Sem - III MECH & Prod

App. Maths - III

QP Code : 14535

20-11-14

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

N.B : (1) Question no.**1** is **compulsory**.
(2) Answer any **three** from remaining.
(3) **Figures** to the **right** indicate marks.

1. (a) Find laplace transform of $t^3\cos t$. 5

(b) Find the image of $|z - ai| = a$ under the transformation $w = \frac{1}{z}$. 5

(c) Construct an analytic function whose real part is $e^{2x}(x\cos 2y - y\sin 2y)$. 5

(d) Show that the set of functions $\cos nx$ $n = 1, 2, 3 \ldots$ is orthogonal on $(0, 2\pi)$. 5

2. (a) By using Convolution Theorem. Find invese laplace transform of $\frac{1}{s^2(s+1)^2}$. 6

(b) Find bilinear transformation that maps the points 2, i, -2 onto the point 1, i, -1. 6

(c) Find Fourier Series for $f(x) = \cos mx$ in $(\pi, -\pi)$ where m is not an integer. Deduce that $\cos m\pi = \frac{2m}{\pi}\left(\frac{1}{2m^2} + \frac{1}{m^2-1^2} + \frac{1}{m^2-2^2} \ldots\ldots \frac{1}{m^2-n^2}\right)$ hence show that $\sum_1^\infty \frac{1}{9n^2-1} = \frac{1}{2} - \frac{\pi\sqrt{3}}{18}$. 8

3. (a) Find Complex form of fourier series $f(x) = e^{3x}$ in $0 < x < 3$. 6

(b) Using Crank Nicholoson method solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ subject to $0 \le x \le 1$ $u(0, t) = 0$, $u(1, t) = 0$, $u(x, 0) = 100x(1-x)$ taking $h = 0.25$ in one step. 6

(c) Using laplace transform solve $(D^2+2D+5)y = e^{-t}\sin t$ when $y(0) = 0$ and $y'(0) = 1$. 8

4. (a) Evaluate $\int f(z)dz$ along the Parabola $y = 2x^2$ from $z = 0$ to $z = 3 + 18i$ where $f(z) = x^2 - 2iy$ 6

(b) Find half range cosinc series for 6

$$f(x) = x \quad 0 < x < \pi/2$$
$$= \pi - x \quad \pi/2 < x < \pi$$

(c) Obtain two distinct Laurent's series of $f(z) = \frac{1}{(1+z^2)(z+2)}$ for $1 < |z| < 2$ and $|z| > 2$. 8

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5. (a) By using Bender Schmidt method solve $\frac{\partial^2 f}{\partial x^2} = \frac{\partial f}{\partial t}$ $f(0, t) = f(5, t) = 0$. $f(x, 0) = x^2 (25 - x^2)$ find f in range taking $h = 1$ and upto 5 seconds. 6

(b) Evaluate $\int_0^\infty e^{-t} \frac{\sin^2 t}{t} dt$. 6

(c) Evaluate $\int_0^{2\pi} \frac{\cos 3\theta}{5 - 4\cos\theta} d\theta$. 8

6. (a) A string is stretched and fastened to two points distance ℓ apart. motion is started by displacing the string in the form $y = a \sin\left(\frac{\pi x}{\ell}\right)$ from which it is released at time $t = 0$. Show that the displacement of a point at a distance x from one end at a distance x from one end at time t is given by $y(x, t) = a \sin\left(\frac{\pi x}{\ell}\right) \cos\left(\pi \frac{ct}{\ell}\right)$. 6

(b) If $f(z) = u + iv$ is analytic and $u - v = e^x (\cos y - \sin y)$ find f(z) in terms of z. 6

(c) Evaluate : 8

$L^{-1}(2 \tanh^{-1} s)$

$L^{-1}\left[\frac{s}{(s-2)^6}\right]$.

MECH

Sem-III / Production Process-I / 08-12-14

QP Code :14632

[3 Hours] **[Total Marks: 80**

N.B. :(1) Question No. **1** is **compulsory.**
(2) Attempt any **three** questions from Q.No.- **2** to Q. No. **6.**
(3) All questions **carry** equal marks.

1. Attempt the following questions:—
   (a) Classify various welding processes in detail. 5
   (b) What is meant by blending and compacting in powder metallurgy? 5
   (c) Compare transfer moulding and compression moulding processes. 5
   (d) State the function of a riser. 5

2. Attempt the following question:—
   (a) What is the difference between a core and a core print? 5
   (b) What are the typical application areas of powder metallurgy process? 5
   (c) Describe injection moulding process for thermoplastics with a neat labeled sketch. 5
   (d) Describe MPT process with a neat labelled sketch. 5

3. Attempt the following questions:—
   (a) What is meant by solid state welding processes? List various solid state welding processes. Draw a neat labelled sketch of any one solid state welding processes. 5
   (b) What is meant by sintering? 5
   (c) Describe lamination process for plastics with a neat labelled sketch 5
   (d) What is meant by forging? Differentiate between closed die forging and open die forging. 5

4. Attempt the follwoing questions:—
   (a) Draw neat labelled sketches of the various types of cores used in sand casting? 5
   (b) What is meant by a riser? State the functions of a riser. 5
   (c) What are the limitations of powder metallurgy processes over other competing processes? 5
   (d) Describe calendering process for plastics with a neat labelled sketch. 5

5. Attempt the following questions:—
   (a) Differentiate between MIG welding and TIG welding. 5
   (b) What are the advantages of using a metal pattern? 5
   (c) What is blending and compacting in powder metallurgy? 5
   (d) Describe Ultrasonic Testing process with a neat labelled sketch. 5

6. (a) What is the effect of cold working of metal. 5
   (b) How is swaging process carried out? Draw a neat labelled sketch to support this. 5
   (c) Describe resistance seam welding process with a neat labelled sketch. 5
   (d) Different between direct extrusion and indirect extrusion. Also draw a neat labelled sketch of both of them. 5

SE-III | Strength of Materials | 02-12-14

MECH

QP Code :14593

Time: - 3 hrs. **Maximum Marks:- 80**

N. B.

1. Question no. 1 is compulsory.
2. Answer any THREE out of the remaining FIVE questions.
3. Assumption made should be clearly stated.
4. Assume any suitable data wherever required but justify the same.
5. **Answer to the questions should be grouped and written together.**

Q1 **Answer any four** 20

a) A circular log of timber has diameter D. Find the dimensions of strongest rectangular section to resist moment, one can cut from this log.

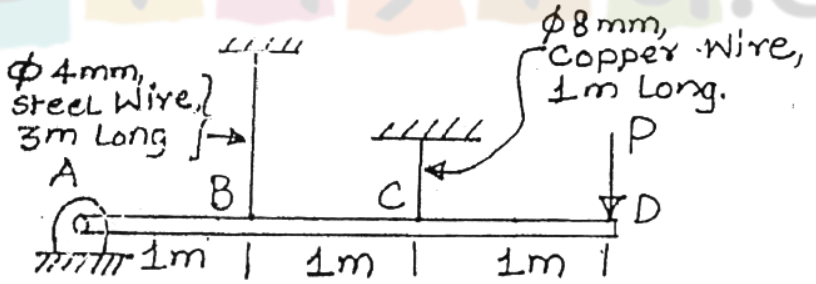
b) Explain beams of Uniform strength.

c) Derive expression for deformation of uniformly Tapering Rectangular section bar.

d) State at least three differences between Torque and Bending Moment.

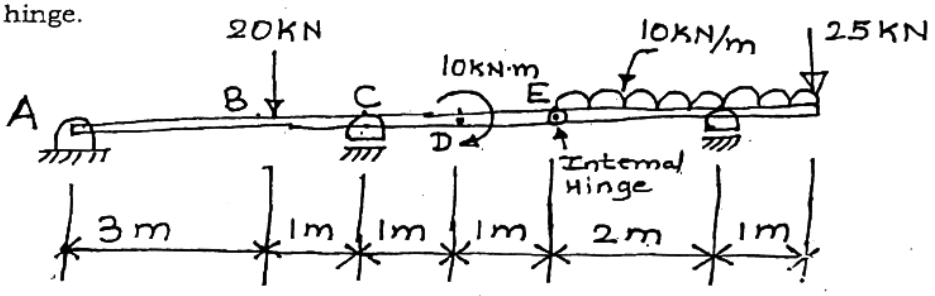
e) State the assumption made in theory of torsion.

Q.2 a) Find the value of P, stress in steel and copper wires if the rigid beam AD rotates clockwise causing a deflection of 3 mm at the D. $E_s=2 \times 10^5$ MPa , $E_c=1 \times 10^5$ MPa. **(10)** 10



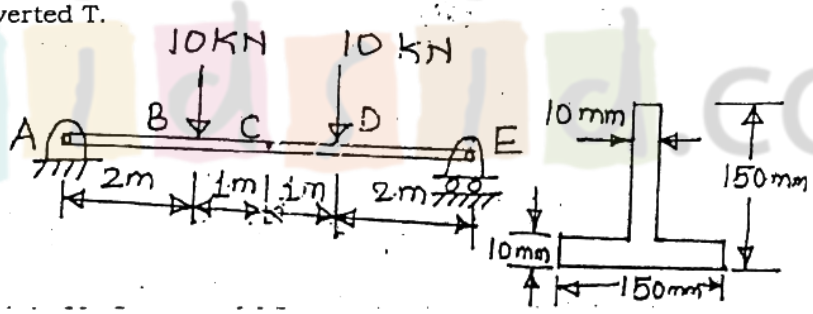
b) A short hallow cylindrical column carries a compressive load of 450kN. Determine the maximum permissible eccentricity of load, if the allowable compressive stress is 75N/mm² & allowable tensile stress is 20N/mm². The external and internal diameters are 200mm and 125mm respectively. Draw the variation of actual resultant stress across the section of the column. 10

Q.3 a) Draw S.F.D. and B.M.D for the beam shown. E is an internal hinge. **10**



b) The end of thin cylinder, 180 mm internal diameter and wall thickness 4 mm are closed by rigid plates and it is then filled with liquid. The cylinder is now subjected to an axial compressive force of 40 kN. Due to this the liquid pressure rises by 0.1 N/mm². Assume E=2.1 X 10^5 N/mm² and 1/m=0.3, calculate the bulk module of liquid. **10**

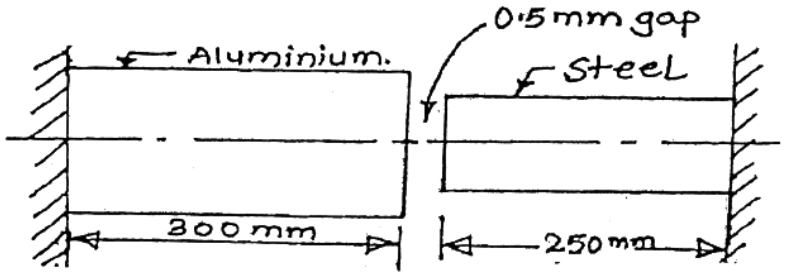
Q.4 a) Find maximum bending stress at point C on the beam AE shown in figure. Note that the cross section of the beam is in the form of inverted T. **10**



b) At 20° C, a gap of 0.5 mm exists between the ends of rods as shown. Taking for aluminum E_{AL} =70GPa, α_{AL} =23 X 10^{-6} / °C, A_{AL}=2000 mm² and for steel E_s=190 GPa, α_s =18 X 10^{-6}/°C, A_s=800 mm². When the temperature reaches 140°C determine: **10**

a) Normal stress in aluminum.

b) Exact length of aluminum rod.



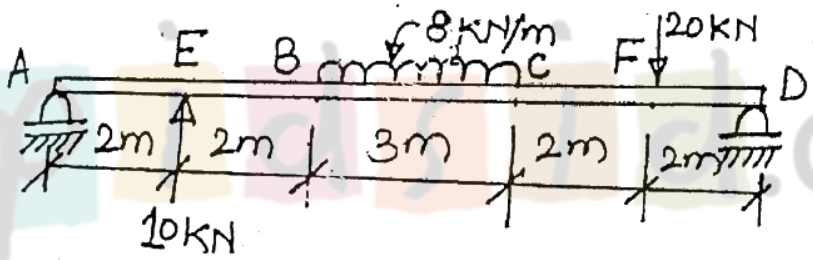
Q5 a) Determine the diameter of the shaft to transmit 1MW rotating at 220 rpm and the working conditions to be satisfied are: **10**

a. that the shaft not twist more than 1^0 on length of 12 diameters and

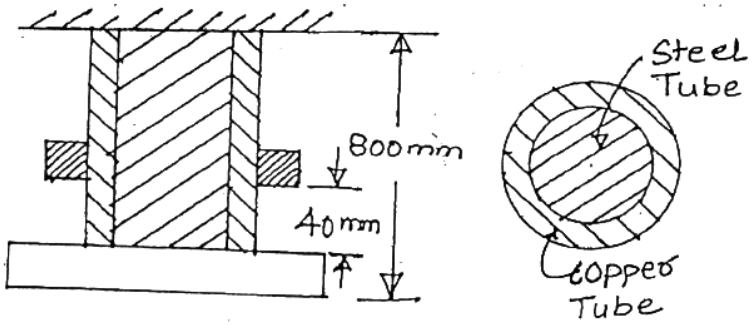
b. the shear stress must not exceed 60N/mm2. Take C=84KN/mm2

b) Find Euler's crippling load for hollow cylindrical column of 200 mm external diameter and 25 mm thick. Both ends of the column are hinged and length of the column is 6 m. Take E= 8 X 10^4 N/mm^2. Compare Euler's crippling load with Rankine's crippling load for the same column. Take f_c=550 MPa & a = 1/1600. For what length of the column the critical loads by Euler's and Rankine's formula will be equal to each other. **10**

Q.6 a) Determine the deflection at B and the slop at D for simply supported beam as shown. Also find the maximum deflection and its location. Take E= 2 X 10^5 N/mm^2 and I=300 X10^8 mm^4. **10**



b) The compound bar shown in figure consists of a 30mm diameter steel rod encased in a copper tube of internal diameter 30mm and external diameter 40mm. Find the stresses produced in steel and copper rod when a load of 100 N falls from a height of 40mm. Take E_s=2 X 10^5 N/mm^2, E_c= 1X 10^5 N/mm^2 **10**



SE-III | Thermodynamics | MECH

26-11-14

QP Code : 14568

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

NB:- i) Question no. 1 is compulsory

ii) Answer any three questions from remaining

iii) Use of steam table & Mollier chart is permitted.

1) Write a short note on any four of the following (5X4)

a) Zeroth law and its significance

b) Absolute thermodynamic temperature scale

c) Principle of entropy increase and its applications

d) Joule- Thomson porous plug experiment

e) Reheat Rankine cycle

2) a) State and prove Clausius Theorem (8)

b) A power washer is being used to clean the walls of house. Water at the rate of 0.1 kg/s enters at 20 °C and 1atm, with the velocity 0.2 m/s. The jet of water exits at 23 °C, 1 atm with a velocity 50 m/s at an elevation of 5m. At steady state the magnitude of the heat transfer rate from power unit to the surrounding is 10% of the power input. Determine the power input to the motor in kW. (12)

3) a) Prove that the difference in heat capacities is $C_p - C_v = \frac{TV\beta^2}{K_T}$ Where β is volume Expansivity and K_T is isothermal compressibility. (10)

b) A household refrigerator is maintained at a temperature of 2°C. Every time the door is opened, warm material is placed inside introducing an average of 420 kJ, but making only a small change in the temperature of the refrigerator. The door is opened 20 times a day and the refrigerator operates at 15% of the Ideal COP. The cost of the work is 4 rupees per kWh. What is the monthly bill for this refrigerator? The atmosphere is at 30°C. (10)

4) a) The swept volume of an engine working on duel cycle is 0.0053 m^3 & clearance volume is 0.00035 m^3. The maximum pressure is 65 bar. Heat addition ends at 5% of the stroke. The temperature & pressure at the beginning of compression are 80 °C & 0.9 bar respectively. Determine i) work done ii) Mean effective pressure iii) air standard efficiency. (10)

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b) A steam turbine is supplied with dry saturated steam at 20 bar . The exhaust takes place at 0.3 bar. For a flow rate of 10 kg/s. Calculate
i) Quality of steam at the end of expansion ii) Power required to drive the pump
iii) Turbine power iv) The Rankine efficiency v) The heat flow in the condenser (10)

5) a) What is an irreversibility? State it's types and causes (6)

b) Air enters a compressor in a steady flow at 140 KPa, 17° C & 70 m/s and leaves at 350 KPa, 127 °C & 110 m/s. The environment is at 100 KPa, 7°C. Calculate per kg of air-
(i)The actual amount of work required (ii)The minimum work required
(iii)The irreversibility of the process (10)

c) Calculate the enthalpy, volume and entropy of 2 kg of steam at a pressure of 1.9 MPa having the dryness fraction of 0.85. (4)

6) a) Prove that the entropy is the property of system (4)

b) 1 Kg of Nitrogen gas at 1 bar and 300K is compressed to 5bar and 400K. Find i) Index of process ii) Work Transfer iii) Heat transfer iv) Change in internal Energy (6)

c) Liquid octane C_8H_{18} at 25°C is used as a fuel. Air used is 140 % of theoretical air & is supplied at 25°C. Assume a complete combustion & the product leaves the combustion chamber at 1500 K. Find the transfer per kg mole of fuel. Use the following data: (10)

substance	h_f^0 (MJ/K mol)	h_{298K} (MJ/K mol)	h_{1500k} (MJ/K mol)
C_8H_{18} (Liquid)	-250	-	-
O_2	-	8.68	49.29
N_2	-	8.67	47.07
H_2O (gas)	-241.8	9.90	57.99
CO_2	-393.5	9.36	71.078

Thermodynamics

Course : Prog. 616 to 630 S.E. (SEM III) (CBSGS) (Even)

Q.P Code : 14568

Correction :

PLEASE READ AS

Q 6 (C) Please read last line as Find the Heat transfer per kg mole of fuel.

Q 6 (B) no correction

Query Update time : 26/11/2014