

ENGINEERING SCIENCE (867)

This subject may not be taken with Physics.

The syllabus is designed for candidates who have followed a course with a bias towards engineering.

The examiners will attach importance to an understanding of scientific principles and will look for evidence that these have been studied practically. The examiners may ask to see the practical notebooks.

CLASS XI

There will be two papers in the subject:

Paper I - Theory: 3 hours..... 80 Marks

Paper II - Project Work 20 Marks

PAPER I (THEORY): 80 MARKS

Note: All questions will be set in the S.I. System. The unit abbreviations to be used in all question papers in this subject will be those contained in the Guide to the use of International System (SI) units SP; 5-1969 (Published by the Indian Standards Institution).

1. Velocity and acceleration. Laws of motion. Force, mass and acceleration. Acceleration due to gravity. Measurement of g, including examples of bodies moving with variable acceleration, treated graphically.
2. Angular velocity and angular acceleration.
3. Composition and resolution of velocity. Simple problem on projectiles, involving combined horizontal and vertical motion.
4. Measurement and effects of force. Equilibrium of concurrent forces in plane. Parallelogram, triangle and polygon of forces. Reaction, resultant and equilibrant. Bow's notation. Equilibrium of body on inclined plane. Treatment by graphical and mathematical methods.
5. Moments. Application to parallel forces, levers, vertically loaded rigid beams. Centre of gravity: experimental determination and calculation in simple cases. Its relation to stability.
6. Pressure in liquids and its transmission. Principle of Archimedes; floatation. Density and specific gravity of solids and liquids. Simple hydraulic pumps and jacks. Lift and force pumps; the siphon.
7. Air Pressure. Boyle's law. Barometers. Manometers and the Bourdon gauge. The bicycle pump. (Details of the Fortin barometer are not required.)
8. Temperature and temperature scales.
9. Thermal expansion of solids, liquids and gases. Coefficient of linear expansion of solids and coefficient of cubical expansion of liquids and gases. Charles' law. Absolute temperature. (Questions will not be set on apparent coefficients of expansion).
10. Quantity of heat. Joule, Centigrade heat unit. Specific heat capacity of solids and liquids; their determination. Change of state. Latent heats: their determination. Melting and boiling points; the effect of pressure. Heat as a form of energy. Calorific value of fuels (excluding experimental determination).
11. Conduction, convection and radiation.
12. Conversion of heat to mechanical energy and vice versa. Mechanical equivalent of heat, including any one method of determination.

PAPER II (PROJECT WORK): 20 Marks

In addition to the syllabus prescribed above, candidates are also required to be assessed in Project Work. All candidates will be required to have completed two projects from any topic/s covered in theory.

The Project work will be assessed by the subject teacher.

Mark allocation for *each* project (10 marks) :

| Criteria | Marks |
|--|-----------|
| 1. Title of the Project and Introduction | 1 |
| 2. Content | 3 |
| 3. Presentation and originality | 2 |
| 4. Conclusion/Comments/Summary | 1 |
| 5. Viva-Voce | 3 |
| TOTAL | 10 |

List of suggested assignments for Project Work:

1. Study changes in the velocity of a body under the action of a constant force and determine its acceleration. Also plot a graph between velocity and time under a constant force. Discuss the variation in acceleration for masses m , $2m$, $3m$, $4m$ and $5m$ placed on a smooth surface when constant force F is applied on them.

Similarly discuss the variation in acceleration when different forces F , $2F$, $3F$, $4F$ and $5F$ are applied on a body of mass m .

2. You are given a rubber pipe, a nozzle, source of water under pressure, i.e., a tap connected to an overhead water tank, a measuring tape and a large size protractor.

- (i) Study the variation in the range of the jet of water with change in the angle of projection.
- (ii) How would the range change if the velocity of projection is changed (increased/decreased)?
- (iii) Calculate velocity of projection by using maximum value of horizontal range measured as above.
- (iv) How can you achieve a constant pressure of inlet water to keep the projection velocity of water constant?
- (v) Study the variation in maximum height attained by the water stream for different angles of projection.

3. Study atmospheric pressure and humidity (as given in the newspaper) for a month. Plot a graph between atmospheric pressure and humidity. Is there any relationship between humidity and atmospheric pressure? Discuss.

4. Conduct an extensive study on any Indian /foreign Physicist. Prepare a report discussing their contributions.

SAMPLE TABLE FOR PROJECT WORK

| S. No. | Unique Identification Number (Unique ID) of the candidate | <u>PROJECT 1</u> | | | | | <u>PROJECT 2</u> | | | | | TOTAL MARKS |
|-----------|--|------------------|----------------------|------------------------------------|---|------------------------------|------------------|----------------------|------------------------------------|---|------------------------|----------------|
| | | A | B | C | D | E | F | G | H | I | J | (E + J) |
| | | Teacher | Visiting Examiner | Average Marks (A + B ÷ 2) | Viva-Voce by Visiting Examiner | Total Marks (C + D) | Teacher | Visiting Examiner | Average Marks (F + G ÷ 2) | Viva-Voce by Visiting Examiner | Total Marks (H + I) | 20 Marks |
| | | 7 Marks | 7 Marks | 7 Marks | 3 Marks | 10 Marks | 7 Marks | 7 Marks | 7 Marks | 3 Marks | 10 Marks | 20 Marks |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |

*For breakup of the 7 Marks to be awarded separately by the Teacher and the Visiting Examiner, please refer to the table giving the criteria for mark allocation for *each* project.

NOTE: VIVA-VOCE (3 Marks) for each Project is to be conducted only by the Visiting Examiner and should be based on the Project only.