SE-Sem-III - CBSGS - AM-III Mech/Civil 23/11/17

121

Q. P. Code: 11701

(3hours) [Total marks: 80]

N.B. (1) Question No. 1 is compulsory.
(2) Answer **any Three** from remaining
(3) Figures to the right indicate full marks.

1. (a) Find Laplace transform of $e^{-4t} \sin ht \sin t$. 5

(b) Does there exist an analytic function whose real part is $x^3 - 3x^2y - y^3$. Give justification. 5

(c) Show that $\{\cos x, \cos 2x, \cos 3x, \ldots\ldots\}$ is a set of orthogonal functions over an interval $(-\pi, \pi)$. 5

(d) Evaluate $\int_0^{2+i} z^2 dz$ along the line joining the point $z_1 = 0$ and $z_2 = 2 + i$. 5

2. (a) Obtain the Taylor's and Laurent series which represent the function,

$f(z) = \dfrac{1}{(z+1)(z+3)}$ valid in the regions,

(i) $|z| < 1$ (ii) $1 < |z| < 3$ (iii) $|z| > 3$ 6

(b) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into the points $w = 0, i, \infty$. 6

(c) Using Laplace transform, solve the differential equation :

$\dfrac{d^2x}{dt^2} + 4x = t$ with $x(0) = 1$, $x'(0) = -2$ 8

3. (a) Solve $\dfrac{\partial^2 u}{\partial x^2} - 2\dfrac{\partial u}{\partial t} = 0$ by Bender –Schmidt method, given

$u(0,t) = 0, u(x,0) = x(4-x), u(4,t) = 0$, assuming $h = 1$, find u upto t=5. 6

(b) Using convolution theorem find the inverse Laplace transform of

$\dfrac{s}{(s^2+1)(s^2+4)}$. 6

(c) Determine the solution of one-dimensional heat equation $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ under boundary condition $u(0,t) = u(l,t) = 0$, $u(x,0) = x$, l being the length of rod. 8

[TURN OVER]

4. (a) Using Residue theorem, evaluate, $\int_0^{2\pi} \frac{d\theta}{5 + 3\sin\theta}$. 6

(b) Find the inverse Laplace transform of the following:

$$\frac{s^2 + 2s + 3}{(s^2 + 2s + 2)(s^2 + 2s + 5)}$$ 6

(c) Obtain Half Range Sine Series of $f(x) = x(\pi - x)$ in $(0, \pi)$.

Hence, evaluate $-\sum_{m=0}^{\infty} \frac{(-1)^m}{(2m+1)^3}$.

8

5. (a) If $f(x) = e^{-3x}$, $-1 < x < 1$. Obtain Complex form of $f(x)$ in $(-1, 1)$. 6

(b) Find the orthogonal trajectory of the family of curves $3x^2y - y^3 = c$. 6

(c) Solve by Crank –Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t} = 0$,

$u(0,t) = 0$, $u(1,t) = 2t$, $u = 0$, for two time steps taking $h = 0.25$. 8

6. (a) Obtain the Fourier series for $f(x)$ where

$$f(x) = x + \frac{\pi}{2} \quad -\pi < x < 0$$

$$= \frac{\pi}{2} - x \quad 0 < x < \pi$$ 6

(b) Prove that $\int_0^{\infty} e^{-t} \frac{\sin^2 t}{t} dt = \frac{1}{4}\log 5$ 6

(c) Find bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = i, 0, -1$. Hence, find the image of $|z| \leq 1$ onto the w-plane. 8

SE - Sem-III - CBSGS - Mechanical - Thermo 29/11/17

Q. P. Code: 26050

(3 Hours) **[Total Marks 80]**

N. B. : (1) Question No **1** is **compulsory.**
(2) Solve any **three** questions from remaining **five** questions.
(3) Assume suitable data if required.
(4) Use of Mollier Chart, Steam table is permitted.

1. Explain any **four** of the following: - **20**
   (a) What is PMM-I? Why it is impossible?
   (b) Explain principle of increase of entropy.
   (c) What do you mean by high grade energy and low grade energy? Explain with suitable example
   (d) Draw schematic diagram of Rankine cycle with reheat and also draw its T-S and H-S diagrams.
   (e) Explain Brayton cycle with T-S and H-S diagrams.
   (f) Explain adiabatic flame temperature with its practical significance.

2. (a) Differentiate between – **8**
      i) Microscopic and Macroscopic point of view.
      ii) Heat and Work Energy.
   (b) A heat engine operating between two reservoirs at 1000 K and 300 K is used to drive a heat pump which extracts heat from the reservoir at 300 K, at a rate twice that at which the engine rejects heat to it. If the efficiency of the engine is 40% of the maximum possible and the coefficient of performance of the heat pump is 50% of the maximum possible, make calculations for the temperature of the reservoir to which the heat pump rejects heat. Also workout the rate of heat rejection from the heat pump if the rate of supply of heat to the engine is 50 kW. **12**

3. (a) A hot iron forging (specific heat 0.5 kJ/kg K) weighs 30 kg and has a temperature of 500^0C. The forging is dropped into 200 kg oil mass (specific heat 2.5 kJ/kg K) at 25^0C for quenching. Make calculations for the entropy change of forging, entropy change of oil and entropy change of the composite system. It may be presumed that there is no loss of heat to the surroundings. **8**
   (b) Distinguish between surrounding work, useful work and reversible work. **6**
   (c) "An increase in pressure raises the boiling point of a liquid" substantiate it. **6**

4. (a) By burning a fuel, the rate of heat release is 500 kW at 1727^0C. Determine the first law and the second law efficiencies if (**i**) the energy is absorbed in a furnace at the rate of 480 kW at 727^0C, (**ii**) the energy is absorbed at the rate of 450 kW for generation of steam at 227^0C, (**iii**) energy is absorbed in a chemical process at the rate of 300 kW and 47^0C. Take T_0 = 300K. **8**

(b) A steam power plant operates in a Rankine cycle with superheated steam. The inlet steam conditions are pressure 20bar and temperature 360^0C.The steam undergoes isentropic expansion in the turbine and exhausted to a condenser operating at 0.08bar. Determine the efficiency of the cycle. **8**

(c) Define- **4**

i. Dryness fraction
ii. Enthalpy
iii. Internal energy
iv. Entropy

5. (a) In an air standard Diesel cycle, the compression ratio is 16. At the beginning of isentropic compression, the temperature is 15^0C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure process is 1480^0C. Calculate: (i) the cut-off ratio, (ii) the heat supplied per kg of air, (iii) the cycle efficiency, and (iv) mean effective pressure. **12**

(b) Explain flue gas analysis by Orsat apparatus. **8**

6. (a) Derive equation for efficiency of Otto cycle. **5**

(b) Define stoichiometric air, excess air and air fuel ratio. **5**

(c) Define system boundary and surrounding with suitable example and figure. **5**

(d) Write down the SFEE on unit mass basis and apply on turbine and nozzle. **5**

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Q.3 a) The tension flange of a girder of I–section is 240 mm X 40 mm, whereas the compression flange 120 mm X 20 mm. The web is 300 mm deep and 20 mm thick. If the girder is used as simply supported beam of 8 m span, determine the load per m run if the allowable stress is 90 MPa in compression and 30 MPa in tension. **10**

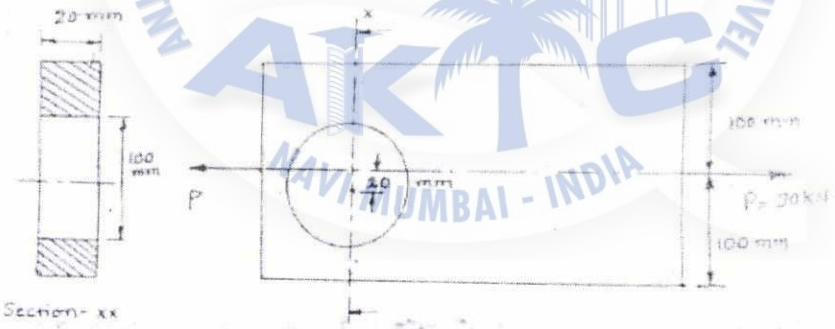
b) A hollow cast iron column whose outside diameter is 300 mm has a thickness of 30 mm. It is 5 m long and fixed at both ends. Calculate the safe load of Rankine formula using a factor of safety 4.Calculate the slenderness ratio and ratio of Euler's critical load to Rankine's critical load.

Take σ_c=550 N/mm^2 and α=1/1600 in Rankine's formula.

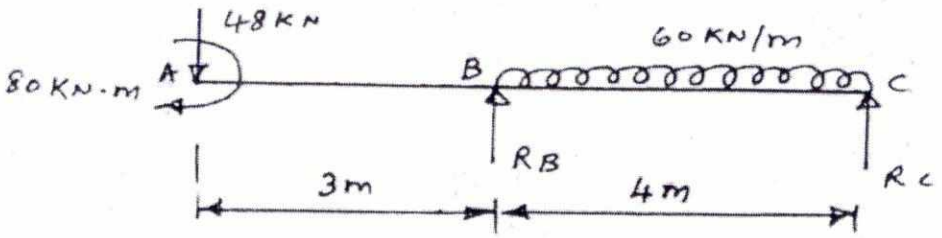
Also take E=8x10^4 N/mm^2 **10**

Q.4a) A hollow shaft of diameter ratio 3/8is to transmit 600 kW at 110 rpm. The maximum torque being 20% greater than mean. The shear stress is not to exceed 63*N/mm*^{2}and twist in a length of3 m is not to exceed 1.4 degrees. Calculate the external and internal diameters which would satisfy both the above conditions. Take G = 8 x 10^4 N/mm^2 **10**

b) Figure below shows a rectangular plate with a hole drilled in it. Determine the greatest and the least intensities of stress at the critical section of the plate when subjected 'to an axial pull of 90 kN. **10**



Q.5 a) A simply supported beam is subjected to the loads as shown in the figure. Determine the maximum deflection induced in the beam. Take value of EI = 1·2 x 10^5 N-m^2. **10**



(19) SE:- Mechanical (CBGS) Sem-III 7/12/201
SOM

Q.P. Code: 27344

Duration: 3 Hours **Total Marks: 80**

N.B.: 1. Question No **1** is **compulsory**
2. Attempt any **Three** questions from the remaining five questions.
3. Assume any **suitable data** if necessary with justification.
4. Figures to the right indicates max. marks

Q.1. Attempt any **four** of the following questions. **20**

a) Draw the shear force and bending moment diagram for a cantilever beam with uniformly distributed load and a concentrated load at the free end.

b) A cantilever 3 m long carries a UDL over the entire length. Find the deflection at the free end if the slope at the free end is 3^0.

c) Derive the relation between E G K.

d) Obtain an expression for strain energy stored due to torsion in a solid shaft.

e) A bar of 12 mm in diameter is acted upon by an axial load of 20 KN. The change in diameter is measured as 0.003 mm. Determine (i) the Poisson's ratio and (ii) the modulus of elasticity and the bulk modulus. The value of modulus of rigidity is 80 GPa.

Q.2 a) A steel tube of 35 mm outer diameter and 30 mm inner diameter encloses a gun metal rod of 25 mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, determine the stress developed in the rod and the tube when the temperature of the assembly is raised to 240°C. Take, **10**

Young's modulus for steel= 205 GPa,

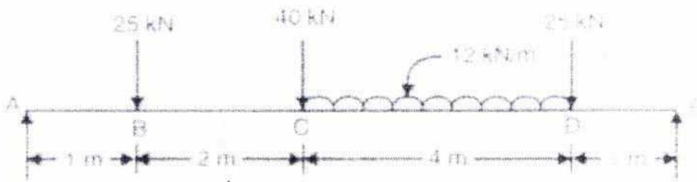
Young's modulus for gun metal = 91.5 GPa

Coefficient of thermal expansion of steel = $11 \times 10^{-6}/^0 C$

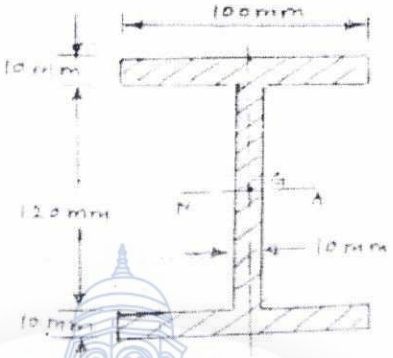
Coefficient of thermal expansion of gun metal = $18 \times 10^{-6}/^0 C$.

Also find the increase in length if the original length of the assembly is 1 m.

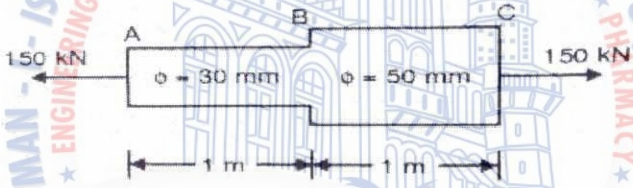
b) Draw the shear force and bending moment diagram for a simply supported beam as shown in the figure. **10**



b) Draw shear stress variation diagram for a beam section shown in figure. Take SF=100KN. **10**



Q.6 a) A steel rod consist of two equal portions each 1 meter long is as shown find the total strain energy of the rod when it is subjected to an axial pull of 150 KN. Take E-200 X 10^3 N/mm^2 **10**



b) An unknown weight falls by 22 mm on to a collar rigidly connected to the lower end of the vertical bar 3 m long and 500 mm^2 in section. If the maximum instantaneous extension is known to be 2.5 mm, find the corresponding stress and the magnitude of the falling weight. Take E = 2 x 10^5 N/mm^2. **10**

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(11) SE - Sem-III - CBSGS - Mechanical - P.P-I 13/12/

Q. P. Code: 24188

[Total Marks: 80]

N.B. A. Question no.1 is **compulsory**.

B .Attempt any three questions out of remaining five questions

C. Figures to right indicates full marks

1. a) Classify various welding process. [5]

b) Explain Rolling defects. [5]

c) How is rod made by extrusion. [5]

d) Compare transfer moulding and compression moulding. [5]

2. a] Differentiate the following: [10]

i) Pattern and core boxes.

ii) Wing core & hanging type of cores

b] Discuss friction welding with its applications. [5]

c] Differentiate between soldering & brazing. [5]

3. a] Explain rotary swaging with its sketch. [6]

b] Describe Calendaring process for plastic with a neat labeled sketch. [6]

c] Describe the basic steps of powder metallurgy process. Discuss applications, advantages and disadvantages of powder metallurgy. [8]

4. a] What is meant by Sintering. [5]

b] Differentiate between core and core print. [5]

c] What is meant by riser? State the functions of riser. [5]

d] Differentiate between TIG & MIG welding. [5]

5. a] List the different NDT methods?Explain ultrasonic process method of inspection. [8]

b] Explain with neat sketch "Radiographic Non-destructive test" [6]

c] Expalin vaccum forming process of polymers. [6]

6. a] With neat sketch explain the working principle of plastic injection moulding process. [5]

b] Write Short note on following: [10]

i) Centrifugal casting.

ii) Transfer moulding process

c] What is meant by forging? Differentiate closed and open die forging. [5]