-.25%

(1)What determine the characteristic color of (a)a metal and (b) a transparent nonmetal?(6%)

(2)Define the following terms.(15%)
(a)slip and twinning deformation.
(b)edge dislocation and screw dislocation.
(c)solid solution and intermediate phase.
(d)hard and soft magnetic materials
(e)intrinsic and extrinsic semiconductors.

(3)What are the factors That affect diffusion (4%)

25%

(1) Describe the terms in the following (16%)
(a) galvanic corrosion and crevice corrosion
(b) standard electromotive (emf) series and galvanic series potential
(c) Schottky defect and Frenkel defect
(d) Conduction band and valence band in semiconductor

(2) (a) Briefly describe why there is no bainite transformation region on the continuous cooling transformation (CCT) diagram for an iron-carbon alloy of eutectic composition. (4%)
(b) Do you think that temperature can influence the magnetic characteristics of materials? Scheme a diagram to interpret and also define the Curie temperature. (5%)

. (25%)

(1) A frame ABC travels horizontally with an acceleration a_0 (see Fig. 1). Obtain a formula for the maximum stress σ_{max} in the vertical arm AB, which has length L, thickness t, and mass density ρ. (7%)

(2) Construct the shear-force and bending-moment diagrams for the beam shown in Fig. 2. (8%)

(3) A plastic cylinder P is held between a rigid plate and a foundation (see Fig. 3). Determine the compressive stress σ_p in the plastic when the nuts on the steel bolts S are tightened by one complete turn. Data for the assembly are as follows: length L = 250 mm, pitch of the bolt threads p = 1.2 mm, modulus of elasticity for steel E_s = 200 GPa, modulus of elasticity for the plastic E_p = 7.5 GPa, cross-sectional area of one bolt A_s = 36.0 mm^2, cross-sectional area of the plastic cylinder A_p = 960 mm^2. (10%)

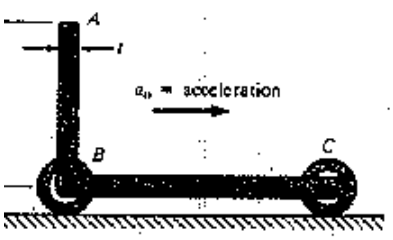

Fig. 1

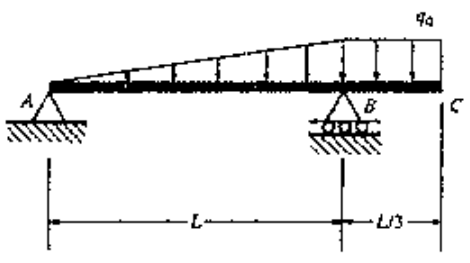

Fig. 2

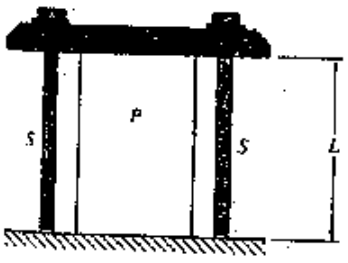

Fig. 3

四. (25%)

(1) A beam is loaded as in Fig. 4.1. Use the equations of equilibrium, $V'(x)+q(x)=0$ and $M'(x)=V(x)$ where $q(x)$ is the distributed load applied to the beam, along with the corresponding integrated forms, to construct the shear and moment diagrams. (15%)

(2) A segmented torsional member is acted upon by the torques shown in Fig. 4.2. The C_i represent the torsional spring constants $C_i = J_i G/L_i$. Determine the rotation at points A and B using Castigliano's second theorem.(Hint: the complementary strain energy can be expressed as $U_i^* = \int_0^{L_i} \frac{T_i^2}{2J_iG_i}dx$) (10%)

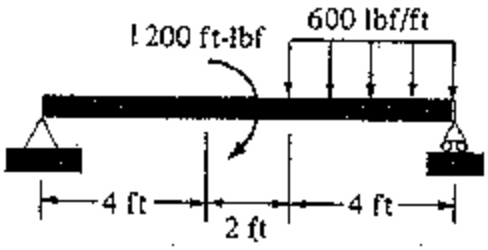

Fig. 4.1.

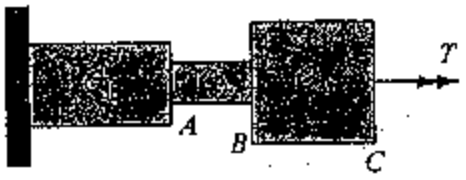

Fig. 4.2