



Total No. of Printed Pages – 3

AEUD
MECHANICAL ENGINEERING
PAPER – II
SUBJECT CODE : 11

Full Marks : 200

Time : 3 Hours

Instructions For Candidates :

Please read each of the following instructions carefully before attempting questions.

- (1) *Answers must be written in **ENGLISH** only.*
- (2) *The question paper contains a total of 8 questions in **TWO** Sections : Section-A and Section-B. (**FOUR** questions in each section)*
- (3) *Question No. 1 of Section 'A' and Question No. 5 of Section 'B' are compulsory.*
- (4) *Candidates have to attempt another **THREE** questions from remaining **SIX** questions choosing atleast **ONE** question from each section.*
- (5) *Assume suitable data if found necessary.*
- (6) *Wherever any assumption be made for answering a question, they must be clearly indicated.*
- (7) *Marks carried by a question / section is indicated against it.*
- (8) *Unless struck off, attempt of question shall be counted even if attempted partly.*
- (9) *Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.*

SECTION – A

Marks

5 × 8 = 40

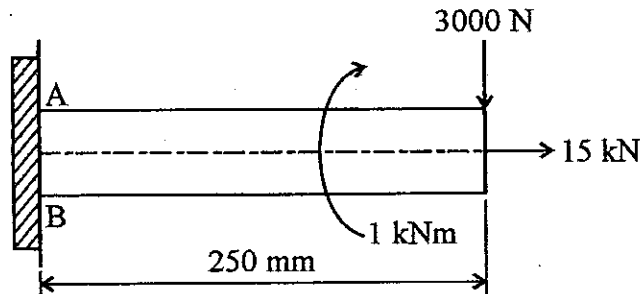
1.
 - (a) What is true stress and true strain ? Derive relationship for true stress and strain in terms of engineering stress and strain.
 - (b) Derive an expression for Euler's critical load for the case of buckling of pin ended column.
 - (c) Derive expression for torque requirement for lifting load in a power screw.
 - (d) What is center of percussion ? How we can calculate center of percussion of a compound pendulum ?
 - (e) Write a note on simple, compound, planetary gear train.



Marks

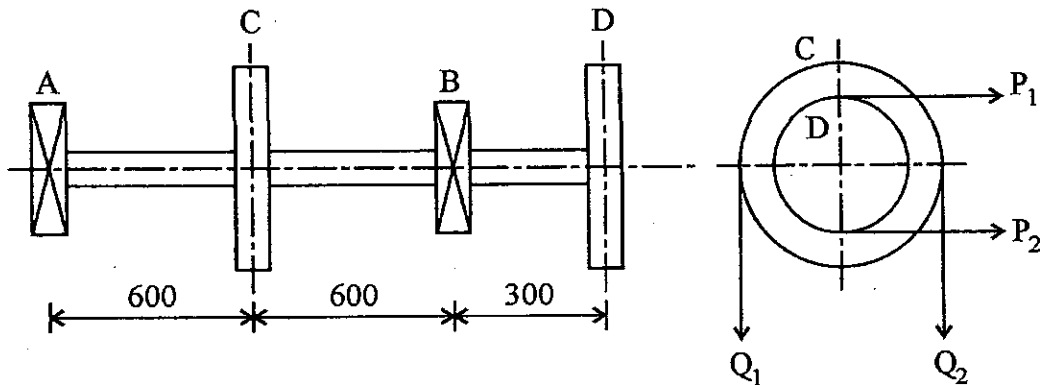
2. A circular rod of 50 mm diameter is subjected to load as shown in figure. Determine the nature and magnitude of stresses at point A and B.

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3. A horizontal shaft AD supported in bearing at A and B and carrying pulleys at C and D is to transmit 75 kW at 500 rpm from drive pulley D to off-take pulley C, as shown in figure. Calculate the diameter of shaft. The data given is $P_1 = 2P_2$ and $Q_1 = 2Q_2$, radius of pulley C is 220 mm, radius of pulley D is 160 mm, allowable shear stress is 45 MPa.

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4. Discuss in detail constant acceleration and deceleration follower motion using necessary derivations and diagram. Comment and show the nature of displacement, velocity, and acceleration curve of such motion.

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SECTION – B

5 × 8 = 40

5. (a) Write short notes on large-particle composites and fibre-reinforced composite.
 (b) Show atomic packing factor for the FCC crystal is 0.74.



- (c) Write a short note on centreless grinding using suitable sketches.
- (d) Discuss gating-system design.
- (e) Write a note on precipitation hardening.
6. (a) State and describe in detail three different mechanisms of strengthening in metals. 40
- (b) Describe recovery, recrystallization and grain growth. How tensile strength and ductility vary during recovery, recrystallization and grain growth ?
7. In an orthogonal cutting test with a tool of rake angle 10° , the following observations were made :
- Chip – thickness ratio = 0.3
- Horizontal component of the cutting force = 1290 N
- Vertical component of the cutting force = 1650 N
- From the Merchant's theory, calculate the various components of the cutting forces and the coefficient of friction at the chip-tool interface. 40
8. Solve following problem using simplex method
- Minimize $f = -40x_1 - 100x_2$
- Subject to
- $$10x_1 + 5x_2 \leq 2500$$
- $$4x_1 + 10x_2 \leq 2000$$
- $$2x_1 + 3x_2 \leq 900$$
- $$x_1 \geq 0 \quad x_2 \geq 0$$
- Further comment on nature of solution. 40
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