CMIL/MOD OH/ADTU/III/CBCGS/AM-III/8/5/18

Q.P. Code : 39159

(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 $f(t) = e^{-t} \sin t . \cos 2t$. 5

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

c) The equations of lines of regression are $x + 2y = 5$ and $2x + 3y = -8$. Find i) means of x and y, ii) coefficient of correlation between x and y. 5

d) Evaluate $\int_c (z^2 - 2\bar{z} + 1)dz$ where C is the circle $|z| = 1$. 5

2. a) Using convolution theorem, find the inverse Laplace transform of 6

$$F(s) = \frac{1}{(s^2+9)(s^2+4)}$$

b) Obtain Fourier series of $f(x) = |x|$ in $(-\pi, \pi)$ 6

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

3. a) If $v = e^x siny$, prove that v is a harmonic function. Also find the corresponding harmonic conjugate function and analytic function. 6

b) Using Bender –Schmidt method, solve $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$, subject to the conditions,

$u(0,t) = 0, u(5,t) = 0, u(x,0) = x^2(25 - x^2)$ taking $h = 1$, for 3 minutes. 6

c) Using Residue theorem, evaluate

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

[TURN OVER]

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

$u(0,t) = 0,\ u(1,t) = 2t,\ u(x,0) = 0$ taking $h = 0.25$ for two-time steps. 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 6

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

b) Find the Laplace transform of $\frac{\sin at}{t}$. Does the L.T of $\frac{\cos at}{t}$ exist? 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) Obtain Complex form of Fourier series of $f(x) = e^x, -1 < x < 1$ 6

b) Fit a straight line to the following data, 6

x	100	120	140	160	180	200
y	0.45	0.55	0.60	0.70	0.80	0.85

c) A string is stretched and fastened to two points distance l apart. Motion is started by displacing the string in form $y = a\sin(\pi x / l)$ from which it is released at a time $t = 0$. If the vibrations of a string is given by $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$, show that the displacement of a point at a distance x from one end at time t is given by $y(x,t) = a\sin(\pi x / l)\cos(\pi ct / l)$. 8

Mech / Auto / Civil / Sem III / CBSGS / Apr-18 / 08/05/18

Q. P. Code: 25569

(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) State Cauchy Reimann equation in polar form. Use them to find p if $f(z) = r^2 \cos 2\theta + i \sin p\theta$ is analytic. 5

b) Find Laplace transform of $f(t) = te^{-3t} \sin t$. 5

c) Find half-range sine series for $f(x) = \frac{\pi}{4}$ in $(0, \pi)$. Hence, show that 5

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$$

d) Evaluate $\int_c (z - z^3)\, dz$, where C is left half of the unit circle from $-i$ to i. 5

2. a) Obtain the Taylor's and the Laurent series which represent the function $f(z) = \frac{2}{(z-1)(z-2)}$ in the regions, i) $|z| < 1$ ii) $1 < |z| < 2$ 6

b) Obtain complex form of Fourier series of $f(x) = e^{-x}$, $-1 < x < 1$ in $(-1, 1)$. 6

c) Using Laplace transform, solve the differential equation, $\frac{dx}{dt} + 2x = \cos \omega t$, with $x(0) = 0$. 8

3. a) 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

b) Find the bilinear transformation which maps the points $z = 0, -1, i$ into the points $w = i, 0, \infty$. 6

c) Obtain Fourier Series of $f(x) = \begin{cases} x, & 0 < x \le \pi \\ 2\pi - x, & \pi \le x < 2\pi \end{cases}$ in $(0, 2\pi)$ 8

Hence, deduce that –

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

[TURN OVER]

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4. a) Find the orthogonal trajectory of the family of curves $2x - x^3 + 3xy^2 = c$ 6

b) Find the Fourier series for $f(x) = 1 - x^2$ in $(-1, 1)$. 6

c) Find the inverse Laplace transform of:

i) $F(s) = \frac{1}{s(s^2+9)}$, using Convolution theorem, ii) $F(s) = cot^{-1}(s+1)$. 8

5. 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) Find the image of the circle $|z| = 4$ in the z-plane under the transformation $w = z + 2 + 3i$. Draw the sketch. 6

c) If $v = 3x^2y + 6xy - y^3$, show that v is harmonic and find the corresponding analytic function $f(z) = u + iv$. 8

6. a) Using Residue theorem, evaluate, $\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$ 6

b) Using Laplace transform, evaluate $\int_0^\infty e^{-t}(1 + 3t + t^2)H(t-2)dt$ 6

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

M E CH / AUTO / III / CBCGS / SEM / 22 / 5 / 18

QP CODE : 27637

(Three Hours) Marks 80

- *Q1 is compulsory. Answer any three from the remaining five questions.*
- *Assume suitable data, wherever required.*
- *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.*

I Answer any four of the following.

a. Define bulk modulus. Derive an expression for Young's modulus, in terms of bulk modulus and Poisson's Ratio. *[05]*

b A short column of external diameter 400 mm and internal diameter 200 mm carries an eccentric load of 80 kN. Find the greatest eccentricity, which the load can have without producing tension on the cross section.

c. State the assumptions in the theory of pure bending and derive the formula, *[05]*

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

d. Find the maximum shear stress induced in a solid circular shaft of diameter 150 mm, when it transmits 150 kW power at 180 rpm. *[05]*

e. A steel bar of 50 mm x 50 mm in section and 3 m length is subjected to an axial pull of 140 N. Calculate the strain energy stored in the bar. Find also the extension of the bar. Take E= 200 GPa *[05]*

f. A cantilever of length 4 m carries uniformly varying load of intensities zero at free end and 2 kN/m at fixed end. Draw shears force and bending moment diagrams for the beam. *[05]*

II a. A compound tube consists of a steel tube of 140 mm internal diameter and 160 mm external diameter, and an outer brass tube of 160 mm internal diameter and 180 mm external diameter. Both the two tubes are of 1.5 m length. If the compound tube carries an axial compressive load of 900 kN, find its reduction in length. Also, find the stresses and the loads carried by each tube. *[10]*

$$E_s = 2 \times 10^5 N/mm^2,\ E_b = 1 \times 10^5 N/mm^2$$

b. A point load of 10 kN applied to a simply supported beam at mid-span, produces a deflection of 6 mm and a maximum bending stress of 20 N/mm^2. Calculate the maximum value of the momentary stress produced, when a weight of 5 kN is allowed to fall through a height of 18 mm on the beam at the middle of the span. *[10]*

III a. Two mutually perpendicular planes of an element of material are subjected to tensile stress of 105 N/mm^2, compressive stress of 35 N/mm^2 and shear stress of 70 N/mm^2. Find graphically or otherwise, *[10]*

i. Magnitude and the direction of principal stresses

ii. Magnitude of the normal and the shear stresses on a plane, on which the shear stress is maximum

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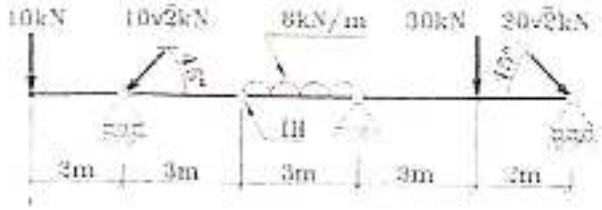
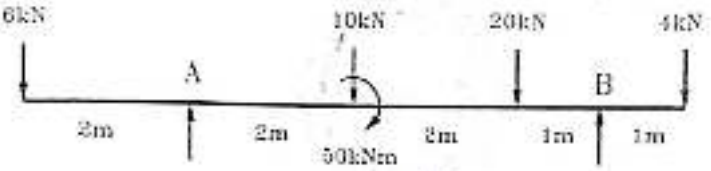
b. Draw axial force , shear force and bending moment diagrams for the beam loaded as shown in figure. Locate all important points. *[10]*



IV a. Determine the position and the amount of maximum deflection for the beam shown in the figure. Take, $EI = 1.8 \times 10^4\ kNm^2$. *[10]*



b. A weight of 200 kN is supported by three adjacent short pillars in a row, each 500 mm² 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=2x10⁵ N/mm², E_c= 0.8x10⁵ N/mm², α_c= 1.2x10⁻⁵/°C, α_s= 1.85x10⁻⁵/°C *[10]*

V a. A hollow shaft, having an internal diameter 40% of its external diameter, transmits 562.5 kW power at 100 rpm. Determine external diameter of the shaft, if shear stress is not to exceed 60 N/mm², and the twist in a length of 2.5 m should not exceed 1.3°. Assume that the maximum torque is 1.25 time the mean torque and $G = 9 \times 10^4\ N/mm^2$. *[10]*

b. A closed cylindrical vessel made of steel plates 4 mm thick with plane ends carries fluid under a pressure of 3 N/mm². The diameter of the cylinder is 250 mm and the length is 750 mm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the changes in diameter, length and volume of the cylinder. *[10]*

$$E = 2.1 \times 10^5 N/mm^2, \quad \frac{1}{m} = 0.286$$

VI a. 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. *[08]*

b. A simply supported beam carries a UDL of intensity 2.5 kN/m over a span of 5 m. The cross-section is T-section having flange 125 mm x 25 mm and web 175 mm x 25 mm. Calculate maximum bending stress and shear stress for the section of the beam. Also, draw the shear stress distribution diagram for maximum shear force. *[10]*

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SEM - III / MECH/AUTO / 03505 / SUM / 22-5-18

Q.P. Code: 27345

Duration: 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) Figures to the right indicate max. marks.

1. Attempt Any FOUR [20]

(a) What is Eular's theory for long columns? List out the assumptions made in it.

(b) A uniform steel bar of 2 m length and 20 mm diameter is subjected to a pull of 60 kN. Determine the stress, change in length, strain energy stored and resilience in the bar when the pull is applied gradually. Take E= 210 GPa

(c) Draw Stress- Strain curve for ductile material & explain salient points on it.

(d) A hollow circular shaft transmits 250 kW power at 400 RPM. Find the diameter of shaft necessary if the allowable stress is limited to100 N/mm^2. Take ratio of diameters as 0.6

(e) Write assumptions made in simple bending and derive flexural formula.

2. (a) A thin cylindrical shell, 3 m long and 1 m in diameter is subjected to an internal pressure of 1 N/mm^2. If the thickness of the shell is 12 mm, find the circumferential and longitudinal stresses. Find also the maximum shear stress and change in dimensions of the shell. Take E = 210 GPa and 1/m = 0.3. [08]

(b) A rectangular block of 220 mm x 130 mm x 60 mm dimension along x, y and z directions respectively. Find the axial tensile forces P_x and P_y acting on the block causing an increase of 0.20 mm along x-direction and 0.00625 mm along z-direction. Find also the decrease in dimensions along y-direction. Take, Poisson's Ratio= 0.3, E = 210 GPa. No load acts along y-direction. [12]

3. (a) A uniform rigid block weighing 200 kN is to be supported on three bars as shown in fig. no. 1. There is a gap of 3.5 mm between the block and the top of the steel bar. Find the stresses developed in the bars. Take, $E_S = 200 \times 10^3$ N/mm^2 and $E_A = 200 \times 10^3$ N/mm^2. Two Aluminium rods are of 20 mm x 20 mm and steel rod of 25 mm x 25 mm as cross section. [12]

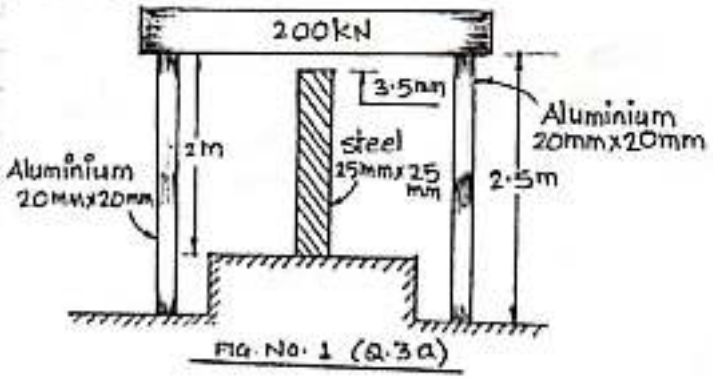

Fig. No. 1 (Q.3 a)

(b) Determine the safe load that the hollow cast iron column having outside diameter 200 mm can carry by Rankine's using formula. The column is 5m long and fixed at both the ends. Take metal thickness = 20 mm, σ_c = 500MPa, E = 94 GPa, 1/α = 1600 and F.O.S. = 4. [08]

4. (a) Calculate maximum deflection at point D, slope at A and maximum deflection in terms of E and I for the beam shown in fig. no 2. [12]

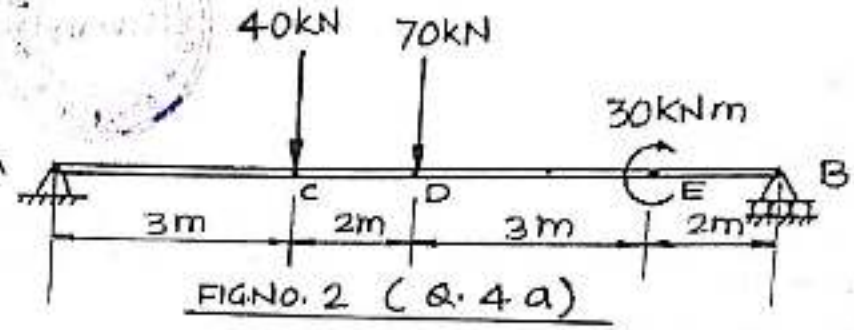

FIG.No. 2 (Q. 4 a)

(b) Find the maximum u.d.l. the simply supported T-beam of span 6 m, as shown in fig. no 3, can carry if the maximum permissible stress is not to exceed 200 MPa. [08]

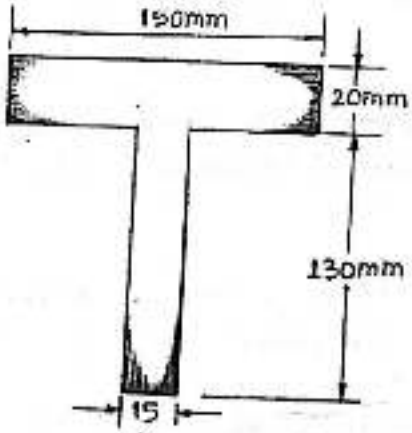

FIG. No. 3 (Q. No. 4b)

5. (a) Draw SFD, BMD and axial force diagram for the beam shown in fig. no 4. Also show the point of contraflexure if any. [12]

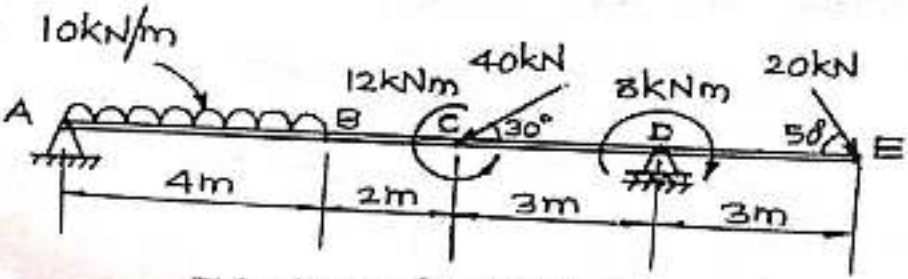

FIG. No. 4 (Q. No. 5a)

(b) A simply supported cast iron beam of inverted T section carries u.d.l. of 1500N/m, as shown in fig. no 5. Draw shear stress distribution across the cross section for maximum shear force for the beam. [08]

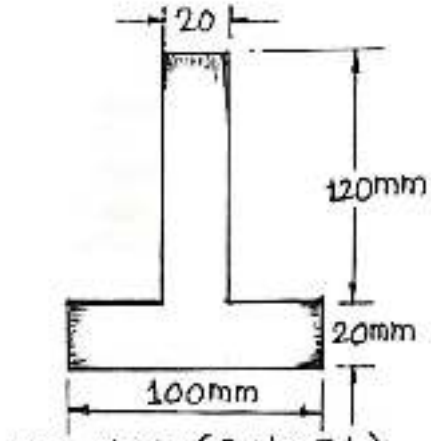

FIG. NO. 5 (Q. NO. 5 b)

6. (a) Draw SFD and BMD for the beam shown in fig. no 6. [10]

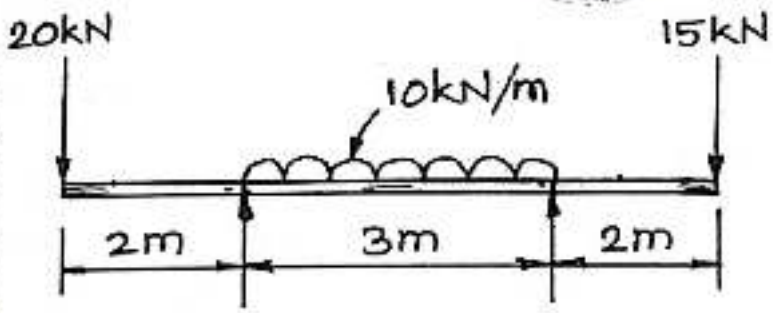

FIG. NO. 6 (Q. NO. 6 a)

(b) Calculate the diameter of shaft if the angle of twist is not to exceed 1^0 in a length of 20 times the diameter of shaft and maximum permissible shear stress is not to exceed 100 N/mm^2. Take, G = 84 GPa. If the shaft is replaced by hollow shaft with the ratio of diameters as 2, find inside and outside diameter of the shaft. A shaft is used to transmit 50 kW at 150 r.p.m [10]

Mech/Auto / Sem V / CBSGS / PP III / 31/05/18

Q. P. Code: 37939

Time : 3 hours **Marks: 80**

Note
1. All questions carry equal marks.
2. Question number one is compulsory.
3. Solve any three questions from remaining questions.
4. Assume suitable data if necessary.

Q.1 Answer **any four** of the following. 20

i) What is high speed machining? What are the requirements of high speed machining?
ii) Write short note on flexible manufacturing system.
iii) Explain general arrangement of two plate injection mould.
iv) Write the difference between jigs and fixtures.
v) Why pilots are used on progressive die? Explain types of pilot.
vi) Explain principle, advantages and limitations of laser beam machining.

Q.2 a) Explain following design principles used to jigs and fixtures. 10

i) Fool proofing
ii) Burr grooves
iii) Ejectors

b) What is indexing? Explain any one type of indexing jig with neat sketch. 10

Q.3 a) Why jig should have four feet not three? 05

b) Write the design principles used for the turning fixtures. 05

c) What is clearance on cutting dies. What are factors affecting clearance? 05

d) What do you mean by bending allowance? Write the factors affecting it. 05

Q. 4 Write short note on the following.

i) Strip layout 05
ii) Double action redraw die. 05
iii) Explain various methods of reducing cutting force in cutting die. 05
iv) With the neat sketch, explain the principle and working of abrasive jet machining. 05

Q.5 a) With neat sketch explain feed system. What is the balanced feed system? Also write factors affecting runner size. 10

b) What is ejection system? List ejection techniques and explain any one of them with neat sketch. 10

Q.6 a) What is agile manufacturing? Also write enablers of agile manufacturing. 10

b) Explain with neat sketch, principle, working, advantages, limitations & applications of EDM. 10

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mech / Auto / sem III / CBGS / MT / 1/6/18

Q. P. Code: 37936

Time: 3 hours Marks: 80

N. B. 1) Question No. 1 is compulsory.
2) Attempt any three questions from remaining five questions.
3) Figures at right indicate marks.

Q. 1 Write notes on **any four**:- (5x4=20)
a) Smart materials
b) Creep Test
c) Effect of Alloying elements on properties of steel.
d) Critical resolved shear stress
e) Classification of Stainless steels

Q. 2 a) What do you understand by Composite materials? Explain their properties and applications. (10)
b) What is Fatigue? Explain fatigue testing in detail. (10)

Q. 3 a) Draw Fe-Fe_3C Diagram and Explain cooling of 0.9 % C alloy in the Fe-Fe_3C Diagram. (10)
b) How are dislocations regenerated at Frank Reed Source? Explain with neat diagram. (10)

Q. 4 a) Draw and explain construction of Time Temperature Transformation (TTT) diagram. Also indicate various cooling patterns on the diagram. (10)
b) Derive an expression for Griffith theory of brittle fracture. Explain Orowan's Modification. (10)

Q. 5 a) Explain slip and twin mechanism of plastic deformation. (10)
b) Classify Crystal Imperfections. Distinguish between Edge and Screw dislocation. (10)

Q. 6 Write short notes on **any four** (5x4=20)
a) Hardenability test
b) Martempering
c) Synthesis of Nanomaterials
d) Recrystallisation annealing
e) Rule of mixtures for composites

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mech / sem III / CBSGS / PP-I / 7/8
Auto

Q. P. Code: 50373

(03Hours) [Total Marks: 80]

N.B. 1) Question No 1 is **Compulsory**

2) Attempt any **three** out of the remaining **five** questions

3) Figures to the **right** indicate full marks

4) Draw neat **sketches** wherever necessary

Q.1 Differentiate between the following **(Any Four)** [20]

a) TIG and MIG welding
b) Thermoplastics & Thermosetting plastics
c) Hot working& Cold working
d) Open Die Forging & Closed Die Forging.
e) Patterns & Core Boxes

Q.2) a) Write short notes on the following [10]

i) Adhesive Bonding

ii) Extrusion Process

b) Compare Press Forging & Drop Forging. b) Explain Weldability. [10]

3. a) Explain - (i) Principle of gating (ii) Principle of risering. [10]

b) Explain any two non-destructive techniques with sketch. [10]

4. a) What is powder metaliurgy? Why gears are manufactured by powder metallurgy? List the advantages of powder metallurgy. [10]

b) Differentiate Welding, soldering and brazing. [10]

5. a) Explain the following welding processes with their applications [10]

i) Resistance welding ii) Submerged arc welding

b) Explain in detail the significance of Production Process-I subject [10]

6. Attempt the following [20]

a) Discuss types of flames in gas welding.
b) Write short note on application of plastics in industries.
c) Describe Ultrasonic testing process with a neat labelled sketch.
d) Discuss Blow Moulding process

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Mech Auto / Sem III / CBCGS / PP-I / 2/6/18

QP Code : 50737

03 Hours [80 Marks]

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

Q1 Attempt any **four** of the following [20]
a. Describe automatic machines.
b. What is thread rolling?
c. How are seamless tubes manufactured?
d. Explain explosive welding
e. Differentiate between arc welding and electron beam welding.

Q2. a. With a neat sketch explain the principle and working of laser beam welding. Also discuss its advantages, limitations and application. [08]
b. Differentiate between the open loop and close loop system. [06]
c. Explain gas cutting operation. [06]

Q3. a. Compare thermoplastics and thermosetting plastics. [08]
b. Describe the desirable properties of moulding sand. [06]
c. What are transfer machines? [06]

Q4. a. Describe types of drilling machines and there application. [08]
b. Explain blow moulding process with a neat sketch. [06]
c. What is riser? Discuss its types and application. [06]

Q5. a. Discuss various defects found in welding. [08]
b. Define weldability and describe the factors affecting it. [06]
c. Differentiate between hot working and cold working processes. [06]

Q6. a. What are the constituents of moulding sand? Discuss their function. [08]
b. Describe machining the operations performed on lathe machine. [06]
c. Define the terms 'Spread', 'Elongation' and 'Draft' with respect to rolling process. [06]

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