

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College

Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)



National Education Policy (NEP)

Choice Based Credit System (CBCS)

Programme Framework and Syllabus for

Open Elective: Physics

खुला वैकल्पिक विषय: भौतिकशास्त्र

(For Students of Arts and Science Faculty)

(कला व वाणिज्य शाखेतील विद्यार्थ्यांकरिता)

Implemented from

Academic Year 2024-25

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
**New Arts, Commerce and Science College, Ahmednagar
(Autonomous)**

खुला वैकल्पिक (OE) विषयाची प्रस्तावना : कला आणि वाणिज्य शाखेसाठी

विद्यापीठ अनुदान आयोग (UGC) व सावित्रीबाई फुले पुणे विद्यापीठ यांच्या मार्गदर्शक तत्वांचे पालन करून आम्ही राष्ट्रीय शैक्षणिक धोरण - २०२० अंतर्गत खुला वैकल्पिक (OE) विषयासाठी भौतिकशास्त्र विषयाचा अभ्यासक्रम बनवित आहोत. राष्ट्रीय शैक्षणिक धोरण - २०२० नुसार खुला वैकल्पिक विषय विद्यार्थ्यांना बहुविद्याशाखीय शिक्षण मिळण्याच्या हेतूने तयार करण्यात येतो. आम्ही खुला वैकल्पिक (OE) - भौतिकशास्त्र या विषयाचा अभ्यासक्रम अश्याप्रकारे तयार करण्यात आलेला आहे की विद्यार्थी शिकलेल्या अभ्यासक्रमातून काही कौशल्य आत्मसात करील आणि या कौशल्यचा वापर करून तो दररोजच्या जीवनातील विविध प्रश्न सोडवू शकेल. हा अभ्यासक्रम शिकत असताना वेळोवेळी विद्यार्थीने आत्मसात केलेल्या कौशल्याचे मूल्यमापन केले जाणार आहे. यातून विद्यार्थीची जडणघडण होणार आहे.

Introduction of Open Electives (Marathi): For Arts and Commerce Faculty

The curriculum for the Open Elective (OE) in Physics designed for the requirement of National Education Policy - 2020 (NEP 2020) following the University Grants Commission (UGC) and Savitribai Phule Pune University guidelines. As per the guidelines, we proposed structure Open Elective Courses. NEP-2020 Policy propose the OE course as an elective course generally chosen from an unrelated subject/discipline with the intention to seek multidisciplinary exposure. For OE in Physics, we designed the curriculum such way that the students from the non science background mostly attract towards the Physics. Students will be able to correlate their curriculum with the day to day life experiences. We designed the OE in Physics curriculum, we have added the skill

oriented courses to encourage students for achieving fruitful skills while completing their bachelor degree. For this course we propose the continuous assessment of the students. This continuous assessment carried out through systematic based on better understanding of the subject.

Open Elective/ Generic Elective Framework and Course Distribution:

Subject: Physics (For Arts and Commerce Faculty)

| Sr. No. | Year | Semester | Level | Course Type | Course Code | Title | Credits |
|--------------|------|----------|-------|-------------|-------------|------------------------|-----------|
| 1. | I | I | 4.5 | OE-01 | OE-PH 01T | Measurement | 02 |
| 2. | I | II | 5.0 | OE-01 | OE-PH 02P | Measurement Lab | 02 |
| 3. | II | III | 5.5 | OE-03 | OE-PH 03T | Basics of Electronics | 02 |
| 4. | II | IV | 6.0 | OE-04 | OE-PH 04P | Basic Electronics Lab. | 02 |
| Total | | | | | | | 08 |

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
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Syllabus of Open Elective: Physics

| Title of the Course: Measurement – मोजमाप | | | | | | | | |
|---|-------------|---------------------|-----------|-------------|----------------|----------------|-----|-------|
| Year: I | | | | Semester: I | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| OE-01 | OE-PH 01 T | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

Learning Objectives:

1. Explain the importance of measurement in everyday life.
2. Introduce different types of measuring instruments for various measurements like electrical, mechanical, thermal, optical quantity.
3. Explain importance of accuracy, precision, resolution, and uncertainty in measurements.
4. Explain different types of errors and their sources in measurement systems.
5. Explain how to remove errors in the measurement.

Course Outcomes (Cos)

1. Understand the importance of the measurement in everyday life.
2. Measure the quantities like electrical, mechanical, thermal, optical using measuring instruments.
3. Understand importance of accuracy, precision, resolution, and uncertainty in measurements.
4. Understand meaning of error and types of errors as well as their sources in measurement systems.
5. Take measurements without error as well as remove errors in the measurement.

Detailed Syllabus:

Unit I: Basics of Instrumentation

(08 Hrs.)

Classification of instruments, Characteristic of instruments, Simple instrument model and its characteristics (static), Process of measurement, Error in measurement: Error, Absolute errors, Percentage error, Relative Accuracy, Percentage Accuracy. Types of error: Gross Errors, Systematic Errors, Random Errors. (Ref. 1, Chapter 1)

Unit II: Statistical analysis of Error

(07 Hrs.)

Arithmetic mean, Deviation, average deviation, standard deviation. Measurement error combinations, Sum of quantities, Difference of quantities, Product of quantities, Quotient of

quantities, Quantities raised to a power, Various Physical Quantities and their SI and CGS units. Interconversion between the SI and CGS units, Problems. (Ref. 3, Chaper 2)

Unit III: Basic Measuring Instruments**(07 Hrs.)**

Temperature Measurement: Thermometer - Construction, Types of Thermometer, Scales and interconversion. Dimension Measurement: Vernier Caliper - Construction and Least count, Micrometer Screw Gauge - Construction and Least Count. Speedometer - Construction and Least count. (Ref. 9,10,11,12)

Unit IV: Electrical Measurements**(08 Hrs.)**

Construction of analog and digital meter for Current, Voltage and Power measurement, Galvanometer. Pressure Measurement: Barometer, Manometer, Level Bottle. Other Measuring Instruments: Speedometer, Hygrometer, Compass, Stop Watch, Anemometer, etc. (Ref. 6, Chapter 4)

अभ्यासक्रमः**युनिट I: मोजमाप उपकरणे मूलभूत संकल्पना****(०८ तास)**

साधनांचे वर्गीकरण, साधनांचे वैशिष्ट्य, सोपे साधन मॉडेल आणि त्याची वैशिष्ट्ये (स्थिर), मापन प्रक्रिया, मोजमापातील त्रुटी: त्रुटी, परिपूर्ण त्रुटी, टक्केवारी त्रुटी, सापेक्ष अचूकता, टक्केवारी अचूकता. त्रुटीचे प्रकार: एकूण त्रुटी, पद्धतशीर त्रुटी, यादृच्छिक त्रुटी. . (Ref. 1, Chapter 1)

युनिट II: त्रुटीचे सांख्यिकीय विश्लेषण**(०७ तास)**

अंकगणित सरासरी, विचलन, सरासरी विचलन, मानक विचलन. मोजमाप त्रुटी संयोजन, प्रमाणांची बेरीज, परिमाणांचा फरक, प्रमाणांचे उत्पादन, परिमाणांचे भाग, एका बळापर्यंत वाढवलेले प्रमाण, विविध भौतिक परिमाण आणि त्यांची SI आणि CGS एकेके. SI आणि CGS एकेके मधील परस्पर रूपांतरण, गणित. (Ref. 3, Chaper 2)

युनिट III: मूलभूत मोजमाप साधने**(०७ तास)**

तापमान मोजमाप: थर्मामीटर - रचना, थर्मामीटरचे प्रकार, तराजू आणि परस्पर रूपांतरण. परिमाण मापन: व्हर्नियर कॅलिपर – रचना आणि सर्वात कमी गणना, मायक्रोमीटर स्क्रू गेज - रचना आणि सर्वात कमी गणना. स्पीडोमीटर - रचना आणि सर्वात कमी गणना. (Ref. 9,10,11,12)

यूनिट IV : विद्युत मोजमाप

(०८ तास)

करंट, व्होल्टेज आणि शक्ती मापन, गॅल्व्हानोमीटरसाठी ॲनालॉग आणि डिजिटल मीटरचे रचना . दाब मापन: बॅरोमीटर, मॅनोमीटर, लेव्हल बाटली. इतर मापन यंत्रे: स्पीडोमीटर, हायग्रोमीटर, कंपास, स्टॉप वॉच, एनीमोमीटर इ. . (Ref. 6, Chapter 4)

Suggested Readings/Material:

1. John R. Taylor, An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, 2ed. University Science Books, 1997.
2. Jack P. Holman, Experimental Methods for Engineers, 7ed. McGraw Hill Education, 2017.
3. Alan S. Morris and Reza Langari, Measurements and Instrumentation: Theory and Application, 2ed. Academic Press Inc., 2015.
4. Peter H. Sydenham and Richard Thorn, Handbook of Measurement Science, 2ed., John Wiley & Sons Inc., 1991.
5. David Halliday, Robert Resnick, Jearl Walker, Fundamentals of Physics, 10ed. Wiley, 2013.
6. H.S. Kalsi, Electronic Instrumentation, 3ed., McGraw Hill Education, 2017.
7. U.A. Bakshi, Electrical Measurement and Measuring Instruments, Technical Publications, 2021.
8. Tumanski, Slawomir , Principles of electrical measurements, CRC Press, 2006.
9. Rajesh Mishra, Fundamentals of Vernier Calliper and Screw Gauge, ISBN 978 9388111195, Publisher, Self Published, 2018.
10. Robert E. Bentley, Temperature and Humidity MEAsurment, Vol. 1, Springer, 1998.
11. A. Bhatiya, Principle and Methods of Temperature measurment, 2020
12. Ali Ostadfar, Biofluid Mechanics, Principles and Applications, Academic Press, 2016
13. Ravi Kumar, Department of Mechanical Engineering, IIT Roorkee, Mechanical Measurement System, <https://archive.nptel.ac.in/courses/112/107/112107242/>
14. Avishek Chatterjee, Department of Electrical Engineering, IIT Kharagpur, Electrical Measurement and Electronic Instruments, <https://archive.nptel.ac.in/courses/108/105/108105153/>

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Syllabus of Open Elective: Physics

| Title of the Course: Measurement Lab | | | | | | | | |
|--------------------------------------|-------------|---------------------|-----------|--------------|----------------|----------------|-----|-------|
| Year: I | | | | Semester: II | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| OE-02 | OE-PH 02P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

Learning Objectives:

1. Learn the importance of measurement in physics and science.
2. Learn about different types of measurements (electrical, mechanical, thermal, optical, etc.)
3. Understand the concepts of accuracy, precision, resolution, and uncertainty in measurements.
4. Learn about different types of errors and their sources in measurement systems.

Course Outcomes (Cos)

1. Distinguish between different types of errors (systematic, random, human) and their sources.
2. Apply statistical methods for data analysis and error propagation.
3. Use various measuring instruments (rulers, calipers, balances, etc.) correctly.
4. Perform basic experimental techniques and report measurements with appropriate precision and uncertainty.

Detailed Syllabus: 12 Experiment

| Sr. No | Title of the experiment |
|--------|--|
| 1. | Study different types of scales and determine their least counts. |
| 2. | Measure mass of different object using beam balance. |
| 3. | Measure volume of sphere, cylinder using Vernier caliper. |
| 4. | Measure inner and outer diameter of pipe using Vernier caliper. |
| 5. | Measure diameter of wire using micrometer screw gauge. |
| 6. | Measure volume of irregularly shaped solid. |
| 7. | Measure value of resistance using analog and digital multimeter |
| 8. | Measure the value of oscillation and time period for a disc suspended at a point . |
| 9. | Make a paper scale using least count. |
| 10. | Measure the density and thickness of aluminum foil. |
| 11. | Measure the area of regular geometric shapes- circle, square , rectangle . |
| 12. | Measure the depth of given cylinder using Vernier caliper. |
| 13. | Determine the radius of curvature of spherical surface using spherometer . |
| 14. | Measure length ,breadth and height of given rectangular block. |

| | |
|-----|---|
| 15. | Determine the area of 1D, 2D and 3D object. |
|-----|---|

Activity: Study tour visit report / mini project / science exhibition participation or any other activity equivalent to **TWO** experiments.

अभ्यासक्रम: (कोणतेही १२ फक्त)

| अ. क्र. | प्रत्यक्षिकाचे नाव |
|---------|---|
| 1. | वेगवेगळ्या माप पट्टीचा अभ्यास आणि त्यांची किमान संख्या शोधणे. |
| 2. | बिम बॅलेन्स चा वापर करून वेगवेगळ्या वस्तूंचे वस्तुमान मोजमाप करणे. |
| 3. | व्हर्नियर कॅलिपरच्या मदतीने गोलाकार आणि दंडगोलाकृती वस्तूचे आकारमान/वस्तुमान मोजणे. |
| 4. | व्हर्नियर कॅलिपरच्या मदतीने दंडगोलाकृती पाइपचा आतील आणि बाहेरील व्यास मोजणे. |
| 5. | मायक्रोमीटर स्कू गेज च्या मदतीने वायरची त्रिज्या मोजणे . |
| 6. | अनियमित आकाराच्या वस्तूच्या घनतेचे प्रमाण मोजमाप. |
| 7. | अॅनालॉग आणि डिजिटल मल्टीमीटर वापरून प्रतिकार मूल्य (Resistance) मोजमाप करणे. |
| 8. | सध्या दोलकाचा दोलन आणि दोलन कालावधीचे मूल्य मोजमाप करणे. |
| 9. | कमीत कमी संख्या वापरून पेपर स्केल बनवणे |
| 10. | अॅल्युमिनियम च्या पट्टीची घनता आणि जाडी याचे मोजमाप करणे. |
| 11. | नियमित भौमितिक आकारांची क्षेत्रफळ याचे मोजमाप करणे - वर्तुळ, चौरस, आयत. |
| 12. | व्हर्नियर कॅलिपर वापरून दिलेल्या दंडगोलाकृती वस्तूची खोली मोजणे. |
| 13. | स्फेरोमीटरचा वापर करून गोलाकार पृष्ठभागाच्या वक्रतेची त्रिज्या निश्चित करणे. |
| 14. | दिलेल्या आयताकृती ब्लॉकची लांबी, रुंदी आणि उंची मोजणे. |
| 15. | 1-D, 2-D आणि 3-D वस्तूंचे परिमाण मोजमाप करणे. |

Activity: Study tour visit report / mini project / science exhibition participation or any other activity equivalent to **TWO** experiments.