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END SEMESTER EXAMINATION, NOVEMBER-2018

Semester – 3rd

Subject Code : BES-304

APPLIED MECHANICS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. All questions of PART – A are compulsory.
2. Answer any *five* questions from PART – B.

PART – A

Marks – 25

1. Fill in the blanks :

1 × 10 = 10

- (a) The process of finding out the resultant force of a number of given forces, is called _____.

- (b) The forces, which meet at one point, are known as _____.

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- (c) The resultant of two forces P and Q acting at an angle 90° is equal to _____.
- (d) If the arm of a couple is doubled, its moment will be _____.
- (e) In a couple, the lines of action of the forces are _____.
- (f) The centre of gravity of an equilateral triangle with each side (a) is _____ from any of the three sides.
- (g) Moment of inertia of a rectangle about its centroidal horizontal axis is _____.
- (h) The unit of work done in SI system of units is _____.
- (i) The vertical component of force 10N is 8.66N. Its horizontal component will be _____ N.
- (j) Two forces 4N and 6N are acting along the same line, then the magnitude of resultant of the forces will be _____ N.

2. Write true or false :

$$1 \times 10 = 10$$

- (a) The SI unit of pressure is joule.
- (b) The resultant of two forces equal to 50N and 30N acting at an angle of 60° is equal to 70N.
- (c) A body is said to be in equilibrium, if it has no linear motion.
- (d) Lami's theorem cannot be applied in case of concurrent forces.
- (e) The centre of gravity of a uniform rod is at its middle point.
- (f) A redundant frame is also known as imperfect frame.
- (g) A car starting from rest is accelerated at the rate of 0.4 m/s^2 , then the distance covered by the car in 20 seconds is 70m.
- (h) The frictional force is dependent of area of the contact surface.
- (i) The method of determination of the resultant of forces acting on a particle is called composition of forces.
- (j) The SI unit of moment of a force is N-m.

3. Choose the correct answer :

1×5=5

(a) According to Lami's theorem, the three forces

(i) must be equal

(ii) must be at 120° to each other

(iii) must be both of above

(iv) may not be any of the two

(b) If the sum of all the forces acting on a body is zero, then the body may be in equilibrium provided the forces are

(i) concurrent

(ii) parallel

(iii) like parallel

(iv) unlike parallel

(c) If the area of a section is in mm^2 and the distance of the centre of area from a line is in mm, then units of moment of inertia of the section about the line is expressed in

(i) mm^2

(ii) mm^3

(iii) mm^4

(iv) mm^5

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(4)

(d) The rate of change of velocity is called

(i) displacement

(ii) acceleration

(iii) angular velocity

(iv) angular displacement

(e) The moment of inertia of a circular body of diameter 1 mm is equal to

(i) 1 mm^4

(ii) 0.049 mm^4

(iii) 0.5 mm^4

(iv) None of the above

PART - B

Marks - 45

4. (a) Distinguish between resolution of force and composition of force. 2

(b) Enunciate any two principles of equilibrium. 2

(c) State and prove Lami's theorem. 5

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(5)

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5. (a) Find the magnitude of two equal forces acting at a point with an angle of 60° between them, if the resultant is equal to $30\sqrt{3}\text{ N}$.

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- (b) The resultant of two forces when they act at right angles is 10 N , whereas when they act at an angle of 60° the resultant is $\sqrt{148}\text{ N}$. Determine the magnitude of the two forces.

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6. (a) Differentiate between clockwise moment and anti-clockwise moment.

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- (b) Four parallel forces of magnitudes 100 N , 200 N , 50 N and 400 N are shown in fig. (i). Determine the magnitude of the resultant and also the distance of the resultant from point A.

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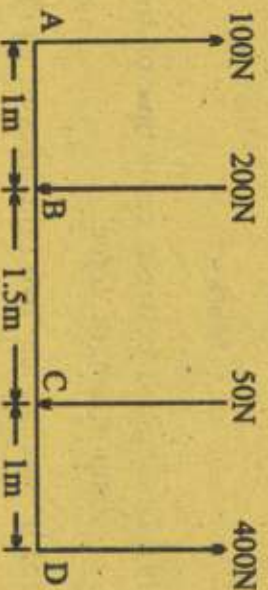


Fig. (i)

7. (a) What do you mean by free body diagram? Draw the free body diagram of a ball of weight W , placed on a horizontal surface.

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- (b) A smooth circular cylinder of weight 1000 N and radius 10 cm rests in a right-angled groove whose sides are inclined at an angle of 30° and 60° to the horizontal as shown in fig. (ii). Determine the reaction R_A and R_C at the points of contact.

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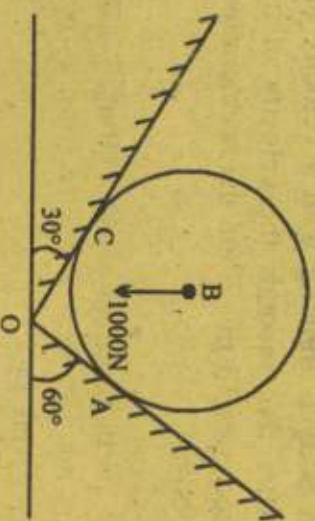


Fig. (ii)

8. (a) Define co-efficient of friction and angle of friction.

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- (b) A pull of 20 N , inclined at 25° to the horizontal plane, is required just to move a body placed on a rough horizontal plane. But the push required to move the body is 25 N . If the push is inclined at 25° to the horizontal, find the weight of the body and co-efficient of friction.

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9. Write the differences between centre of gravity and centroid. Find the moment of inertia about the horizontal centroidal axis of an 'I' section of following dimension :

$$2+7=9$$

Top flange = 10 cm × 2 cm

Web = 2 cm × 15 cm

Bottom flange = 20 cm × 2 cm.

10. (a) A body is moving with a velocity of 3 m/s. After five seconds the velocity of the body becomes 13 m/s. Find the acceleration of the body.

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- (b) A particle moves along a straight line so that its displacement in metre from a fixed point is given by,

$$s = t^3 + 3t^2 + 4t + 5$$

Find :

- (i) Velocity at start and after 4 seconds,
(ii) Acceleration at start and after 4 seconds.

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