



17350

21415

3 Hours/100 Marks

Seat No.

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Instructions : (1) **All** questions are **compulsory**.

(2) *Illustrate your answers with **neat** sketches **wherever** necessary.*

(3) *Figures to the **right** indicate **full** marks.*

(4) **Assume** suitable data, **if** necessary.

(5) **Use** of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and **any other** Electronic Communication devices are **not** permissible in **Examination Hall**.

MARKS

1. Attempt **any ten** of the following :

20

- a) Differentiate between scalar quantity and vector quantity.
- b) Write any two characteristics of force.
- c) State the condition of equilibrium.
- d) Define Lamis theorem.
- e) List out the types of beam.
- f) What is coefficient of friction ?
- g) Define centre of gravity.
- h) What is centroid of plane lamina ?
- i) State law of machine. What is its important ?
- j) State the concept of Ideal machine.
- k) What is efficiency of machine ?
- l) Define stress and strain.

P.T.O.



2. Attempt **any four** of the following :

- A force of 100 kN makes an angle of 135° with the horizontal. Find its orthogonal components.
- Write four characteristics of couple. Also define it.
- Two forces acting at and away from the point have magnitudes of 20 kN and 25 kN respectively having an included angle of 60° . Find their resultant in magnitude.
- Calculate the magnitude and direction of resultant for concurrent force system of shown in Fig. No.1

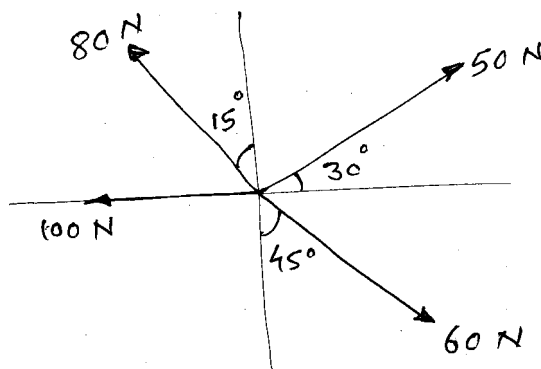


Fig. No. 1

- Explain principle of transmissibility.
- Differentiate between mass and weight.

3. Attempt **any four** of the following :

- An electric bulb of weight 10 N hangs vertically from a ceiling. Its wire is pulled by a horizontal force 'P' such that its wire makes an angle of 10° with vertical. Find force 'P' and tension in wire.
- State any four types of beams with sketch.
- A simply supported beam of span 10 m, carries two point load of 60 kN and 40 kN at 2 m and 5 m from LHS in addition to this beam also carries UDL of 16 kN/m over 5 m from RHS. Calculate support reactions by analytical method.



MARKS

- d) A block of 1000 N is kept on horizontal surface. A horizontal force 300 N is required to just move it. Find normal reaction, frictional resistance, resultant reaction, and coefficient of friction.
- e) A body weighing 200 N is resting on a rough horizontal plane. A pull of 30 N applied at 30° up the horizontal just moves the body. Find the coefficient of friction.
- f) Define friction with its advantages and disadvantages.

4. Attempt **any two** of the following :

16

- a) Locate centroid of 'L' section having flange $10\text{ mm} \times 80\text{ mm}$ and web $10\text{ mm} \times 120\text{ mm}$.
- b) Find centroid of 'I' section with following data, top flange $20\text{ mm} \times 10\text{ mm}$, bottom flange $100\text{ mm} \times 20\text{ mm}$, web thickness 15 mm, overall depth 250 mm.
- c) A block of weight 500 N is placed on a inclined plane at an angle of 20° with horizontal. If coefficient of friction is 0.14, find force 'P' applied parallel to the plane just move the body up the plane.

5. Attempt **any four** of the following :

16

- a) A right circular cone of 5 cm radius and 50 cm height is placed coaxially on a solid cylinder of 5 cm radius and 100 cm height. Find center of gravity of the composite solid.
- b) Show on sketch the centre of gravity of a solid cone having height 400 mm and also locate C. G. for hemisphere having 400 mm diameter.
- c) Draw a neat sketch of differential circle and wheel. Showing all components.
- d) A screw jack has an effort wheel diameter of 300 mm and pitch is 6 mm. If a load of 1200 N is lifted by an effort of 200 N. Find the coefficient of machine.
- e) An effort of 800 N is required to lift a load of 10 kN. On this machine an effort of 1400 N lifts a load of 22 kN. Find the law of machine.
- f) The diameter of bigger and smaller pulleys of westons differential pulley block are 250 mm and 100 mm respect. Determine effort required to lift a load of 2 kN with 80% efficiency.



6. Attempt **any two** of the following :

16

- a) A circular bar having 200 mm^2 area is subjected to the axial loads as shown in Fig. No. 2. Find the value of 'P' and the total elongation. Take $E = 2 \times 10^5 \text{ N/mm}^2$.

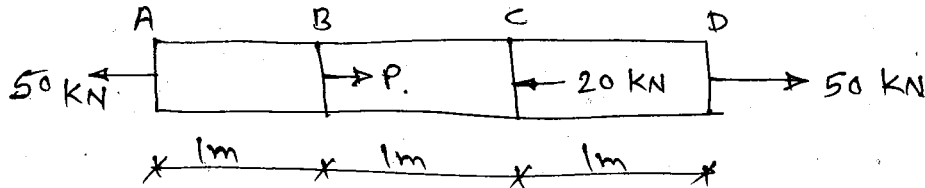


Fig. No. 2

- b) A thin tyre is shrunk on a wheel of 1200 mm diameter. Find the diameter tyre if the hoop stress is limited to 120 N/mm^2 . Find the least temperature, to which the tyre must be heated, above that of wheel before it would be slipped on.
- c) Define Bulk modulus, Poisson's ratio, volumetric strain and modulus of rigidity.
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