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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE, APRIL-2020

APPLIED MECHANICS AND STRENGTH OF MATERIALS

[Maximum marks: 75] (Time: 2.15 Hours)

PART – A

(Answer any ***three*** questions in one or two sentences. Each question carries 2 marks)

I. (1). Define Poisson's ratio.

(2). State perpendicular axis theorem.

(3). What is meant by 'angle of repose'.

(4). Define polar moment of inertia. .

(5). Differentiate between column and strut. (3 x 2 = 6)

PART – B

(Answer any ***four*** of the following questions. Each question carries 6 marks)

II. (1). Define Young's modulus, Rigidity modulus and bulk modulus.

(2). State the laws of dynamic friction.

(3). State and prove parallel axis theorem.

(4). A thin cylinder of 120cm diameter is to carry water under a pressure of 2 N/mm^2. If the longitudinal stress and circumferential stress are not to exceed 30 N/mm^2 and 40N/mm^2 respectively. Determine the suitable thickness of cylinder when the efficiencies of longitudinal and circumferential joints are 70% and 80% respectively.

(5). Explain caulking and fullering operations.

(6). A closely coiled helical spring is made of 6mm wire. The maximum shear stress and deflection under a 200 N load is not to exceed 80MPa and 11mm respectively. Determine the number of coils and the mean diameter. Take modulus of rigidity of the spring material as 84 MPa.

(7). What are the assumptions in the Euler's column theory.

(4 x 6= 24)

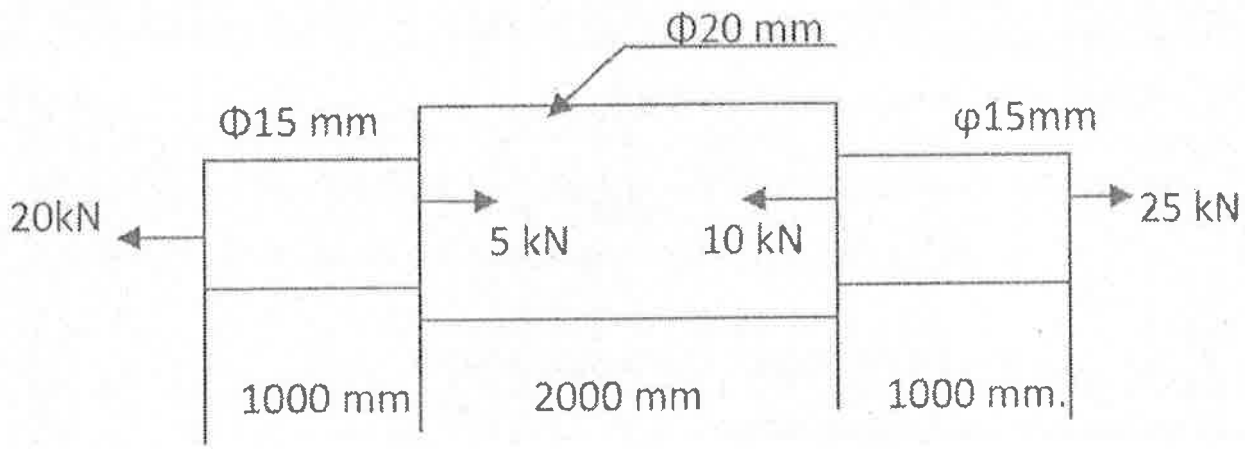
PART – C

(Answer ***any of the three units*** from the following. Each question carries 15 marks)

UNIT –I

III. (a). A reinforced concrete column (500 x 500) mm in section is reinforced with four steel bars of 25mm diameter, one in each corner of the column. The column is carrying a load of 1000 KN. Find the stress in concrete and steel bars. Take E for steel as 210 GPa and E for concrete as 14GPa. (7)

(b). A steel bar is subjected to forces as shown in figure. Find the elongation of the bar. Take E for steel as 200 GPa.



(8)

OR

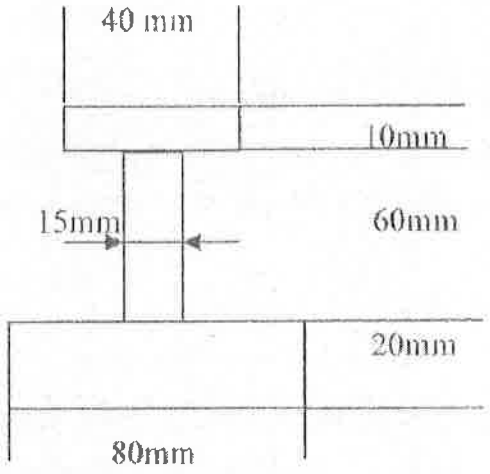
IV. (a). An aluminium rod of 22mm diameter passes through a steel tube of internal diameter 25mm and 3mm thickness. The rod and tube ends are fixed together at a temperature of 180^0C. Find the stress in rod and tube when temperature of the assembly reduced to 60^0C. Take E for Aluminium and steel as 200 GPa and 60 GPa and α for Aluminium and steel as 22.5 x $10^{-6}/^o$ C and 12 x $10^{-6}/^o$ C respectively. (7)

(b). A bar of 30mm diameter is subjected to a pull of 60kN on a gauge length of 200mm, the measured change in length is 0.09 mm and change in diameter is 0.0039mm. Calculate (a). Poissions ratio. (b). Young's modulus. (c). Modulus of rigidity (d). Bulk modulus. (8)

UNIT-II

V. (a). A mass of 50kg is pulled up an inclined plane having 30^0 inclination with horizontal, by a force of 354 N acting parallel to the plane. Find the coefficient of friction. Take $g = 9.81\ m/s^2$. (7)

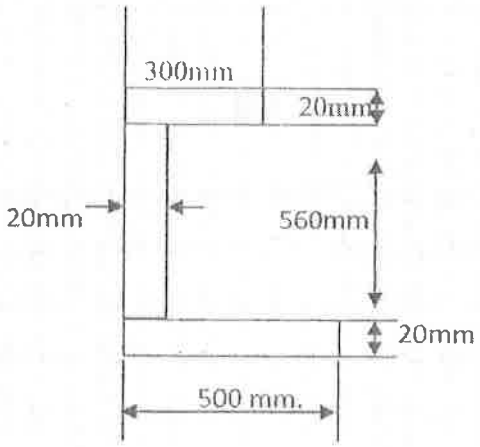
(b). Find the moment of inertia of the given figure.



(8)

OR

VI. (a). Find the centroid of given figure.



(7)

(b). Derive the equation of moment of inertia of a circular section. (8)

UNIT-III

VII. (a). A solid shaft is to transmit 75kW at 200 rpm. The maximum torque is 35% greater than the mean torque. Taking allowable shear stress as $70N/mm^2$, find the suitable diameter of the shaft. (7)

(b). Two plates of 10mm thick are joined by a double riveted lap joint. The diameter of the rivets is 15mm and pitch = 75mm. If permissible tensile stress of plate material, shear stress and bearing stress of rivet are 110 N/mm^2,85 N/mm^2 and 140 N/mm^2 respectively. Determine the efficiency of the riveted joint. (8)

OR

VIII.(a). Explain important terms used in welding with the help of suitable figure. (7)

(b). A hollow shaft having an inside diameter 60% of its outer diameter and has to transmit 200 kW at 80 rpm. If the stress is not to exceed 60MPa, find the diameters of the shaft. (8)

UNIT-IV

IX, (a). Find the cripping load given by Rankine's formula for tubular strut 2.25m long having outer and inner diameter of 37.5mm and 32.5mm respectively loaded through pin joints at both ends. Take yield stress as 315 N/mm^2, a = 1/7500. (7)

(b). A helical spring is made of 12mm diameter steel wire winding it on a 120mm diameter mandrel. If there are 10 active coils, what is the spring constant? Take G = 0.82×10^5 N/mm^2. What force must be applied to the spring to elongate it by 40mm. (8)

OR

X. (a). A wooden beam 100mm wide and 150mm deep is used to support a uniformly distributed load of 1 kN/m over the entire length. The beam is simply supported at the ends. Find the allowable span if maximum defection is limited to $1/400^{th}$ of the span. Take E = 10kN/m. (7)

(b). A simply supported beam having a span of 6m on which a uniformly distributed load of 2 kN/m is acting over 4m from the left support. Draw the shear force and bending moment diagram. (8)