Syllabus for Solid Mechanics Group

Dear Applicants,

We are delighted that you have applied to the Solid Mechanics Group, Department of Applied Mechanics, IIT Madras for pursuing research.

The objective of conducting these interviews is to assess your background knowledge, ability to think and your potential to carry out research in the Solid Mechanics group, Department of Applied Mechanics, IIT Madras.

Usually, the applicants called for the interviews first have to appear for a written examination followed by an oral interview. The written examination is of duration 30 mins and tests the basic knowledge of the applicants. In the interview, the applicants are usually asked to solve problems on the board so that the derivations and the processes adopted by the applicant is clear to the panel.

The questions are usually of fundamental nature and are designed to test the understanding of the applicant and are not memory based.

The applicants are advised to prepare for the interviews according to the following syllabus and related topics. Some reference books for these topics are also suggested.

Good luck !

For MS and direct PhD:

Engineering Mechanics:
Newton's laws of motion, Free body diagrams, determinacy and indeterminacy, equations of equilibrium, trusses, shear force, bending moments, axial forces, friction, virtual work, elements of vibrations

Suggested References:
1. F. Beer, R. Johnston, Vector mechanics for engineers: statics and dynamics. Tata McGraw-Hill.
2. J. Mariam, L Kraige, Engineering mechanics, Vol 1: Statics, Vol 2: Dynamics.

Strength of Materials:
Internal forces, stresses, strains, plane stress, plane strain, Generalized Hooke's law, 2-D Transformation of stresses and strains, Mohr's circle, Torsion, pressure vessels, stresses in beams, beam deflections, beams of various cross-sections, composite beams

Suggested References:
1. F. Beer, R. Johnston, Mechanics of materials, McGraw-Hill.
2. E. Popov, Engineering mechanics of solids, Prentice- Hall.

Basic Mathematics:
Matrix methods, eigenvalues, ordinary differential equations, Fourier series, Taylor series

Suggested References:
1. E. Kreyszig, Advanced engineering mathematics, Wiley.
2. B.S. Grewal, Higher engineering mathematics, Khanna Publishers.

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For PhD:

The applicants would be asked questions primarily on courses relevant to their Master's specialization, Master's project and areas of interest. Keeping in mind the specific interests in the group, PhD applicants are expected to be proficient compulsorily in the first two subjects and **in at least one** of the remaining subjects:

1. **Solid Mechanics**
2. **Engineering mathematics**
3. Finite Element Method
4. Mechanics of materials
5. Fracture Mechanics
6. Composites
7. Vibrations
8. Experimental Stress analysis
9. Plasticity

All PhD applicants <u>must</u> bring their masters thesis/project report at the time of the interview.

The topics and some suggested references for the two compulsory subjects are as mentioned below:

Solid Mechanics:
Stress and strain tensors, equilibrium and compatibility conditions, Constitutive relations, Airy stress functions, torsion, yield and failure criterion

Suggested References:
1. A. Boresi, R. Schmidt, Advanced mechanics of materials, Wiley.
2. S. P. Timoshenko, J.N. Goodier, Theory of elasticity, Tata McGraw-Hill.

Engineering Mathematics:
Linear algebra, ordinary differential equations, Series expansions, Laplace and Fourier transforms

Suggested References:
1. E. Kreyszig, Advanced engineering mathematics, Wiley.
2. B.S. Grewal, Higher engineering mathematics, Khanna Publishers.