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(314) SE - sem-III - Choice based - Civil/Mech - Am-III

28/11/19

Q. P. Code: 25564

(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 $f(t) = te^{-3t} \sin t$. 5

b) Obtain Complex form of Fourier series of $f(x) = e^x, -1 < x < 1$ in $(-1, 1)$. 5

c) Does there exist an analytic function whose real part is $u = k(1 + \cos\theta)$? Give justification. 5

d) The equations of lines of regression are $3x + 2y = 26$ and $6x + y = 31$. Find i) means of x and y, ii) coefficient of correlation between x and y. 5

2. a) Evaluate $\int_0^\infty e^t \sin 2t \cos 3t \, dt$. 6

b) Find the image of the square bounded by lines $x = 0, x = 2, y = 0, y = 2$ in the z-plane under the transformation $w = (1 + i)z + 2 - i$. 6

c) Obtain Fourier series of $f(x) = |x|$ in $(-\pi, \pi)$. Hence, deduce that – 8

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots$$

3. a) Find the inverse Laplace transform of $F(s) = \frac{s}{(s^2+9)(s^2+4)}$. 6

b) Solve $\frac{\partial^2 u}{\partial x^2} - 100\frac{\partial u}{\partial t} = 0$, with $u(0,t) = 0, u(1,t) = 0, u(x,0) = x(1-x)$

taking $h = 0.1$ for three time steps up to $t = 1.5$ by Bender –Schmidt method. 6

c) Using Residue theorem, evaluate

i) $\int_0^{2\pi} \frac{d\theta}{5 + 4\cos\theta}$ ii) $\int_{-\infty}^{\infty} \frac{dx}{(x^2+1)^2}$ 8

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4. a) Solve by Crank –Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$,

$u(0,t) = 0,\ u(5,t) = 100,\ u(x,0) = 20$ taking $h = 1$ for one-time step. 6

b) Obtain the Taylor's and Laurent series which represent the function

$f(z) = \frac{z}{(z-1)(z-2)}$ in the regions, i) $|z| < 1$ ii) $1 < |z| < 2$ 6

c) Solve $(D^2 - 3D + 2)y = 4e^{2t}$ with $y(0) = -3$, $y'(0) = 5$ where $D \equiv \frac{d}{dt}$ 8

5. a) Find an analytic function $f(z) = u + iv$, if

$$u = e^{-x}\{(x^2 - y^2)\cos y + 2xy \sin y\}$$ 6

b) Find the Laplace transform of $f(t) = t\sqrt{1 + \sin t}$ 6

c) Obtain half range Fourier cosine series of $f(x) = x, 0 < x < 2$. Using Parseval's identity, deduce that – 8

$$\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots$$

6. a) If $f(a) = \oint_C \frac{3z^2+7z+1}{z-a} dz,\ C: x^2 + y^2 = 4$

find the values of $f(3), f'(1-i)$ and $f''(1-i)$ 6

b) Find the coefficient of correlation between height of father and height of son from the following data, 6

Height of father	65	66	67	68	69	71	73
Height of son	67	68	64	68	72	69	70

c) A tightly stretched string with fixed end points $x = 0$ and $x = l$, in the shape defined by $y = kx(l - x)$ where k is a constant is released from this position of rest. Find $y(x,t)$, the vertical displacement if $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$. 8

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(15)

SE-Sem-III- Choice Based- Mechanical- Thermo 29/11/15

Q. P. Code: 24252

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

N. B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **three** out of the remaining **five** questions.
(3) Assume suitable data if required and state it clearly.
(4) Use of Steam Table and Mollier diagram is permitted.

1. Attempt any **four** out of the following **20**
   (a) Define heat engine, refrigerator and heat pump.
   (b) Draw a neat diagram of vane type blower and explain its working.
   (c) Define i) wet steam, ii) superheated steam, iii) dryness fraction, iv) saturation temperature
   (d) What do you understand by mean temperature of heat addition? For a given temperature of heat rejection show how the Rankine cycle efficiency depends on the mean temperature of heat addition.
   (e) State the first law for a closed system undergoing a change of state.

2. (a) A reciprocating air compressor takes in 2 m^3/min at 0.11 MPa, 20^0C, which it delivers at 1.5 MPa, 111^0C to an aftercooler where the air is cooled at constant pressure to 25^0C. The power absorbed by the compressor is 4.15 kW. Determine the heat transfer in the compressor and the aftercooler. **10**
   (b) Derive the first and second Tds equations. **5**
   (c) A lump of 800 kg of steel at 1250 K is to be cooled 500 K. If it is desired to use the steel as source of energy, calculate the available and unavailable energies. Take specific heat of steel as 0.5 kJ/kg K and ambient temperature 300 K. **5**

3. (a) A heat pump working on a Carnot cycle takes in heat from a reservoir at 5^0C and delivers heat to a reservoir at 60^0C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840^0C and rejects heat to a reservoir at 60^0C. The reversible heat engine also drives a machine that absorbs 30 kW. If the pump extracts 17 kJ/s from the 5^0C reservoir, determine i) the rate of heat supply from 840^0C source, and ii) the rate of heat rejection to the 60^0C sink. **10**
   (b) Determine entropy change of universe, if two copper blocks of 1 kg & 0.5 kg at 150^0C and 0^0C are joined together. Specific heats for copper at 150^0C and 0^0C are 0.393 kJ/kg K and 0.381 kJ/kg K respectively. **5**
   (c) Determine the maximum work obtainable by using one finite body at temperature T and a thermal energy reservoir at temperature T_0, $T > T_0$ **5**

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4. (a) A cyclic steam power plant is to be designed for a steam temperature at turbine inlet of 360^{0}C and an exhaust pressure of 0.08 bar. After isentropic expansion of steam in the turbine, the moisture content at the turbine exhaust is not to exceed 15%. Determine the greatest allowable steam pressure at the turbine inlet and calculate the Rankine cycle efficiency for these steam conditions. Estimate also the mean temperature of heat addition. **10**

(b) Derive an expression of air standard efficiency for Otto cycle. **5**

(c) Define volumetric efficiency of a compressor. On what factors does it depend? **5**

5. (a) A mass of air is initially at 260^{0}C and 700 kPa and occupies 0.028 m^3. The air is expanded at constant pressure to 0.084 m^3. A polytropic process with n = 1.50 is then carried out, followed by a constant temperature process which completes the cycle. All the processes are reversible. i) sketch the cycle on p-V and T-s plane, ii) find the heat received and heat rejected in the cycle, and iii) find the efficiency of the cycle. **10**

(b) Show that energy is property of a system. **5**

(c) Write Maxwell's equations. **5**

6. (a) An air standard limited pressure cycle has a compression ratio of 15 and compression begins at 0.1 MPa, 40^{0}C. The maximum pressure is limited to 6 MPa and the heat added is 1.675 MJ/kg. Compute i) the heat supplied at constant volume in kJ/kg, ii) the heat supplied at constant pressure in kJ/kg, iii) the work done per kg of air, iv) the cycle efficiency and v) the m.e.p. of the cycle. **10**

(b) A single stage, double acting air compressor is required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15^{0}C. The deliver pressure is 7 bar and the speed 300 rev/min. Take the clearance volume as 5% of the swept volume with a compression and re-expansion index of n = 1.3. Calculate the swept volume of the cylinder, the delivery temperature and the indicated power. **10**

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SE- MECH-CBCS(Choice Based) 07/12/17

Sem-III -SOM

(159)

QP CODE : 27636

3 hours *Total Marks: 80*

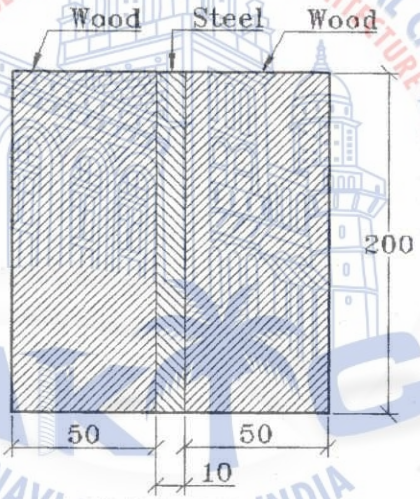
NB

- ***Q1** is **compulsory**. Answer **any three** from the remaining **five** questions.*
- *Assume suitable data, wherever required. Clearly state the assumptions and justify the same.*
- *Illustrate answers with sketches, wherever required.*
- *Write legibly with blue or black ink pen. Use pencil only to draw diagrams and graphs.*

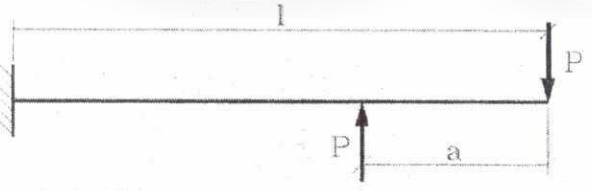
1 *Answer any four of the following:*

a. If a round bar of 37.5 mm diameter and 2.4 m length is stretched by 2.5 mm, find its bulk modulus and lateral contraction. Take, Young's modulus= 110 GN/m^2 and shear modulus = 42 GN/m^2 for the material of the bar. *05*

b. A flitched beam consists of steel and timber as shown in figure. Determine the moment of resistance of the beam. Take σ_s= 100 N/mm^2 and σ_w= 5 N/mm^2. All Dimensions are in mm. *05*



c. Draw the S. F. and B. M. diagrams for the beam loaded shown in the figure. *05*



d. Calculate the bursting pressure for a cold drawn seamless steel tubing of 60 mm inside diameter and 2 mm wall thickness. Ultimate Strength of steel is 380 N/mm^2. *05*

e. Find the maximum power that can be transmitted through a 50 mm diameter shaft at 150 rpm, if the maximum permissible shear stress in the shaft is 80 N/mm^2. *05*

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2a. A beam weighing 450 N is held horizontal by three vertical wires, one attached to the middle of the beam and the others to the ends of the beam. The outer wires are of brass with 1.25 mm diameter, and the central wire is of steel with 0.625 mm diameter. Estimate the stresses induced in the wires, assuming that the beam is rigid and the wires are of same length and un-stretched before attaching to the beam. Take Young's moduli of brass as 8.6×10^4 N/mm^2 and of steel as 2.1×10^5 N/mm^2. *10*

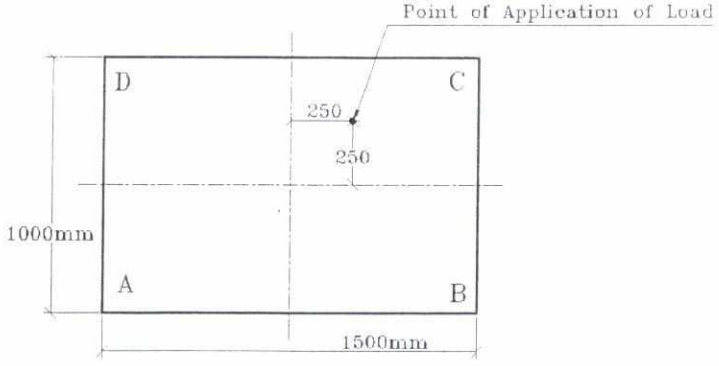
b. At a point in a material under stress, the intensity of the resultant stress on a certain plane is 50 N/mm^2 (tensile) inclined at 30° to the normal of that plane. The stress on a plane at right angles to this has a tensile component of intensity 30 N/mm^2. Find, *10*

i. The resultant stress on the second plane
ii. The principal planes and stresses
iii. Plane of maximum shear and intensity

3a. For the beam shown below, draw A. F., S. F. and B. M. diagrams and mark important points. *10*

b. Determine the slope and deflection at the free end of the beam loaded as shown in the figure. E= 200 GPa, I= 14×10^{-6} m^4 *10*

4a. A rectangular pier is subjected to a compressive load of 450 kN as shown in the figure. Find the stress intensities at the four corners of the pier. *10*



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Internal diameter of a hollow shaft is 0.6 of its external diameter. It has to transmit 300 kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2, find the internal and external diameters of the shaft, assuming that the maximum torque is 1.4 times the mean torque. **10**

5a. A 200 kg weight is dropped on to a collar at the lower end of a vertical bar of 3 m long and 28 mm diameter. Calculate the height of drop, if the maximum instantaneous stress is not to exceed 120 N/mm^2. What is the corresponding instantaneous elongation? Take E= 2 x 10^5 N/mm^2. **10**

b. A simply supported beam, with a span of 1.3 m and a rectangular cross section of 150 mm wide and 250 mm deep, carries a concentrated load of ***W*** at the centre. If the allowable stresses are 7 N/mm^2 for bending and 1 N/mm^2 for shear, what is the value of the safe load ***W***? **10**

6a. A hollow cast iron column of 200 mm external diameter, 150 mm internal diameter and 8 m long has both ends fixed. It is subjected to axial compressive load. Taking factor of safety as 6, $\sigma_c = 560\ N/mm^2, \alpha = \frac{1}{1600}$, determine the safe Rankine load. **10**

b. A weight of 200 kN is supported by three adjacent short pillars in a row, each 500 mm^2 in section. The central pillar is made of steel and the outer ones are of copper. The pillars are adjusted such that at 15 °C, each carries equal load. The temperature is then raised to 115 °C. Estimate the stresses in each pillar at 15 °C and 115 °C. Take: E_s=2x10^5 N/mm^2, E_c= 0.8x10^5 N/mm^2, α_s= 1.2x10^{-5}/°C, α_c= 1.85x10^{-5}/°C. **10**

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159 SE-sem-III- choice Based – Mechanical- P.P – I 13/12/1

Q. P. Code: 26345

Time: 3 Hours **[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. Solve any Four: [20]
   a) What are Transfer machines?
   b) Explain Rolling defects.
   c) How is rod made by extrusion?
   d) With neat sketch explain the working principle of plastic injection moulding process
   e) Differentiate Shaper and Planner

2. a)Differentiate the following: [10]
   i) Pattern and core boxes.
   ii) Lapping and Honing
   b) Differentiate between TIG & MIG welding. [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) How are Milling Machines classified with a neat sketch? Describe any one Milling Machine. [8]

4. a) Explain centreless grinding operation [5]
   b) Differentiate between core and core print. [5]
   c)What is meant by riser? State the functions of riser. [5]
   d) Discuss friction welding with its applications. [5]

5. a) State various vertical machining centres. Describe any one in detail [8]
   b) Differentiate between open loop and closed system in CNC machines. [6]
   c) Explain vacuum forming process of polymers. [6]

6. a) What is meant by forging? Differentiate closed and open die forging. [5]
   b) Write Short note on following: [10]
   i) Machine Tools Classification
   ii) Automatic machines
   c) Compare transfer moulding and compression moulding. [5]

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159 SE-Sem III- Choice Based - Mechanical - M

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19/12/15

Q. P. Code: 26048

Time: **3** hours **Max.Marks:80**

NB: 1. **Q.1 is compulsory.**
2. Solve any **three** from the remaining questions.
3. All questions carry equal marks

Q.1 Answer **any FOUR**: (20)

(a) Difference between steels and cast irons
(b) Allotropic modifications of iron
(c) Classification of materials
(d) Modes of deformation in materials
(e) Stainless steels and its classification

Q.2 (A)Define critical cooling rate. Describe various cooling curves on TTT diagram for eutectoid steel and discuss the transformations. (10)
(B)Explain the property and micro-structure changes occurring during cold working and recrystallization annealing of metals. (10)

Q.3 (A)Draw Fe-Fe_3C equilibrium diagram and label all the important temperatures, composition and phases clearly. Also write the invariant reactions. (10)
(B)Describe the cooling of 0.5%C steel to room temperature. Also find out the proportion of micro constituents in it at room temperature. (10)

Q.4 (A) What is fatigue of metals? Explain the method of testing the metals for fatigue. Discuss the various methods used to increase fatigue life of a component. (10)
(B) What is Hardenability? What are factors affecting hardenability? Explain Jominy End Quench test. (10)

Q.5 (A) How is surface hardening different from case hardening? Discuss any one of the case hardening methods in detail. (10)
(B) A continuous and aligned fibre-reinforced composite is to be produced consisting of 30 vol% aramid fibres in polycarbonate matrix. Find the modulus of the compositein longitudinal direction.(Given: modulus of elasticity for aramid fibre = 131 GPa modulus of elasticity for polycarbonate = 2.4 GPa) (5)
(C) What are smart materials? Discuss a few applications for smart materials. (5)

Q.6 Write short notes on **(Any FOUR):** (20)

(a) Nano materials and their synthesis route
(b) Creep behaviour in metals
(c) Dislocations and strain hardening
(d) Isomorphous phase diagram
(e) Retained austenite
(f) MR fluids

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