sem-III / APP. Maths-III / MECH & PROD

31-05-14

QP Code : **NP-18610**

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

N.B. (1) Question no. **1** is **compulsory.**
(2) Solve any **three** questions out of the remaining Q.no. **2** to Q. no. **6.**

1. (a) Find the inverse Laplace transform of

$$\frac{S^2+5}{(S^2+4S+13)^2}$$

(b) If $V = 3x^2y + 6xy - y^3$, show that the function V is harmonic, find the corresponding analytic function.

(c) Evaluate $\int_C \bar{z}dz$ where C is the upper half of the circle $r = 1$.

(d) Prove that $f_1(x) = 1,\ f_2(x) = x,\ f_3(x) = \frac{3x^2-1}{2}$ are orthogonal over $(-1, 1)$.

2. (a) Evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t}\,dt$ 6

(b) Obtain complex form of fourier series $f(x) = e^{-ax}$ for in $(-\pi, \pi)$ 6

(c) Using Crank-Nicholson simplified formula solve , $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$ 8

$u(0,t) = 0,\ u(4,t) = 0,\ u(x,0) = \frac{x}{3}(16 - x^2)$

Find uij for $i = 0, 1, 2, 3, 4$, and $j = 0, 1, 2$.

3. (a) Evaluate $\int_C \frac{\sin^6 z}{\left(z - \pi/6\right)^3}\,dz$ where C is $|z| = 1$ 6

(b) Find the fourier expansion for $f(x) = x - x^2 - 1 < x < 1$ 6

(c) Determine the solution of one dimensional heat equation, $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ under the boundary conditions $u(0, t) = 0$ $u(\ell, t) = 0$ and $u(x, 0) = x$, $(0 < x < \ell)$, ℓ being length of the rod. 8

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4. (a) Find inverse Laplace transform by using convolution theroem, 6

$$f(s) = \frac{s^2}{(s^2 - a^2)^2}$$

(b) Find the image of the region bounded by $x = 0, x = 2, y = 0, y = 2$ in the Z plane under transformation $W = (1 + i) Z$. 6

(c) Find all possible Laurent's expansions of the function $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ about $Z = -1$. 8

5. (a) Solve $\frac{\partial^2 u}{\partial x^2} - 32 \frac{\partial u}{\partial t} = 0$ by Bender-Schmidt method, subject to the conditions $u(0, t) = 0, u(x, 0) = 0, u(1, t) = t$ taking $h = 0.25, 0 < x < 1$. 6

(b) Obtain hlaf range sine series for $f(x)$ when 6

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

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

(c) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2 + a^2)(x^2 + b^2)}$ by using residues. $a > 0, b > 0$ 8

6. (a) Find the orthogonal tranjectory of the family of curves $x^3y - xy^3 = c$. 6

(b) Obtain the fourier expansion of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval 6

$0 < x < 2\pi, \quad f(x + 2\pi) = f(x)$

Also deduce that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots\ldots$

(c) Solve using Laplace transform $(D^2 - 3D + 2) y = 4 e^{2t}$, with $y(0) = -3$ $y'(0) = 5$. 8

Sem-III / Production Process-I / 03-06-14 / MECH

QP Code : **NP-18708**

(3 Hours) [Total Marks : 80

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attemp any **three** questions out of remaining questions.
(3) Illustrate your answers with neat sketches.

1. (a) Explain the various casting detects with their causes and remedies. 10
(b) Explain press forging? Discuss its advantages over hammer forging. 5
(c) Differentiate soldering and brazing. 5

2. (a) A cylindrical riser is to be designed for a sad casting mould. The size of steel casting, is 7.5 cm × 12.5 cm × 2 cm. The provious operation have indicated that the total soliditication time for casting is 96 second. The cylindrical riser have (d/n) = 1. Find the size of riser so that the total soliditication time is 120 seconds. 10
(b) Discuss resistance welding process with its applications. 5
(c) Diffrentiate open the forging and closed die forging. 5

3. (a) Discuss the various defects in rolled parts. 10
(b) Discuss riveted joints state their advantages over other joints. 5
(c) Explain submerged are welding with its applications. 5

4. (a) Explain the stepwise procedure of powder metallurary in detail. 10
(b) Explain the Rotational moulding with its advantages and applications. 5
(c) Explain die penetrant testing method of NDT. 5

5. (a) Explain the screw type injection moulding with neat sketch. Discuss its advantages, limitations and applications. 10
(b) What is powder metalluray? Discuss its advantages, applications and limitatins. 5
(c) Explain with neat sketches different types of flames generated in gas welding? 5

6. Write Short note on (any **four**) :– 20
(i) Pattern materials
(ii) Welding defects
(iii) Ultrasonic testing
(iv) CO_2 welding
(v) Thread Rolling.

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CBGS May-2014 MECH (CBGS)

BE-III | Mech | Strength of Materials

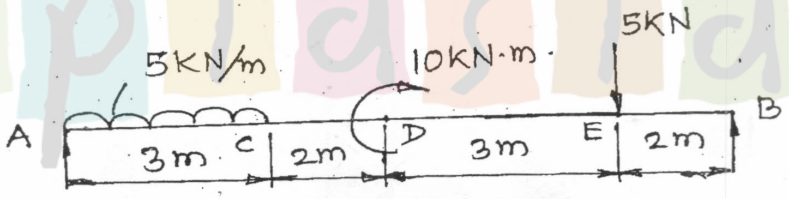
QP Code : **NP-18669**

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

N.B.: (1) Question No.**1** is **compulsory**. Answer any **three** from the remaining **five** questions.
(2) **All** questions carry **equal** marks.
(3) Assume **suitable** data wherever **necessary**.
(4) **Use** of non-programmable calculator is **permitted**.
(5) **Figures** to **right** indicate **full** marks.

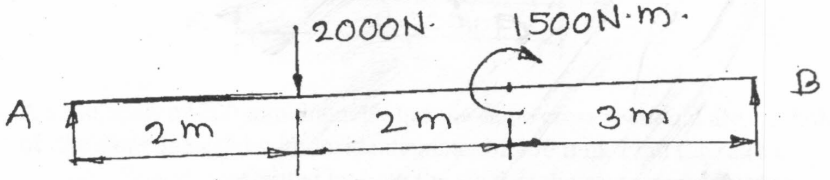
1. Attempt any **four** :— **20**
   (a) What is sagging and hogging in bending moments give its sign conventions.
   (b) Draw stress strain curve for ductile material and explain salient points on it.
   (c) What are the assumptions made in simple bending, derive flexural formula.
   (d) Calculate the strain energy stored in a bar 2m long, 50mm wide and 40mm thick when it is subjected to a tensile load of 60 kN. Take, E = 200 GPa.
   (e) What are the assumptions made in the analysis of struts and column by Eular's buckling theory ? What are its limitations ?
   (f) A steel spherical shell of radius 600 mm has a wall thickness of 6mm. Determine maximum stress caused due to internal pressure of a 0·8N/mm^2. Take, E = 210 GPa and Poisson's Ratio = 0·3

2. (a) A beam of 10m length is acted upon by forces and couple as shown in fig. Draw SFD and BMD. **14**



   (b) Derive the relation between Elastic constants i.e. E, K and G. **6**

3. (a) Find deflection of point B for the beam as shown in figure. **10**



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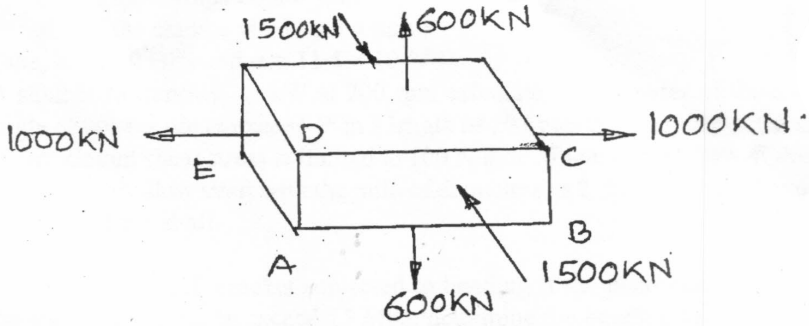
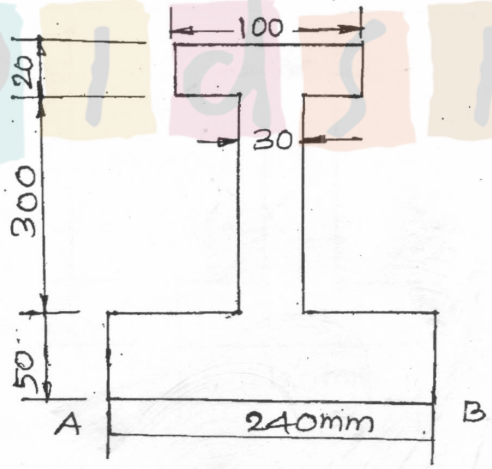
Con. 11998-14.

(b) A rectangular black is loaded as shown in figure. Find the change in dimensions and also change in volume. Take, Poisson's Ratio as 0·3 and E = 210 GPa AB = 500 mm, BC = 200 mm and AE = 400 mm. **10**



4. (a) The tension flange of cost iron I-section beam is 240mm wide and 50mm deep. The compression flange is 100 mm wide and 20 mm deep where as the web is 300 mm ×30 mm. Find the load per meter run which can be carried over a 4 m span by a simply supported beam if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension. **10**



(b) A solid shaft of 200 mm diameter has the same cross sectional area as hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of – **10**

(i) Power transmitted by both the shaft at the same angular velocity

(ii) Angle of twist in equal length of these shaft when stressed to same intensities.

5. (a) A 4 m long steel bar of square cross section of 40 mm side, is heated through 75°C with its ends clamped before heating. Calculate the thrust exerted by the bar on clamps : **10**

(i) if the clamps do not yield

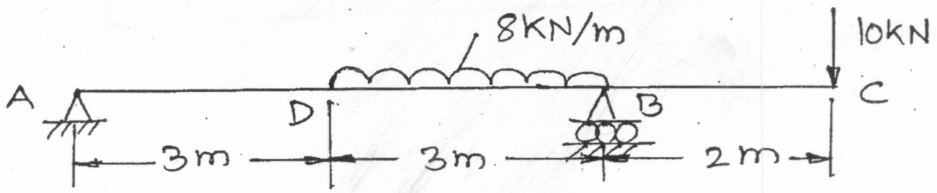
(ii) if the clamps yield by 0·6 mm.

Take, E = 210 GPa and $\alpha = 11{\cdot}5 \times 10^{-6}$/°C

(b) A shaft is to transmit 40 kW at 200 rpm calculate the diameter of the shaft if the angle of twist is not to exceed 1° in a length of 20 times the diameter of the shaft and the maximum shear stress is limited to 100 N/mm^2. Take, G = 84 GPa. If the shaft is replaced by hollow shaft with the ratio of diameters as 2. Find the inside and outside diameter of the shaft. **10**

6. (a) Figure shows a C.I. bracket subjected to bending if the maximum tensile stress in the top flange is not to exceed 15 MPa, determine the bending moment the section can take. If the beam is subjected to shear force of 150 kN. Sketch the stress distribution over the depth of the section. **10**

(b) Determine deflection at free end 'C' for the beam as shown in figure. **10**
Take, E = 210 GPa and I = 15×10^{-6} m^4.



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MECH

SE/Sem-III/MECH/Thermodynamics/May 14

QP Code : **NP-18643**

(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. (a) What is cut-off ratio? How does it affect the thermal efficiency of Diesel cycle? 4
(b) State the Clausius-Clapeyron equation. 4
(c) I kg of steam at a pressure of 17 bar and dryness 0. 95 is heated at a constant pressure until it is completely dry. Determine: (i) Increase in volume (ii) Quantity of heat added. 4
(d) Differentiate between non-flow and flow process. What is steady flow process? 4
(e) Define adiabatic flame temperature and explain its practical significance. 4

2. (a) Derive Maxwell's equations. 4
(b) Show that the efficiency of all reversible heat engines operating between the same temperature limits is same. 8
(c) 0.06 m^3 air at 5 bar and 200°C expands isentropically until the pressure becomes 2 bar. It is then heated at constant pressure until the enthalpy increase during this process is 80 KJ. Calculate work done in each process and total work done. 8

3. (a) What are the four processes which constitute the Stirling cycle? Show that the regenerative Stirling cycle has same efficiency as the Carnot cycle. 6
(b) An engine with 30% efficiency drives a refrigerator having COP of 5. What is the heat input into the engine if 10 MJ of heat is removed from the cold body by the refrigerator? Find total quantity of heat rejected to the surrounding. 6
(c) The products of combustion of an unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat apparatus: 8
CO_2 = 8.0%, CO = 0.9% O_2 = 8.8% and N_2 = 82.3%
Determine : (i) The composition ofthe fuel.
(ii) The air-fuel ratio.
(iii) The percentage excess air used.

4. (a) Define : (i) Dryness fraction 4
(ii) Critical point
(iii) Triple point
(iv) Degree of superheat
(b) 0.6 m^3 of air at 37°C and I bar is heated at constant volume until the pressure becomes 2 bar. It is then cooled at constant pressure to its original temperature. Calculate the change of entropy in each process. 6

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(c) In an air standard cycle pressure at the beginning of compression is I bar, while temperature is 310 K. Compression ratio is 10:1, Heat added is 2800 KJ/Kg of charge. The maximum pressure limit is 70 bar. If heat is added partially at constant volume and partially at constant pressure, find: **10**

(i) Air standard efficiency (ii) Mean effective pressure.

5. (a) Explain: (i) Enthalpy of reaction (ii) Enthalpy of formation (iii) Heating value. **6**

(b) How much of the 1200 KJ of thermal energy at 700 K can be converted to useful work if the environment is at 25°C **4**

(c) A turbocompressor delivers 2.33 m^3/s of air at 0.276 MPa, 43°C which is heated at this pressure to 430°C and finally expanded in a turbine which delivers 860 kW. During expansion there is a heat transfer of 0.09 MJ/s to the surroundings. Calculate the turbine exhaust temperture if changes in kinetic and potential energy are negligible. **10**

6. (a) Derive an expression for availability of a non flow process. **8**

(b) In a reheat cycle steam at 500°C expands in H.P. turbine till it is saturated vapour. It is reheated at constant pressure to 400°C and then expands in L. P. turbine to 40°C.If the maximum moisture content is limited to 15% at the turbine exhaust, find **12**

(i) Reheat pressure.
(ii) The pressure of steam at inlet to H.P. turbine.
(iii) Net specific work output.
(iv) Cycle efficiency.
(v) Steam rate.
