Short Questions:

1. Define deforming and restoring force.
2. What is elasticity and plasticity? Explain why steel is more elastic than rubber.
3. How will you justify that stone is more rigid than iron? *(hint: stone offers more opposition to deforming force)*
4. Why are steel rods embedded in concrete in a house roof? Explain. *(hint: to increase Tensile strength)*
5. Why are bridges declared unsafe after a long use? *(hint: After long use the metals used in bridges losses its elastic strength)*
6. Why are rubbers used as vibration absorbers?
7. Compare the mechanical properties of a steel cable, made by twisting many thin wires together, with those of solid steel rod of same diameter. *{hint: steel cable made by twisting many thin wires has greater tensile strength (flexibility) and less shear strength (rigidity) but solid steel rod has opposite nature.}*
8. Will the Young's modulus of elasticity change if the load hanging on it is doubled? Why?
9. Explain physical meaning of Poisson's ratio.
10. Sketch stress vs Strain graph and explain proportional limit, elastic limit, yield point and breaking stress.
11. Sketch the variation of PE with interatomic separation and discuss it?
12. What is elastic fatigue? Why do spring balances show wrong readings after being used for a long time?
13. What happens to the modulus of elasticity of most of the materials with increase in temperature?
14. Two wires A & B have equal lengths and are made of same material. If the diameter of wire A is twice that of a wire B, which wire has the greater extension for a given load?
15. Why is spring made of steel but not copper?

Numerical:

1. A force of $20N$ applied to the ends of a wire $4m$ long produces an extension of $0.24mm$. If the diameter of wire is $2mm$, calculate the stress on the wire, its strain and the value of the Young's modulus.
2. A copper wire and steel wire of same cross sectional area and of length $1m$ and $2m$ respectively are connected end to end. A force is applied, which stretches their combined length by $1cm$. Find how much each wire is elongated.
3. The rubber cord of catapult has a cross sectional area $1mm^2$ and total upstretched length $10cm$. It is stretched to $12cm$ and then released to project a missile of mass $5gm$. Calculate the velocity of projection.
4. A wire of length $2.5m$ and area of cross section $1 \times 10^{-6}m^2$ has a mass of $15kg$ hanging on it. What is the extension produced? How much is the energy stored in the extended wire is Young's modulus of wire is $2 \times 10^{11}Nm^{-2}$.
5. What force is required to stretched a steel wire of cross-sectional area $1cm^2$ to double its length?
6. Calculate the work done in stretching a steel wire $100cm$ in length of cross sectional area $0.030\ cm^2$ when a load of $100N$ is slowly applied before the elastic limit is reached.
7. A steel cable with cross sectional area $3\ cm^2$ has an elastic limit of $2.40 \times 10^8 Pa$. Find the maximum upward acceleration that can be given by a $1200kg$ elevator supported by the cable if stress is not exceed one-third of the elastic limit.
8. The rubber cord of catapult is pulled back until its original length has been doubled. Assuming that the cross sectional of the cord is $2mm^2$ and that Young's modulus for rubber is 10^7Nm^{-2}, Calculate the tension in the cord. If the two arms of the catapult are $6cm$ apart and the un-stretched length of the cord is $8cm$, what is the stretching force?
9. The rubber cord of a catapult has cross-sectional area $1mm^2$ and a total un-stretched length $10cm$. It is stretched to 12cm and then released to project a missile of mass $5gm$. From energy considerations, or otherwise, calculate the velocity of projection taking Young's modulus for the rubber as $5 \times 10^8 Nm^{-2}$.