd., New-Delhi | |
| 7. | Mechanics & Electrodynamics (XVII-<br>Edition, Course- 1 & 2) | Brijlal, Subramanyam & Jivan Seshan, | 2008. | S. Chand & Company Ltd., New-Delhi | |
| 8 | Properties of Matter (XIII-Edition) – | Brijlal & Subramanyam, | 2001. | Eurasia Publishing House Pvt. Ltd., New-Delhi | |
| 9 | Elements of Properties of Matter (<br>XXVIII-<br>6. | D. S. Mathur | Edition -<br>2005. | S. Chand & Company Ltd., NewDelhi, | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| 10 | Physics, Vol. No. I (V-Edition) | Resnick, Halliday & Krane | 2005. | John Wiley & Sons Inc., New-York, | |
| 11 | Berkeley Physics, Vol. No. I – | | | ABC Publications, Bangalore & New-Delhi. | |
| 12 | University Physics (XI-Edition) | Young & Freedman | 2004. | Pearson Education, | |
| 13 | Introduction to Relativity-. | R. Resnik | | | |
| 14 | . Relativistic Mechanics- | Gupta and Kumar. | | | |

**List of Reference text books from University Syllabus**

| **Sl No** | **Title of the book** | **Author/s** | **Edition, Year of Publication** | **Publisher** | **No. of copies available in the library** |
|---|---|---|---|---|---|
| 1 | Engineering Physics by | MN Avadhanulu, PG Ksheersagar | | | Nil |
| 2 | Fundamental laws of Mechanics | Igor Irodov | | | Nil |
| 3 | Vectors, Tensors, and the Basic Equations of Fluid Mechanics | Rutherford Aris. | | | Nil |
| 4 | An Introduction to Mechanics Book | Daniel Kleppner and Robert J. Kolenkow. | | | Nil |

**List of URLs / Blogs / Other e-Sources**

**1**. https://www.youtube.com/watch?v=PMpoamNGceM
2.https://www.youtube.com/watch?v=PMpoamNGceM&list=RDLVPMpoamNGceM&start_radio=1&rv=PMpoamNGceM&t=52
3. https://www.youtube.com/watch?v=zl3Uj18eHek&list=RDLVPMpoamNGceM&index=11
4. https://www.youtube.com/watch?v=bow4rworT-k
5. https://www.youtube.com/watch?v=etjZmdmrjSU
6. https://onlinecourses.nptel.ac.in/noc19_mm16/preview

**Module / Chapter No 1**

| Sl No | Question | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | State and explain Gradient, Divergence and Curl. | 5 | 1 |
| 2 | Define Frame of Reference. Differentiate between inertial and non inertial frames of reference. | 5 | 1 |
| 3 | Discuss two Centrifugal force and Coriolis force. | 5 | 2 |
| 4 | Differentiate between conservative and non conservative forces. | 5 | 2 |
| 5 | Discuss Kepler's laws of motion. | 5 | 3 |

**Module / Chapter No 2**

| Sl No | Question | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | Discuss briefly the properties of Ideal fluids | 5 | 6 |

| | | | |
|---|---|---|---|
| 2 | Derive an expression for Euler's equation of Motion. | 5 | 6 |
| 3 | State Bernoulli's theorem and derive an expression for it. | 5 | 6 |
| 4 | Define Viscosity and determine Viscosity by rotating cylinder method. | 5 | 6 |
| 5 | Write a short note on Poiseuille's equation. | 5 | 6 |

**Module / Chapter No 3**

| Sl No | Question | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | 1. Define Stress and Strain and elasticity. | 5 | 5 |
| 2 | State and explain Hooke's law. | 5 | 5 |
| 3 | . Derive relationship between Young's modulus and Bulk modulus. | 5 | 5 |
| 4 | Derive relationship between Young's modulus and Bulk modulus and rigidity modulus. | 5 | 5 |
| 5 | Derive an expression for Internal energy of a strained body. | 5 | 5 |

**Module / Chapter No 4**

| Sl No | Question | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | Write the inferences of Michelson Morley experiment. | 5 | 3 |
| 2 | Write the Postulates of special relativity. | 5 | 4 |
| 3 | Derive Mass-Energy relation. | 5 | 4 |
| 4 | Write a short note on Lorentz transformations. | 5 | 4 |
| 5 | Write a short note on Length contraction, Time dilation | 5 | 4 |

**Module / Chapter No 1**

| Sl No | Assignment | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | explain Gradient, Divergence and Curl. Discuss its importance | 5 | 1 |
| 2 | Relate inertial and non inertial frames of references in day to day life | 5 | 1 |
| 3 | Discuss Centrifugal force and Coriolis force. | 5 | 2 |
| 4 | List and explain conservative and non conservative forces. | 5 | 2 |
| 5 | Discuss Kepler's laws of motion. | 5 | 3 |

**Module / Chapter No 2**

| Sl No | Assignment | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | Discuss characteristics of Ideal fluids | 5 | 6 |

| | | | |
|---|---|---|---|
| 2 | Explain the need of a vertical pipe established in parallel to the water tank | 5 | 6 |
| 3 | State Bernoulli's theorem and derive an expression for it. | 5 | 6 |
| 4 | Define Viscosity give its significance | 5 | 6 |
| 5 | Write a short note on Poiseuille's equation. Where do you apply Bernoulli's theorem | 5 | 6 |

**Module / Chapter No 3**

| Sl No | Assignment | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | Is elasticity needed for materials? Justify | 5 | 5 |
| 2 | State and explain Hooke's law. | 5 | 5 |
| 3 | What is the role of steel in buildings constructions? | 5 | 5 |
| 4 | Derive relationship between Young's modulus and Bulk modulus and rigidity modulus. | 5 | 5 |
| 5 | Explain the need of shock absorbers for vehicles | 5 | 5 |

**Module / Chapter No 4**

| Sl No | Assignment | Max Marks | Related course outcome |
|---|---|---|---|
| 1 | Write the Significance of Michelson Morley experiment. | 5 | 3 |
| 2 | Write the Postulates of special relativity. Why are they needed? Justify | 5 | 4 |
| 3 | Derive Mass-Energy relation. | 5 | 4 |

| | | | |
|---|---|---|---|
| 4 | Explain the need of Lorentz transformations. | 5 | 4 |
| 5 | Write a short note on Length contraction, Time dilation. Justify | 5 | 4 |

**RAFFLES UNIVERSITY, NEEMRANA**
**SCHOOL OF BASIC AND APPLIED SCIENCES**
**MIDTERM EXAMINATIONS (PCM & PCsM)**

**SEMESTER – I YEAR - I SUB: MECHANICS SUB CODE: PHY – 101 DATE:16 – 11 – 2022 TIMINGS: 10:00 – 11:00 HRS**
**MAX MARKS: 10 NOTE: ANSWER ANY FOUR OF THE FOLLOWING 2.5 X 4 = 10 M**

1. Show that the vector 2x2 i – 4xyj + 3xz2k is irrotational at (1, -2,-1).
2. Differentiate between inertial and non-inertial frames of reference.
3. Write a brief note on Coriolis force.
4. What are the properties of ideal fluids?
5. State and Derive Bernoulli's theorem.

| S.No | Classification | Name of the students |
|---|---|---|
| | **Slow learners (less than 50 %)** | |
| | Remedial teaching<br>**Questions for practice**<br>**Special guidance beyond college hour**<br>**Trace out physical and mental problems if any**<br>**Encourage even for small achievement**<br>**Giving memory tip**<br>**Review time to time** | **ARVIND YADAV**<br>**BABRI BHAN SINGH YADAV**<br>**BITTU SAINI**<br>**DEEPAK**<br>**NITIN KUMAR**<br>**PURSHOTAM JANGIR**<br>**RAHUL YADAV**<br>**SHIVAM SINGH YADAV**<br>**YUVRAG SINGH**<br>**ANMOL YADAV**<br>**VIJAY RAJPUT** |

| S.No | Classification | Name of the students |
|---|---|---|
| | **Fast learners (Above 76 %)** | |
| | **Actions taken** | |
| 1<br>2 | Solve Engineering Problems<br>Study beyond the syllabus | **Kanika, Prashanth, Simran, Shubham, Shivani, Vinay, Preethi,** |

| S.No | Classification | Name of the students |
|---|---|---|
| | **Average learners (51-75 %)** | |
| | **Actions taken** | |
| 1<br>2<br>3<br><br>4 | Motivate students<br>Audio-visual aids<br>Create confidence level in their interest areas<br>Mind map | **Neha, Mayank, Manjeet, Pankaj, Paras, Ashish** |

## LESSON PLAN THEORY (SLOW LEARNERS)

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Planned | Engaged | (code) | (code) | (code) | Correctly Responded | Not Responded correctly | Total Assessed | 12 | |
| **1** | Microstates and<br>macrostates –<br>classical description in terms of phase space | 1 | 1<br>2<br>5 | 1<br>1<br>1 | | | a,b,c,d | I,III, IV | A,C,D | 5 | 4 | 9 | 12 | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | and quantum description in terms of wave functions, | | 6 | 1 | | | | | | | | | | |
| | idea of ensemble, | 1 | 1 | 2 | | | a,b,c,e | I, IV,II | A,C,D | 4 | 7 | 11 | 12 | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | | 3 | 3 | | | | | | | | | | |
| | Quiz | | 4 | 2 | | | | | | | | | | |
| | Problem solving | | 5 | 2 | | | | | | | | | | |
| | Problem solving | | 2 | 2 | | | | | | | | | | |
| | Micro-canonical ensemble, | | 5 | 2 | | | | | | | | | | |
| | canonical | 1 | 6 | 2 | | | | | | | | | | |
| | and grand canonical ensemble, | | 1 | 2 | | | | | | | | | | |
| | partition function of a system in thermal equilibrium with heat bath | | 2 | 2 | | | a,b,c,d,g,n, e | I,II ,III, IV | A,C,D | 4 | 6 | 10 | 12 | |
| | , law of equipartition of energy, | | 3 | 2 | | | | | | | | | | |
| 2 | its limit of validity and application–, | 1 | 6 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 2 | 8 | 10 | 12 | |
| | Quantum statistics | | 1 | 6 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | , Gibbs' paradox | | 4 | 6 | | | | | | | | | | |
| | , identical particle and symmetry requirement, | 1 | 5 | 6 | | | a,b,c,d,g,e | I,II,III, V, VI | A,C,D | 3 | 8 | 11 | 12 | |
| | derivation of Fermi – Dirac statistics | | 1 | 6 | | | | | | | | | | |
| | derivation of Bose – Einstein statistics most | | 2 | 6 | | | | | | | | | | |
| | probable distributions (micro – canonical ensemble), | | 5 | 6 | | | | | | | | | | |
| | Classical limit of quantum statistics | 1 | 6 | 6 | | | a,b,c | I,III,IV, V | A,C,D | 3 | 7 | 10 | 12 | |
| | Quiz | | 1 | 6 | | | | | | | | | | |
| | Bose – Einstein distribution law, | | 3 | 5 | | | | | | | | | | |
| 3 | derivation, application of Bose – Einstein statistics | 1 | 4 | 5 | | | a,b,c | I,V,VI | A,C,G | 2 | 7 | 9 | 12 | |
| | to derive Planck's law, | | 5 | 5 | | | | | | | | | | |
| | Rayleigh Jean's and Wien's law as limiting cases of Planck's law, | | 2 | 5 | | | | | | | | | | |
| | phonons and lattice, specific heat of solids, | | 4 | 5 | | | | | | | | | 12 | |
| | Einstein theory, | | 5 | 5 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | and Debye's theory, | 1 | 6 | 5 | | | a,b,c,e | I,II,V VI | A,C,G | 3 | 7 | 10 | | |
| | Bose- Einstein condensation | | 1 | 5 | | | | | | | | | | |
| | Microstates and | | 2 | 5 | | | | | | | | | | |
| 4 | macrostates – | 1 | 3 | 3 | | | a, b,e | I,II,V, IV | A,C,G | 3 | 8 | 11 | 12 | |
| | classical description in terms of phase space | | 6 | 3 | | | | | | | | | | |
| | and quantum description in terms of wave functions, | | 1 | 4 | | | | | | | | | | |
| | idea of ensemble, | | 4 | 4 | | | | | | | | | | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | 1 | 5 | 4 | | | b,e,c | I,II,V | A,C,G | 3 | 6 | 9 | 12 | |
| | Quiz | | 2 | 4 | | | | | | | | | | |
| | Problem solving | | 6 | 4 | | | | | | | | | | |

## LESSON PLAN THEORY (AVERAGE LEARNERS)

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Planned | Engaged | (code) | (code) | (code) | Correctly Responded | Not Responded correctly | Total Assessed | 8 | |
| 1 | Microstates and | 1 | 1 | 1 | | | a,b,c,d | I,III, IV | A,C,D | 3 | 4 | 7 | 8 | |
| | macrostates – | | 2 | 1 | | | | | | | | | | |
| | classical description in terms of phase space | | 5 | 1 | | | | | | | | | | |
| | and quantum description in terms of wave functions, | | 6 | 1 | | | | | | | | | | |
| | idea of ensemble, | 1 | 1 | 2 | | | a,b,c,e | I, IV,II | A,C,D | 2 | 4 | 6 | 8 | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | | 3 | 3 | | | | | | | | | | |
| | Quiz | | 4 | 2 | | | | | | | | | | |
| | Problem solving | | 5 | 2 | | | | | | | | | | |
| | Problem solving | | 2 | 2 | | | | | | | | | | |
| | Micro-canonical ensemble, | | 5 | 2 | | | | | | | | | | |
| | canonical | | 6 | 2 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | and grand canonical ensemble, | 1 | 1 | 2 | | | | | | 4 | 3 | 7 | 8 | |
| | partition function of a system in thermal equilibrium with heat bath | | 2 | 2 | | | a,b,c,d,g,n ,e | I,II ,III, IV | A,C,D | | | | | |
| | , law of equipartition of energy, | | 3 | 2 | | | | | | | | | | |
| 2 | its limit of validity and application–, | 1 | 6 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 3 | 3 | 6 | 8 | |
| | Quantum statistics | | 1 | 6 | | | | | | | | | | |
| | , Gibbs' paradox | | 4 | 6 | | | | | | | | | | |
| | , identical particle and symmetry requirement, | 1 | 5 | 6 | | | a,b,c,d,g,e | I,II,III, V, VI | A,C,D | 4 | 3 | 7 | 8 | |
| | derivation of Fermi – Dirac statistics | | 1 | 6 | | | | | | | | | | |
| | derivation of Bose – Einstein statistics most | | 2 | 6 | | | | | | | | | | |
| | probable distributions (micro – canonical ensemble), | | 5 | 6 | | | | | | | | | | |
| | Classical limit of quantum statistics | 1 | 6 | 6 | | | a,b,c | I,III,IV,V | A,C,D | 3 | 4 | 7 | 8 | |
| | Quiz | | 1 | 6 | | | | | | | | | | |
| | Bose – Einstein distribution law, | | 3 | 5 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | derivation, application of Bose – Einstein statistics | 1 | 4 | 5 | | | a,b,c | I,V,VI | A,C,G | 2 | 6 | 8 | 8 | |
| | to derive Planck's law, | | 5 | 5 | | | | | | | | | | |
| | Rayleigh Jean's and Wien's law as limiting cases of Planck's law, | | 2 | 5 | | | | | | | | | | |
| | phonons and lattice, specific heat of solids, | 1 | 4 | 5 | | | a,b,c,e | I,II,VI | A,C,G | 3 | 4 | 7 | 8 | |
| | Einstein theory, | | 5 | 5 | | | | | | | | | | |
| | and Debye's theory, | | 6 | 5 | | | | | | | | | | |
| | Bose- Einstein condensation | | 1 | 5 | | | | | | | | | | |
| | Microstates and | | 2 | 5 | | | | | | | | | | |
| 4 | macrostates – | 1 | 3 | 3 | | | a, b,e | I,II,V, IV | A,C,G | 3 | 3 | 6 | 8 | |
| | classical description in terms of phase space | | 6 | 3 | | | | | | | | | | |
| | and quantum description in terms of wave functions, | | 1 | 4 | | | | | | | | | | |
| | idea of ensemble, | | 4 | 4 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | 1 | 5 | 4 | | | b,e,c | I,II,V | A,C,G | 3 | 4 | 7 | 8 | |
| | Quiz | | 2 | 4 | | | | | | | | | | |
| | Problem solving | | 6 | 4 | | | | | | | | | | |

## LESSON PLAN THEORY (FAST LEARNERS)

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Planned | Engaged | (code) | (code) | (code) | Correctly Responded | Not Responded correctly | Total Assessed | 5 | |
| 1 | Microstates and | 1 | 1 | 1 | | | a,b,c,d | I,III, IV | A,C,D | 3 | 2 | 5 | 5 | |
| | macrostates – | | 2 | 1 | | | | | | | | | | |
| | classical description in terms of phase space | | 5 | 1 | | | | | | | | | | |
| | and quantum description in terms of wave functions, | | 6 | 1 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | idea of ensemble, | 1 | 1 | 2 | | | a,b,c,e | I, IV,II | A,C,D | 2 | 2 | 4 | 5 | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | | 3 | 3 | | | | | | | | | | |
| | Quiz | | 4 | 2 | | | | | | | | | | |
| | Problem solving | | 5 | 2 | | | | | | | | | | |
| | Problem solving | | 2 | 2 | | | | | | | | | | |
| | Micro-canonical ensemble, | | 5 | 2 | | | | | | | | | | |
| | canonical | 1 | 6 | 2 | | | | | | | | | | |
| | and grand canonical ensemble, | | 1 | 2 | | | | | | | | | | |
| | partition function of a system in thermal equilibrium with heat bath | | 2 | 2 | | | a,b,c,d,g,n,e | I,II ,III, IV | A,C,D | 2 | 3 | 5 | 5 | |
| | , law of equipartition of energy, | | 3 | 2 | | | | | | | | | | |
| 2 | its limit of validity and application–, | 1 | 6 | 6 | | | a,b,c,e | I,II,VI | A,C,D | 2 | 3 | 5 | 5 | |
| | Quantum statistics | | 1 | 6 | | | | | | | | | | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | , Gibbs' paradox | | 4 | 6 | | | | | | | | | | |
| | , identical particle and symmetry requirement, | 1 | 5 | 6 | | | a,b,c,d,g,e | I,II,III, V, VI | A,C,D | 3 | 2 | 5 | 5 | |
| | derivation of Fermi – Dirac statistics | | 1 | 6 | | | | | | | | | | |
| | derivation of Bose – Einstein statistics most | | 2 | 6 | | | | | | | | | | |
| | probable distributions (micro – canonical ensemble), | | 5 | 6 | | | | | | | | | | |
| | Classical limit of quantum statistics | 1 | 6 | 6 | | | a,b,c | I,III,IV,V | A,C,D | 2 | 2 | 4 | 5 | |
| | Quiz | | 1 | 6 | | | | | | | | | | |
| | Bose – Einstein distribution law, | | 3 | 5 | | | | | | | | | | |
| 3 | derivation, application of Bose – Einstein statistics | 1 | 4 | 5 | | | a,b,c | I,V,VI | A,C,G | 2 | 3 | 5 | 5 | |
| | to derive Planck's law, | | 5 | 5 | | | | | | | | | | |
| | Rayleigh Jean's and Wien's law as limiting cases of Planck's law, | | 2 | 5 | | | | | | | | | | |
| | phonons and lattice, specific heat of solids, | | 4 | 5 | | | | | | | | 4 | 5 | |

| Unit No. | Title & Contents of the chapter | Number of Hours | PO | CO | Date | | Methodology | Teaching aids used | Method of Assessment | No. of Students assessed | | | Total Students | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Einstein theory, | 1 | 5 | 5 | | | a,b,c,e | I,II,V VI | A,C,G | 3 | 1 | | | |
| | and Debye's theory, | | 6 | 5 | | | | | | | | | | |
| | Bose- Einstein condensation | | 1 | 5 | | | | | | | | | | |
| | Microstates and | | 2 | 5 | | | | | | | | | | |
| 4 | macrostates – | 1 | 3 | 3 | | | a, b,e | I,II,V, IV | A,C,G | 3 | 2 | 5 | 5 | |
| | classical description in terms of phase space | | 6 | 3 | | | | | | | | | | |
| | and quantum description in terms of wave functions, | | 1 | 4 | | | | | | | | | | |
| | idea of ensemble, | | 4 | 4 | | | | | | | | | | |
| | hypothesis of equal a priori probability for microstates of an isolated system in equilibrium | 1 | 5 | 4 | | | b,e,c | I,II,V | A,C,G | 3 | 2 | 5 | 5 | |
| | Quiz | | 2 | 4 | | | | | | | | | | |
| | Problem solving | | 6 | 4 | | | | | | | | | | |

**Feedback on Curriculum**

Formats have been developed for the following stakeholders

1. Present / Current students
2. Students just passing out (Exit Interview)
3. Alumni
4. Parents
5. Industry based supervisors
6. Placement (campus recruiters)
7. Departmental Advisory Board