

B-TECH 4<sup>th</sup> SEM ENDTERM EXAMINATION, 2017

Subject Name: Engineering Materials,

Subject Code: UPE04B11

Full Mark: 100

Time: 3 hours

Answer all the questions

- 1 Describe the following types of primary bonding (a) Metallic (b) Ionic (5)
- 2 ✓ Differentiate substitutional and interstitial solid solutions with examples (5)
- 3 ✓ With help of a suitable binary phase diagram, explain eutectic and pro-eutectic reactions. (5)
- 4 ✓ Under what conditions a cored structure is formed? (5)
- 5 ✓ Sketch a neat iron carbon phase diagram and label all the plausible phases. (10)
- 6 ✓ Describe the structural changes that takes place when plain carbon steels containing (a) 0.4 % C (b) 1.0 % C (10)
- 7 ✓ Differentiate between normalizing and annealing (10)
- 8 Describe the following heat treatment process in detail a) Austempering (10)  
b) Martempering .  
Substantiate your answer with suitable TTT diagrams
- 9 What is carburizing? Explain pack carburizing in detail. (10)
- 10 Describe the stages of a ductile failure. (10)
- 11 Explain how elastomers, compared to ductile materials, do not follow Hookes law when subjected to tensile force (10)
- 12 Write short notes on (a) ABS (b) Acrylics (c) Cellulose acetate (d) Nylon (e) Polyethylene (10)

Subject Name: Thermal Power Engineering,

Subject Code: UPE04B06,

Full Mark: 100

Time: 3 hours

Question no.1 is compulsory and answer any four from the rest. Each question carries 20 marks

1. (a) Define: - Heat conduction, convection and radiation. (b) Using appropriate control volume show that the time dependent conduction equation in cylindrical coordinates for a material with constant thermal conductivity, density and specific heat is given by- (5+15)

$$\frac{\partial^2 T}{\partial r^2} + \frac{1}{r} \frac{\partial T}{\partial r} + \frac{\partial^2 T}{\partial z^2} = \frac{1}{\alpha} \frac{\partial T}{\partial t}$$

where,  $\alpha$  is a thermal diffusivity

2. (a) Define- Prandtl No, Nusselt No, Stanton No, Peclet No and Grashoff No. (b) What is governing in Steam Engine? (c) Hot air at 400°C flows through 50 Cm diameter horizontal pipe which is exposed to atmosphere at 25°C. Calculate the heat dissipation to the atmosphere. Length of the pipe is 2m by natural convection from outside surface. Properties of the air at mean temperature-  $\rho = 0.815 \text{ kg/m}^3$ ,  $C_p = 1.019 \text{ KJ/kg-k}$ ,  $K = 0.035 \text{ W/m-k}$ ,  $\mu = 24.25 \times 10^{-6} \text{ kg/m-s}$ . (10+3+7)
3. (a) Why compounding is required in Steam Engine? (b) Find the heat transfer through composite wall shown in figure below:-



$K_1 = 150 \text{ w/mk}$ ,  $K_2 = 120 \text{ w/mk}$ ,  $K_3 = 180 \text{ w/mk}$ ,  $K_4 = 50 \text{ w/mk}$ ,  $K_5 = 80 \text{ w/mk}$ ,  $K_6 = 100 \text{ w/mk}$

$A_1 = 0.36 \text{ m}^2$ ,  $A_2 = 0.30 \text{ m}^2$ ,  $A_3 = 1.56 \text{ m}^2$ ,  $A_4 = 2.50 \text{ m}^2$ ,  $A_5 = 0.96 \text{ m}^2$ ,  $A_6 = 0.76 \text{ m}^2$

(b) Show that degree of reaction for Parson's turbine is 50%. Derive an equation for height of blades of a Reaction turbine. ((2+8)+(5+5))

4. (a) Draw and discuss different steps of a four stroke petrol engine with neat sketch. Also draw the theoretical and actual p-v diagram for the same.  
(b) Derive an equation for the efficiency of Carnot cycle with steam as working substance with p-v and T-S diagram. (12+8)
5. (a) Write a short note on Nozzle efficiency. What is the condition for maximum discharge through a nozzle?  
(b) Steam enters a group of nozzles of a steam turbine at 12 bar and 220°C and leaves at 1.2 bar. The steam turbine develops 220 kW with a specific steam consumption of 13.5 kg/kWh. If the diameter of nozzles at throat is 7mm, calculate the number of nozzles. Take the dryness fraction of steam at throat is 0.992.  
(c) What are the different types of steam Nozzles? Define them with neat sketch. (12+5+3)
6. (a) Write down the classification of steam turbine according to heat drop process.

(b) In a De Laval turbine steam issues from the nozzle with a velocity of  $1200 \text{ m/s}$ . the nozzle angle is  $20^\circ$ , the mean blade velocity is  $400 \text{ m/s}$ , and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is  $1000 \text{ kg}$ . Calculate: blade angles, relative velocity of steam entering the blades, tangential force on the blades, power developed, blade efficiency. Take blade velocity co-efficient as  $0.8$ .

(c) Write a short note on pressure compounding.

(5+10+5)



Time: 3 hrs

The figures in the margin indicate full marks for the questions.

Answer all the Questions

1. a. Write an algorithm to determine the largest of three numbers  $a, b, c$ .  
b. Let  $P(x)$  be the polynomial due to linear interpolation of the function  $f(x)$ . The deviation  $E = f(x) - P(x)$  is called  
(i) Truncation error (ii) Rounding error (iii) Absolute error (iv) Relative error (2+2)

2. a. Employ the power method to determine the highest eigen value and the corresponding eigen vector:  $2x_1 - x_2 = \lambda x_1$ ,  $-x_1 + 2x_2 - x_3 = \lambda x_2$ ,  $-x_2 + 2x_3 = \lambda x_3$

- b. Write a C-program to evaluate the following integral using Simpson's 3/8 rule. (6+6)  
$$\int_0^1 \frac{dx}{(3+x)}$$

3. a. The velocity  $v$  (km/min) of a moped which starts from rest is given at fixed intervals of time  $t$  (min) as follows:

$t$	2	4	6	8	10	12	14	16	18	20
$v$	12	16	24	30	31	25	15	7	3	0

Estimate approximately the distance covered in 40 mins.

- b. Draw a flowchart for Newton's backward interpolation formula. (7+5)

4. a. Given  $y' = 2x^3 + 4y$ ,  $y(0) = 1$ ; compute  $y(0.2)$ ,  $y(0.4)$  and  $y(0.6)$  by Euler's method taking  $h = 0.04$ .

- b. Write a program in C to evaluate the integral  $\int_0^1 \frac{x^2}{x^3+1}$ , by using Simpson's 1/3<sup>rd</sup> rule. (5+7)

5. a. Write a C – program for Gauss-Elimination method.

- b. Draw a flow chart for finding roots by using Secant method. (7+5)

6. Solve the BVP:  $y'' + y' + y = 0$ ,  $y(0) = 0$ ,  $y(1) = 1$ ; using finite difference method taking  
(i)  $h = 0.25$  and (ii)  $h = 0.125$ . (12)

7. Solve the equation  $3x \frac{dy}{dx} + 2y^2 - 3 = 0$ ;  $y(4) = 1$  for  $y(4.1)$  and  $y(4.2)$ , taking  $h=0.1$  using Runge-Kutta method of the 2<sup>nd</sup> & 4<sup>th</sup> order. (12)

8. a. Find the inverse of the matrix  $A = \begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix}$  by Gauss-Jordan method.

- b. Find the value of the following integral using Trapezoidal and Simpson's 1/3 rule. Take the step width as 0.1. Compare the result with the exact solution and also find the errors. (6+6)

$$y = \int_{0.2}^{1.4} (\sin x - \log_e x + e^x) dx$$

9. a. Find a cubic polynomial which takes the following set of values (0, 2), (2, 4), (4, 2) and (6, 20).  
b. Solve the following system by Gauss-Jacobi iteration method, correct up-to three decimal places.

$$\begin{aligned} 10x_1 - 2x_2 - x_3 - x_4 &= 5 \\ -2x_1 + 10x_2 - x_3 - x_4 &= 10 \\ -2x_1 - x_2 + 10x_3 - 2x_4 &= 30 \\ x_1 - x_2 - 2x_3 + 10x_4 &= 15 \end{aligned}$$

C

(2+10)

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