St clements University - Higher Education School
NIUE

HighLight computer Group - IOY Technical college

BACHELOR OF APPLIED ENGINEERING - ELECTRICAL

BAE 404 ENGINEERING THERMODYNAMICS & STRENGTH OF MATERIALS

TEST

100 MARKS
EACH 10MARKS

Q1 $0.113 m^3$ OF AIR AT 8.25 BAR IS EXPANDED IN A CYLINDER UNTIL THE VOLUME IS $0.331 m^3$. CALCULATE FINAL PRESSURE AND WORK DONE IF THE EXPANSION IS
(a) ISOTHERMAL (b) ADIABATIC

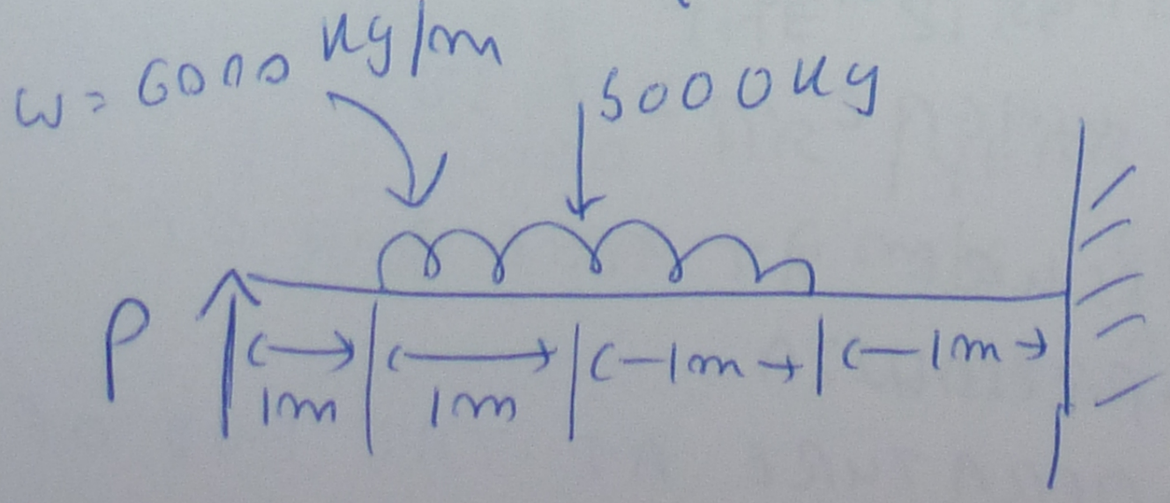
Q2 THE COMPRESSION RATIO OF A COMPRESSION IGNITION ENGINE IS 14 TO 1. THE DIAMETER OF THE CYLINDER IS 500mm AND THE STROKE/BORE RATIO IS 1.2 TO 1 AT THE BEGINNING OF COMPRESSION, PRESSURE AND TEMPERATURE ARE 1.03 BAR AND 51C.
IT FOLLOWS $PV^n = C$. WHERE $n = 1.36$.
CALCULATE (a) PRESSURE AT THE END OF COMPRESSION
(b) TEMPERATURE AT THE END OF COMPRESSION
(c) MASS (d) MASS
(e) INTERNAL ENERGY CHANGE (f) HEAT

Q3 4 lb of AIR AT A PRESSURE OF 100 lb/in² OCCUPIES A VOLUME OF 10 ft³. THIS AIR IS THEN EXPANDED TO A VOLUME OF 50 ft³. FIND THE FINAL TEMPERATURE, THE WORK-DONE AND THE HEAT ABSORBED (OR) REJECTED BY THIS AIR FOR EACH OF THE FOLLOWING METHOD OF EXPANSION

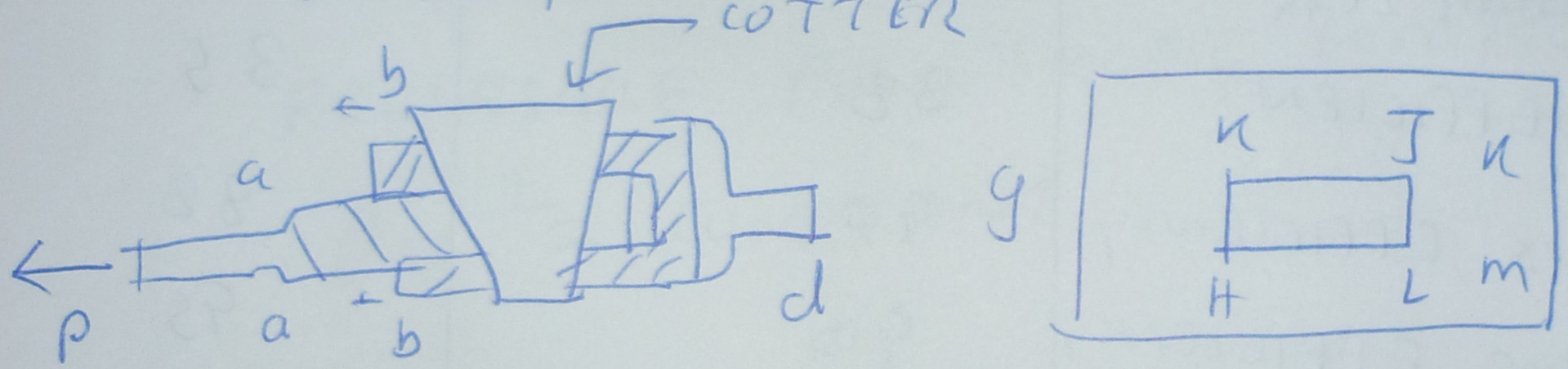
(a) CONSTANT PRESSURE (b) ISOTHERMAL

(c) ADIABATIC (d) $PV^{1.2}$ = CONSTANT

Q4 A CANTILEVER 4m LONG IS SUPPORTED AT THE FREE AND BY A PROP, AT THE SAME LEVEL AS THE FIXED END. A UNIFORMLY DISTRIBUTED LOAD OF 6000 kg/m IS CARRIED ALONG THE MIDDLE HALF OF THE BEAM TOGETHER WITH A CENTRAL CONCENTRIC LOAD OF 5000 kg. DETERMINE THE LOAD ON THE PROP AND THE MAXIMUM BENDING MOMENT (WRITE THE EQUATIONS)



Q5 IN THE JOINT SHOWN, IF THE DIAMETER OF THE ROD IS 5 cm AND THE THICKNESS OF THE COTTER 1.25 cm - FIND THE OTHER DIMENSIONS REQUIRED SO THAT THE STRENGTH SHALL BE AGAINST ALL TYPES OF FAILURE PERMISSIBLE STRENGTHS ARE 300 N/mm² TENSION 150 N/mm² SHEAR IN THE MEMBERS 225 N/mm² IN COTTER AND 450 N/mm² CRUSHING



Q6 IN A DOUBLE RIVETTED LAP JOINT OF PLATES 15 mm THICK, THE RIVETS ARE 21 mm DIAMETER AND THE PITCH IS 60mm THE SHEARING STRENGTH OF THE RIVET MATERIAL IS 345 MN/m² AND THE TENSILE STRENGTH OF THE PLATE IS 420 MN/m². FIND THE % EFFICIENCY OF THE JOINT COMPARED WITH THE RIVET PLATE

Q9 A RECIPROCATING COMPRESSOR DELIVERS 0.1 kg/s OF AIR AT A PRESSURE OF 12 BAR. THE AIR ENTERS THE COMPRESSOR AT A PRESSURE OF 1 BAR AND A TEMPERATURE OF 15°C.

CALCULATE THE DELIVERY TEMPERATURE OF THE AIR, THE WORK TRANSFER AND THE HEAT TRANSFER RATE IN THE COMPRESSION PROCESS FOR REVERSIBLE POLYTROPIC COMPRESSION

$PV^{1.2} = CONSTANT$

Q10 WRITE THE EQUATIONS FOR

(a) LINEAR STRAIN TENSOR

(b) LAGRANGE CAUCHY STRESS TENSOR

(c) EQUATION OF MASS BALANCE