

E-936**B. E. IInd Semester Examination, May – 2019****ELEMENTS OF MECHANICAL ENGINEERING (All Branches)****(Main Exam)****Time : Three Hours]****[Maximum Marks : 60**

Note : Attempt *all* questions from *Section – A*, *four* questions from *Section – B* and *three* questions from *Section – C*.

SECTION – A**[Marks : 1 × 10 = 10**

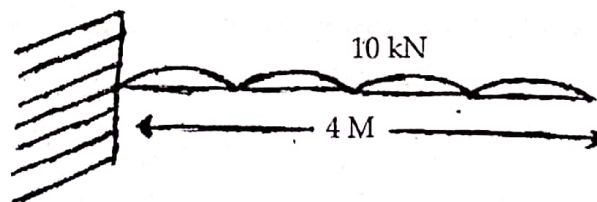
1. The moment of inertia of a square of side a about its diagonal is :

- (a) $a^2/8$ (b) $a^3/12$
(c) $a^4/12$ (d) $a^4/16$

2. At the point of Contraflexure, the value of bending moment is

- (a) Constant (b) Maximum
(c) Changes its sign (d) Minimum

3. Determine the bending moment at fixed end :



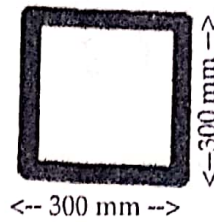
- (a) 40 kNm (b) 50 kNm
(c) 60 kNm (d) 80 kNm

4. The state of an ideal gas is changed isothermally in a process, what is the change in the internal energy of the gas during this process ?

- (a) $\Delta U = W$ (b) $\Delta U = Q$
(c) $\Delta U > 0$ (d) $\Delta U = 0$

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5. Find the modulus of section of square beam of size 300×300 mm.

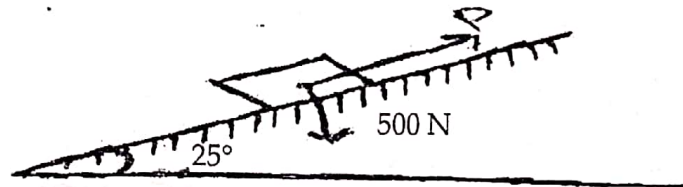


- (a) $4.8 \times 10^6 \text{ mm}^3$ (b) $4.5 \times 10^6 \text{ mm}^3$
 (c) $5.6 \times 10^6 \text{ mm}^3$ (d) $4.2 \times 10^6 \text{ mm}^3$
6. A number of forces acting at a point will be in equilibrium if :
- (a) Their total sum is zero
 (b) Two resolved parts in two directions at right angles are equal
 (c) Sum of resolved parts in any two perpendicular directions both are zero
 (d) All of them are inclined equally
7. The coefficient of friction depends upon :
- (a) Nature of surfaces (b) Area of contact
 (c) Shape of the surfaces (d) All of the above
8. Compression ratio of I. C. engines is
- (a) The ratio of volumes of air in cylinder before compression stroke and after compression stroke
 (b) Volume displaced by piston per stroke and clearance volume in cylinder
 (c) Ratio of pressure after compression and before compression
 (d) Swept volume/cylinder volume
9. The thermal efficiency of two-stroke cycle engine is a four-stroke cycle engine.
- (a) Equal to (b) Less than
 (c) Greater than (d) None of the above
10. A container with rigid walls filled with a sample of ideal gas. The absolute temperature of the gas is doubled. What happens to the pressure of the gas ?
- (a) Doubles (b) Quadruples
 (c) Triples (d) Decreased to one-half

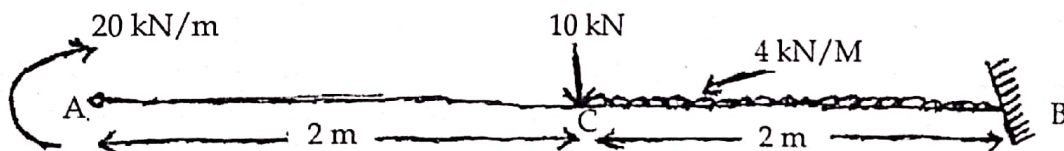
SECTION - B

[Marks : $5 \times 4 = 20$]

1. Give the Statement and drive the expression for Varignon's theorem with help of suitable example.
2. Comparison between two stroke and four-stroke petrol engine and give reason why we prefer four stroke engine in place of two stroke engine.
3. Drive the expression of Moment of inertia of a rectangular section.
4. Define the term thermodynamic equilibrium, thermodynamic properties and Concept of continuum.
5. A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the incline plane as shown in Fig. Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 20° .



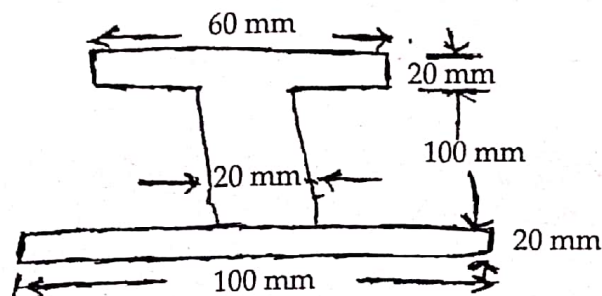
6. Draw the shear force and bending moment diagrams of a cantilever beam as shown in figure.



SECTION - C

[Marks : $10 \times 3 = 30$]

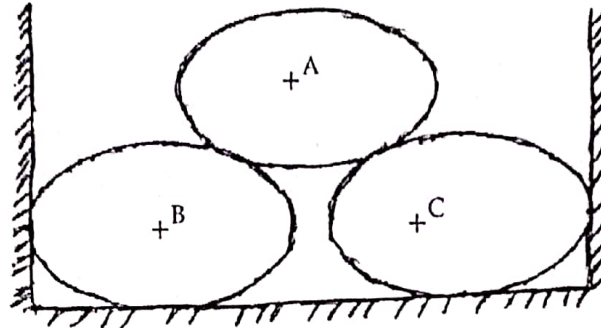
1. An I-section is made up of three rectangles as shown in Figure. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section.



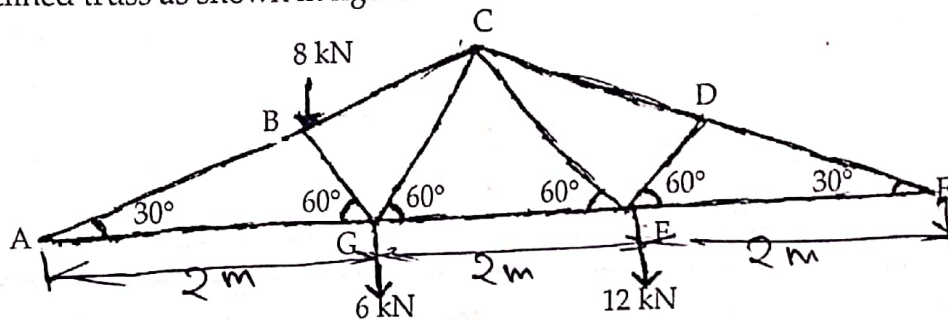
(3)

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2. Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. Determine the pressure exerted by (i) the cylinder A on B at the point of contact (ii) the cylinder B on the base and (iii) the cylinder B on the wall.



3. An inclined truss as shown in figure.



Determine the nature and magnitude of the forces in the members BC, GC and GF of the truss.

4. A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is -340 kJ. The system completes 200 cycles/min. Complete the following table showing the method for each item, and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
1-2	0	4340
2-3	42000	0
3-4	-4200	-73200
4-1

5. Explain the working of four-stroke C. I. engine with help of neat sketch and compare it with the four-stroke S.I. Engine.