

Roll No.

Total No. of Pages : 7

1(CCE.M)3

Mechanical Engineering-I

(16)

Time : Three Hours]

[Maximum Marks : 300

INSTRUCTIONS

- (i) Answers must be written in English.
- (ii) The number of marks carried by each question is indicated at the end of the question.
- (iii) The answer to each question or part thereof should begin on a fresh page.
- (iv) Your answer should be precise and coherent.
- (v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.
- (vi) Candidates should attempt question no. **1** and **5** which are compulsory and any **three** more out of the remaining questions selecting at least **one** question from each Section.
- (vii) If you encounter any typographical error, please read it as it appears in the text-book.
- (viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.
- (ix) No continuation sheets shall be provided to any candidate under any circumstances.

- (e) What are the factors on which the selection of electrode material depends ? List the most commonly used electrode materials.

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7. (a) Draw the sketch of single point cutting tool and show its important geometrical elements.
 (b) With the help of a sketch explain the following :
 (i) Orthogonal cutting process
 (ii) Oblique cutting process.
 (c) In an orthogonal cutting operation, the following data have been observed :

Uncut chip thickness = 0.127 mm

Width of cut = 6.35 mm

Cutting speed = 2 m/s

Rake angle = 10°

Cutting force = 567 N

Thrust force = 227 N

Chip thickness = 0.228 mm

Determine :

- (i) Shear angle
 (ii) Friction angle
 (iii) Shear stress along the shear plane
 (iv) Power for cutting operation, and
 (v) Chip velocity.

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8. (a) What are the advantages offered by V-belt drives ?
 (b) For power transmission by belt drive, derive the following expression,

$$(T_1 - T_c) / (T_2 - T_c) = e^{\mu\theta}$$

where T_1 is tension force in tight side and T_2 is tension in slack side of the belt and T_c is centrifugal force, μ is coefficient of friction between belt and pulley and θ is angle of contact.

- (d) Write brief notes on the following :

- (i) What is break-even point ?
 (ii) What is human factor engineering ?
 (iii) What do you understand by inventory control ?
 (iv) What is statistical quality control ?
 (v) What is production control ?

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2. (a) Define the terms 'shear force' and 'bending moment'. What are the 'sagging' and 'hogging' bending moment ?
 (b) A cantilever beam of 10 m span carries loads of 4kN and 6kN at 2 m and 6 m respectively from the fixed end alongwith another load of 6 kN at the free end. Draw the shear force and bending moment diagram. Refer Figure 1.

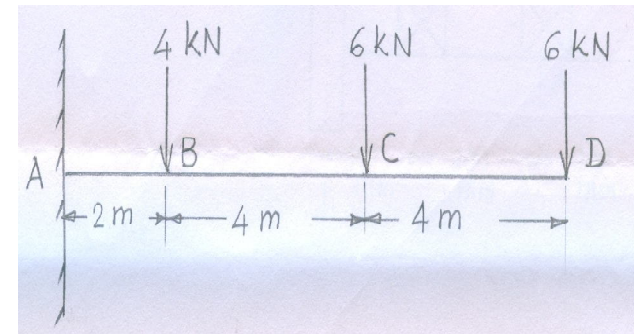


Figure 1

- (c) Figure 2 shows a simply supported beam of 200 mm wide, 300 mm deep and with 4 m in length. Determine the bending stress at point C which is 60 mm below the top surface and 1.2 m from the left support.

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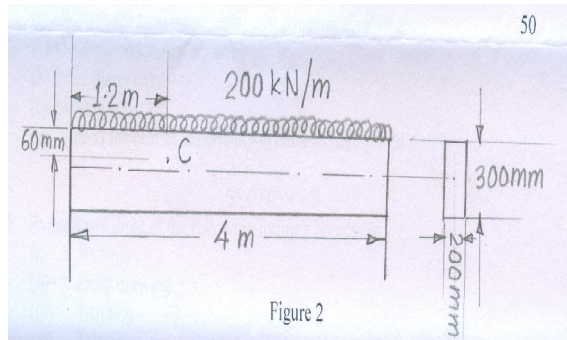


Figure 2

3. (a) With help of a sketch the spur gear terminology.
- (b) A gear pair with 18 teeth pinion driving a 72 teeth gear. The module is 4 mm with pressure angle 20° . Determine : addendum, dedendum, circular pitch and radii of base circles.
- (c) A shaft as shown in Figure 3 is transmitting power from pulley to a coupling at 800 rev/min. Diameter of pulley is 300 mm with a leather belt of 50 mm wide and 6 mm thick. Permissible stress in the belt is 2.4 MPa with coefficient of friction as 0.24. Determine the bending moment and torque at section – AA. Take leather density as 970 kg/m^3 .

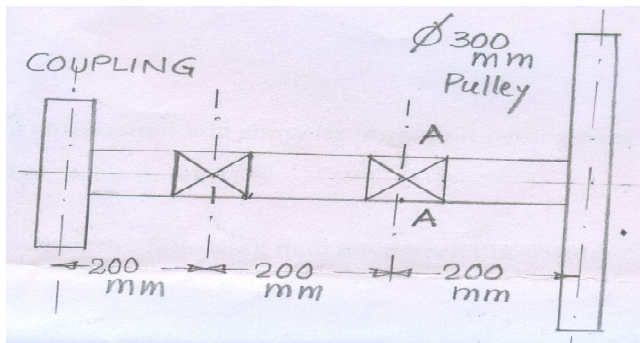


Figure 3

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4. (a) What is ABC classification ? What is the criterion used to classify items in the A, B and C categories ?
- (b) What is buffer stock ? What is the reason for keeping buffer stock ?
- (c) What are the criteria a general manager will use in evaluating over-all performance of inventory system ?
- (d) What is the total incremental cost equation involving :
- Ordering and inventory cost
 - Price discount
 - Shortage cost
 - What is the cost of uncertainty in demand during lead time ?

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SECTION-B

5. Explain any **three** of the following forming processes :
- Rolling
 - Deep drawing
 - Bending
 - Extrusion
 - Punching and blanking
 - Forging. 25×3=75
6. (a) Explain the mechanics of abrasive jet machining. List the process parameters of abrasive jet machining.
- (b) Explain the mechanics of ultrasonic machining with a list of process parameters.
- (c) List the main elements of ultrasonic machining unit and explain any one of them.
- (d) Explain the electric discharge machining process.

- (x) Candidates shall put a cross (x) on blank pages of Answer Script.
- (xi) No blank page be left in between answer to various questions.
- (xii) No programmable Calculator is allowed.
- (xiii) No stencil (with different markings) is allowed.

SECTION–A

1. Answer any **three** of the following :

(a) Define the following :

- (i) Shear strain
- (ii) Fatigue strength
- (iii) Thermal stress
- (iv) Contact stress
- (v) Residual stress. 25

(b) Define the following :

- (i) Kinematic link
- (ii) Kinematic pair
- (iii) Kinematic chain
- (iv) Higher pair
- (v) Lower pair. 25

(c) Define the following processes :

- (i) Shell moulding
- (ii) Investment casting
- (iii) Thermal welding
- (iv) Arc welding
- (v) Tube drawing. 25

- (c) A pump is driven by a belt from a motor which runs at 900 rev/min. A belt of 8 mm thick and 240 mm wide is used. The diameter of motor pulley and driver pulley are 360 mm and 1200 mm respectively with centre distance of 1200 mm. Coefficient of friction between pulley surface and belt is 0.36. The permissible stress in the belt is 2.4 MPa. The belt mass density is 970 kg/m³. Determine the power capacity of the belt drive. 50