Auto | Sem III | CBCGS | AM - III | 20/11 | 2018.

Paper / Subject Code: 50401 / APPLIED MATHEMATICS- III

Q. P. Code: 25565

(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 $f(t) = \int_0^t u\, e^{-3u} \sin u\, du$. 5

b) Show that the set of functions $\{\cos nx, n = 1,2,3 \ldots\}$ is orthogonal on $(0,2\pi)$. 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 $x + 6y = 6$ and $3x + 2y = 10$. Find i) means of x and y, ii) coefficient of correlation between x and y. 5

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

b) Find the image of the triangle bounded by lines $x = 0, y = 0, x + y = 1$ in the z-plane under the transformation $w = e^{i\pi/4} z$. 6

c) Obtain Fourier series of $f(x) = x^2$ in $(0,2\pi)$. Hence, deduce that 8

$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + + \cdots.$$

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

[TURN OVER]

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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.

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

$f(z) = \frac{z-1}{z^2-2z-3}$ in the regions, i) $|z| < 1$ ii) $1 < |z| < 3$

c) Solve $(D^2 + 4D + 8)y = 1$ with $y(0) = 0$ and $y'(0) = 1$ where $D \equiv \frac{d}{dt}$

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

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

b) Find the Laplace transform of

$f(t) = \begin{cases} t, & 0 < t < 1 \\ 0, & 1 < t < 2 \end{cases}$ and $f(t+2) = f(t)$ for $t > 0$.

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

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

6. a) If $f(a) = \int_C \frac{4z^2+z+4}{z-a} dz$ where C is the ellipse $4x^2 + 9y^2 = 36$.

Find. i) $f(4)$ ii) $f'(-1)$ and iii) $f''(-i)$

b) Use least square regression to fit a straight line to the following data,

x	5	10	15	20	25	30	35	40	45	50
y	17	24	31	33	37	37	40	40	42	41

c) A string is stretched and fastened to two points distance l apart. Motion is start by displacing the string in form $y = asin(\pi x / l)$ from which it is released at 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 t displacement of a point at a distance x from one end at time t is given by $y(x,t) = asin(\pi x / l)\cos(\pi ct / l)$.

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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 $f(x) = x|x|$ in $(-1, 1)$. 6

c) Find the inverse Laplace transform of:-

i) $F(s) = \frac{1}{s(s^2+16)}$, 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 $w = z + 4 + 3i$. Draw the sketch. 6

c) Find the analytic function $f(z) = u + iv$ if

$$u - v = \frac{\cos x + \sin x - e^{-y}}{2\cos x - e^{y} - e^{-y}}$$

when $f\left(\frac{\pi}{2}\right) = 0$. 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

Auto/CBSGS/Sem III/ Thermo/28/4/2018.

Paper / Subject Code: 48802 / THERMODYNAMICS

Q. P. Code: 26051

(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) Explain Zeroth law of thermodynamics with its significance.
   (b) Explain principle of increase of entropy.
   (c) What do you mean by available energy and unavailable energy? Explain with suitable example
   (d) Explain Rankine cycle with reheat.
   (e) Explain Atkinson cycle with T-S and H-S diagrams.
   (f) Explain adiabatic flame temperature with its practical significance.

2. (a) What do you mean by steady flow process. Write equation for steady flow process for compressor and boiler. **8**
   (b) A reversible heat engine operates between 875 K and 310 K and drives a reversible refrigerator operating between 310 K and 255 K. The engine receives 2000 kJ of heat and the net work output from the arrangement equals 350 kJ. Make calculations for the cooling effect. **12**

3. (a) Explain:- **8**
      i. State
      ii. Property
      iii. Pure substance
      iv. system
   (b) A lump of steel of mass 8 kg at 1000 K is dropped in 80 kg of oil at 300K Make calculations for the entropy change of steel, the oil and the universe. Take specific heats of steel and oil as 0.5 kJ/kg K and 3.5 kJ/kg K, respectively. **8**
   (c) Show that entropy is a property of system **4**

4. (a) Water at 25°C is to be heated to 80°C by utilizing the heat available from a source at a steady temperature of 500°C. If the ambient temperature is 20°C, what would be the (i) gain in availability of the water? (ii) Effectiveness of the heating process? **8**
   (b) A steam power plant operates ideally in the basic Rankine cycle. It receives 4 Mpa steam from the boiler firing coal to liberate heat at a steady rate of 100 MW. The steam after expansion in the turbine is exhausted to a condenser that operates at 7.5 kPa. **8**
   Calculate the:-
      i. cycle efficiency
      ii. work ratio for the cycle
      iii. power output (MW) of the plant
      iv. mass flow rate of the working fluid
      v. specific steam consumption

[TURN OVER]

(c) Draw T-S and H-S diagram for steam 4

5. (a) In an air standard Otto cycle has a compression ratio of 8, temperature and pressure at the beginning of compression are 20°C and 1bar respectively. The constant volume Heat addition is 1800 kJ/kg. Calculate the maximum temperature and pressure of the cycle and the temperature of the end of compression process. What are the efficiency and mean effective pressure (mep) of the cycle?. 12
Take Cv = 0718 kJ/kg K and γ = 1.4

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

6. (a) What is cut-off ratio? How does it affect thermal efficiency of Diesel cycle? 5

(b) Explain: (i) Enthalpy of reaction (ii) Enthalpy of formation. 5

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

(d) Explain Joule's experiment. 5

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Auto / CBCGS / Sem III / Thermo / 28/11/2018

Paper / Subject Code: 50402 / THERMODYNAMICS

Time: 3 Hours

Q. P. Code: 39993

80 Marks

NOTE:

- Question No 1 is **COMPULSORY**.
- Attempt any **THREE** questions from question number 2 to 6.
- Assume suitable data if required and state it clearly.
- Use of steam table & Mollier chart is permitted.

1. Solve the following **(any Four)** **20**
   (a) State first law of thermodynamics for closed system. State its limitations.
   (b) Explain heat engine, heat pump and refrigerator with the help of neat sketch.
   (c) Explain free air delivered and volumetric efficiency. Write their equations also.
   (d) Define: available energy, dead state and irreversibility.
   (e) Explain working of Otto cycle with the help of PV and TS diagram. Write the equation for efficiency of the cycle.
   (f) Define types of steam and represent it on p-v diagram for water.

2. (a) 3 kg of air at a pressure of 150 kPa and temperature 360 K is compressed polytropically to 750 kPa according to law $PV^{1.33}=C$. The gas is then cooled to initial temperature at constant pressure. The air is then expanded at constant temperature till it reaches original pressure of 150 kPa. Draw the cycle on p-V diagram and determine net work and heat transfer. **12**
   (b) Prove that energy is property of the system. **8**

3. (a) In a steady flow device, the inlet and outlet conditions are given below. Determine the heat loss or gain by the system in kW. Fluid flow rate through the device is 2.1 kg/s and work output of the device is 750 kW. **8**

Property	Inlet	Outlet
Pressure (bar)	10	8.93
Specific enthalpy (kJ/kg)	2827	2341
Velocity (m/s)	20	120
Elevation (m)	3.2	0.5

   (b) Explain Kelvin-Planck & Clausius statement with the help of sketch. **6**
   (c) A heat engine receives 1000 kW of heat at const temp of 285°C. The hear is rejected at 5 °C. The possible heats rejected are: 840kW, 492kW and 300 kW. Classify the cycle into reversible, irreversible and impossible using Clausius Inequality theorem. **6**

4. (a) Define Critical Point and Triple point. Draw p-T diagram for water and show these points on it. **6**
   (b) Write four Maxwell relations. **4**
   (c) A house is maintained at a temperature of 20°C by means of a heat pump in winter by pumping heat from the atmosphere. Heat losses through the walls of the house are estimated at 0.65 kJ/K temperature different between inside of the house and outside atmosphere. **10**
      (i) If atmospheric temperature is −10°C, what is minimum amount of power required to drive the heat pump?
      (ii) It is proposed to use the same heat pump to cool the house in summer. If the same amount of power is supplied to heat pump then what is the maximum permissible atmospheric temperature?

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5. (a) Draw Carnot cycle, Stirling cycle and Ericsson cycle on common T-S diagram. Mention all the process on the diagram. 6
   (b) Write the classifications of air compressors. 4
   (c) A single stage, single acting reciprocating air compressor delivers 0.6 kg/min of air at 6 bar. The temperature and pressure at the suction stroke are 30°C and 1 bar respectively. The bore and stroke are 100 mm and 150 mm respectively. The clearance volume is 3% of the swept volume and index of expansion and compression is 1.3. Determine (i) Volumetric efficiency of compressor (ii) Indicated power (iii) Speed of the compressor in rpm. 10

6. (a) A steam power plant has boiler and condenser pressure of 60 bar and 0.1 bar respectively. Steam coming out of the boiler is dry and saturated. The plant operates on Rankine cycle. Calculate the thermal efficiency of the cycle. 5
   (b) Explain the working of vane type rotary air compressor with the help of sketch. 5
   (c) In an air standard Dual cycle, pressure and temperature are 0.1 MPa and 27°C. Compression ratio is 18. The pressure ratio for constant volume part of heating process is 1.5 and volume ratio for the constant pressure part of heating is 1.2, Determine (i) Thermal efficiency (ii) Mean effective pressure in MPa. 10

Auto / CBSGS / Sem III / SOM / 4/12/2018

Paper / Subject Code: 48803 / STRENGTH OF MATERIALS

Time -03 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 indicate full marks.

Q1. Attempt any **four** of the following questions.

(a) State the physical significance of core of section. What is the limit of eccentricity of Section of solid rectangular column and hollow circular cylinder **05**

(b) Draw the relativity of stress with strain for ductile and brittle material **05**

(c) What are the limitations of Euler's theory? State the corrections made by Rankin Also state the different end conditions for column. **05**

(d) What is pure Torsion? State the assumption made in the theory of pure torsion. **05**

(e) What do you mean by temperature stresses? Explain. **05**

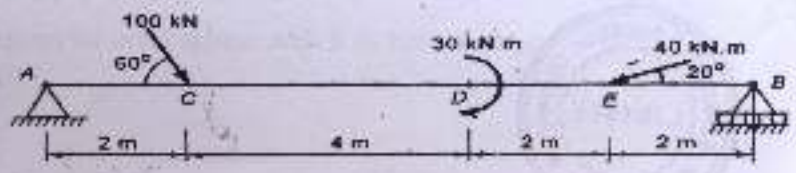
Q2. (a) A 10 mm steel rod passes centrally through a copper tube of 25mm external diameter and 15 mm internal diameter and 2.5 m long.Tube is closed at each end by 25 mm thick steel plates secured by nuts.The nuts are tightened until the copper tube is reduced in length by 0.8 mm.The complete assembly then raised in temperature by 30 degree centigrade. Determine the stresses in steel and copper tubes before and after the rise in temperature. **12**

Take, $E_s = 2 \times 10^5 N/mm^2$, $E_c = 1 \times 10^5 N/mm^2$,
Coefficient of thermal expansion of steel = $12 \times 10^{-6}/^0 C$
Coefficient of thermal expansion of copper = $18 \times 10^{-6}/^0 C$.

(b) A4 m long cast iron hollow column with both ends firmly fixed supports an axial load of 400 KN.The inside diameter of the column is 0.6 times the external diameter. Determine the section of the column. Assume factor of safety to be 5. **08**
Take $\sigma_c = 560 N/mm^2$ and $\alpha = 1/1600$.

Q3. (a) A cantilever beam has a length of 2 m. It is of "T" section with the flange of 100 mm x 15 mm, web 200 x 10 mm. Determine the maximum load per m run that can be applied if the maximum tensile stress is not to exceed 25 N/mm^2. **12**

(b) Drawshear force and bending moment diagram for the beam loaded as shown in the figure **08**



Q4. (a) A hollow circular shaft having 5 mm thickness is used for transmitting 250 kW power at 500 rpm. Determine the external and internal diameters of the shaft, if the permissible shear stress for the material of shaft is 50 N/mm^2.The maximum torque being 20% greater than mean torque. Take $G = 8 \times 10^4 N/mm^2$. **10**

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(b) A load of 75 KN is carried by a column made of cast iron. The external and internal diameters are 200 mm and 180 mm respectively. If the eccentricity of the load is 35 mm, find: 1.The maximum and minimum stress intensities.

2. Upto what eccentricity there is no tensile stress in the column?

Q5. (a) Find the deflections of points B and C for the beam shown in figure.
Assume EI = constant. Point A is a fixed support and point E is a roller support in the figure.

(b) State the assumptions made in the theory of pure bending and prove:

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

6. (a) A symmetrical I-section has flanges 100 mm x 20 mm and web 300 mm x 20 mm. Draw shear stress distribution diagram for a the section when web is horizontal as shown in figure. Take SF=100KN.

(b) An unknown weight falls though 8 mm on to a collar rigidly connected to the lower end of the vertical bar 4m long and 800 mm^2 in section. If the maximum instantaneous extension is known to be 3 mm, what is the corresponding stress and the value of the unknown weight? Take E = 2 x 10^5 N/mm^2.

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Auto | Sem III | CBCGS | SOM | 4/12 | 2018.

Paper / Subject Code: 50403 / STRENGTH OF MATERIALS

Time: 3 Hours **Total Marks: 80**

N:B

- Q1 is compulsory answer any three from remaining.
- Assume suitable data wherever required.
- State the assumptions and justify the same.
- Write legibly with blue or black ink pen. Use pencil only to draw diagrams and graphs.

I Answer any four from the following.

a. A bar of 20 mm diameter is subjected to a pull of 50 kN. The measured extension over a gauge length of 20cm is 0.1 mm and the change in diameter is 0.0035mm calculate the Poisson's ratio and modulus of elasticity. [5]

b. A short column200mm x 100mm is subjected to an eccentric load of 60 kN at an eccentricity of 40 mm in the plane bisecting the 100 mm side .find maximum and minimum intensities of stresses at the base. [5]

c. A M.S. plate is 400 mm long 200mm wide and 50mm thick is subjected to gradually tensile load 1200 kN calculate i)proof resilience ii) modulus of resilience take $E=200x10^3$ MPa. [5]

d. State torsion formula explain meaning of each term. Also state Assumptions made in theory of torsion. [5]

e. A cantilever beam 4m span carrying udl of 5kN/m and permissible bending stress in the material of beam is $15N/mm^2$. Design the section of beam if depth to width ratio is 2. [5]

f. State Assumption made in theory of bending also state bending formula. [5]

II a.A wagon weighing 35 kN is attached to a wire rope and moving down an incline plane at speed of 3.6 kmph. When the rope jams and wagon is suddenly brought to rest. If the length of rope is 60 m. at the time sudden stoppage. Calculate the maximum instantaneous stress and maximum instantaneous elongation produced , diameter of rope is 40mm. take $E=2.1x10^5N/mm^2$ [10]

b.A compound tube consist of a steel tube of 140mm ID and 160 mm OD and an outer brass tube of 160mm ID and 180mm OD. Both the tube are 1.5 m in length. If the compound tube carries an axial compressive load of 900 kN. find its reduction in length also find stresses and the load carried by each tube .E_c= 200 GN/m^2 $E_b=1x10^5N/mm^2$. [10]

III.a At a certain point in a strained material, σ_x= 100 MPa (T), σ_y=40 MPa (C), and shear stress τ=30MPa. Locate the principle planes and evaluate the principal stresses Also find the maximum shear stress and the plane carrying it . Use Mohr's circle method. [10]

b. Draw SF and BM diagram for beam shown with B as internal hinge. [10]

IV.a.A hollow shaft of diameter ratio 3/8(d_i to d_o) is to transmit 375 KW power at 100 rpm. the maximum torque being 20% greater than the mean .the shear stress is not to exceed than 60 N/mm^2 and

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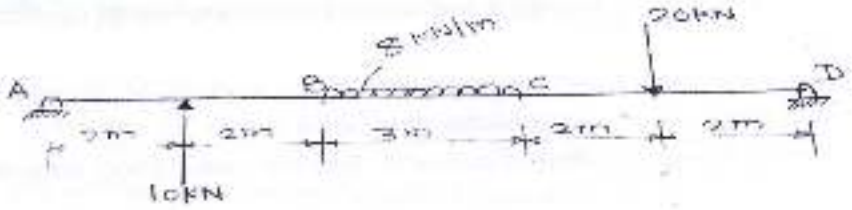
twist in a length of 4 m not to exceed 2°, calculate its external and internal diameter which would satisf both the above condition take G=0.85x10^{5}N/mm^2. [10]

b.Acylindrical shell one meter in diameter and 3 m long has a thickness of 10 mm if it is subjected to a internal pressure of 3N/mm^2. Calculate change in length, change in diameter, change in volume. Take E=210kN/mm^2 and μ=0.3 [10]

V.a.Find the stresses in the wires of the system made of two copper wire and one steel wire of equal length &65 mm^{2}cross sectional area the load of 18 kN is attached to it. The temperature of the system rises by 10°C assume α_c=16x10^{-6}/° C , E $_c$=110kN/mm^2

α_s=12x10^{-6}/° C , E$_s$=210kN/mm^2 [10]

b.Determine the deflection at B and slope at D for simply supported beam as shown. Also find the max.deflection and its location take E= 200 GN/m^2 and I=300x10^{6}mm^4. [10]



VI.a. A hollow cylindrical CI column is 4 m long with both ends fixed . determine the minimum diameter of the column , if it has to carry a safe load of 250kN with a FOS of 5. Take internal diameter as 0.8 times the external diameter E= 200 GN/m^2. [10]

b.A simply supported beam of length 3m and cross section of 100mm x 200mm carrying a udl of 4kN/m neglecting the weight of beam find

i)Max.bending stress in the beam.

ii)Max.shear stress in the beam

iii) The shear stress at a point 1 m to the right of the left support and 25 mm below the top surface of beam. [10]

AUTO / SEM - III / CBSGS / PP - I / 11.12.18

Paper / Subject Code: 48804 / PRODUCTION PROCESS - I

Q. P. Code: 50375

(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

1. Attempt **any four** of the following [20]

a) Mechanism of sintering
b) Thread rolling
c) Centrifugal Casting
d) Carbon Arc Welding
e) Blow Moulding

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

b) Explain rotary swaging with its sketch? [10]

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

b) What is weldability? Discuss various welding defects. [10]

4. a) Explain vacuum forming process of polymers. [5]
b) Differentiate Welding, soldering and brazing. [5]
c) Write short note on Pattern materials [5]
d) Differentiate between open and closed die forging. [5]

5. a) Compare TIG and MIG welding. [10]
b) What is powder metallurgy? Why gears are manufactured by powder metallurgy? List the advantages of powder metallurgy. [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) What are the limitations of powder metallurgy processes over other competing processes?

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Auto / sem III / CBCGS / PP-I / 11/12/18

Paper / Subject Code: 50404 / PRODUCTION PROCESS - I

QP Code: 50738

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. Write a short note on any **four** of the following [20]
a. Compare brazing and soldering.
b. CO_2 moulding
c. Thread rolling
d. Explosive welding
e. Lapping and Honing

Q2. a. With a neat sketch explain the principle and working of thermit welding. Also discuss its advantages, limitations and application. [08]
b. Differentiate between the open loop and close loop system. [06]
c. Explain the types of flames used in gas welding. [06]

Q3. a. Describe the desirable properties of pattern materials. [08]
b. Describe machining the operations performed on lathe machine. [06]
c. What are automatic machines? Write its classification. [06]

Q4. a. Describe the classification, selection procedure and application of drilling machine. [08]
b. Explain blow moulding process with a neat sketch. [06]
c. Differentiate between pattern and core box. [06]

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

Q6. a. With the help of a neat sketch explain the gating system in casting process. [08]
b. Define the terms 'Spread', 'Elongation' and 'Draft' with respect to rolling process. [06]
c. Compare thermoplastics and thermosetting plastics. [06]

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AUTO / III / CBCGS / MT / 17-12-18

Paper / Subject Code: 50405 / MATERIAL TECHNOLOGY

Time: 3 hours **Total marks :80**

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

Q.1 Answer any **four** from the following: **20**

1. Hume–Rothary gave governing conditions for formation of solid solutions. Discuss the conditions.
2. Discuss the differences between slip and twinning.
3. Why FCC metals are more ductile than BCC and HCP metals?
4. What are nanomaterials? Discuss some of their applications.
5. What are limitations of Plain carbon steel? Explain the effect of alloys on phase transformations.

Q.2

1. Define critical cooling rate. Describe various cooling curves on TTT diagram. What factors affect critical cooling rate? **10**
2. Draw Fe-Fe_3C equilibrium diagram and label the temperatures, composition and phases. **10**

Q.3

1. Describe the cooling of the eutectoid steel from liquid state to room temperature. Calculate the phases in the pearlite obtained at room temperature. **10**
2. Describe the micro-structures for: - (i) White cast iron (ii) Malleable cast iron (iii) Grey cast iron (iv) Nodular cast iron (v) Mild steel **10**

Q.4

1. What is strain hardening? Explain the phenomenon on the basis of dislocation theory. **6**
2. What is fatigue of metals? Explain the method of testing metals for fatigue. **8**
3. Define creep. Draw the creep curve and explain the stages of creep. **6**

Q.5

1. Explain critical resolved shear stress (CRSS) and derive an expression for the same. What is the effect of alloying and temperature on the CRSS of any system. **10**
2. What is Hardenability? What are factors affecting hardenability? Explain Jominy End Quench test. **10**

Q.6 Answer any **four**- **20**

1. Discuss the importance of recrystallization annealing.
2. A slowly cooled steel contains 50% ferrite and 50% pearlite at room temperature. Determine the amount of total ferrite and cementite present in the alloy.
3. Calculate the upper bound and lower bound values for density and Young's moduli for a composite made of silicon carbide particles with volume fraction of 0.2 and aluminium matrix. Given that the density of SiC and Al is 3.15 and 2.70 Mg/m^3 respectively and their modulus is 420 and 70GPa respectively.
4. What are smart materials? Where are they used?
5. Discuss the principle and practice of Nitriding.

AUTO(III)(CBCGS)(MT)17-12-18

Paper / Subject Code: 50405 / MATERIAL TECHNOLOGY

Time: 3 hours **Total marks :80**

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

Q.1 Answer any **four** from the following: **20**

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Q.2

1. Define critical cooling rate. Describe various cooling curves on TTT diagram. What factors affect critical cooling rate? **10**
2. Draw Fe-Fe3C equilibrium diagram and label the temperatures, composition and phases. **10**

Q.3

1. Describe the cooling of the eutectoid steel from liquid state to room temperature. Calculate the phases in the pearlite obtained at room temperature. **10**
2. Describe the micro-structures for:- (i) White cast iron (ii) Malleable cast iron (iii) Grey cast iron (iv) Nodular cast iron (v) Mild steel **10**

Q.4

1. What is strain hardening? Explain the phenomenon on the basis of dislocation theory. **6**
2. What is fatigue of metals? Explain the method of testing metals for fatigue. **8**
3. Define creep. Draw the creep curve and explain the stages of creep. **6**

Q.5

1. Explain critical resolved shear stress (CRSS) and derive an expression for the same. **10**
   What is the effect of alloying and temperature on the CRSS of any system.
2. What is Hardenability? What are factors affecting hardenability? Explain Jominy End Quench test. **10**

Q.6 Answer any **four**- **20**

1. Discuss the importance of recrystallization annealing.
2. A slowly cooled steel contains 50% ferrite and 50% pearlite at room temperature. Determine the amount of total ferrite and cementite present in the alloy.
3. Calculate the upper bound and lower bound values for density and Young's moduli for a composite made of silicon carbide particles with volume fraction of 0.2 and aluminium matrix. Given that the density of SiC and Al is 3.15 and 2.70 Mg/m^3 respectively and their modulus is 420 and 70GPa respectively.
4. What are smart materials? Where are they used?
5. Discuss the principle and practice of Nitriding.

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