SE(Mech), Sem-III, A.T.K.T, 24/06/15. Lib 24/06/15

Industrial Electronics

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to university of Mumbai)

KT Exam (June 2015)

Class/Sem : S.E.Mech /III

Duration: 3Hours

Subject: Industrial Electronics

Subject Code: ME207

- Question Number **ONE** is compulsory
- Attempt any **FOUR** questions out of remaining Six questions
- Assume suitable data, if necessary.
- Figure to the right indicate full marks

Master.

Q1) Write short note of the following **20**

a) MOSFET **b)** Type B chopper **c)** DC drives characteristics **d)** IC555 **e)** UPS

Q2) **a)** Explain Voltage commutated chopper. **10**

b) Circuit feeds from 230V, 50Hz ac supply. When R = 20 Ω, α = 30°, β = 198° Calculate average DC output voltage, Rms output voltage, Form factor, Ripple factor, Rectification efficiency Solve the problem for Full wave uncontrolled and controlled converter with R and RL Load. Also comment on results. **10**

Q3) **a)** Write any two instructions of each type and write assembly language program for addition of two numbers, also draw flow chart. **10**

b) Derive the equation for maximum torque and maximum slip for all parameters **10**

Q4) **a)** Explain characteristics of SCR and TRIAC with structure **10**

b) A 3Phase 50Hz, 8 Pole, 400V, 620rpm Delta connected induction motor has the following parameters $R_s = 0.20\Omega, X_s = 0.70\Omega, R_r = 0.2\Omega, X_r = 0.75\Omega$, Calculate maximum torque and maximum slip for following condition 1) Considering all parameters 2) Neglecting stator resistance **10**

Q5) **a)** Explain the half wave controlled converter for R & RL Load **10**

b) Explain Switch Mode Power Supply (SMPS) **10**

Q6) **a)** Explain single phase full wave converter fed DC drives with characteristics of AC drives **10**

b) List types of speed control method of three phase induction motor and explain stator voltage control method **10**

Q7) **a)** Differentiate microcontroller with Microprocessor based on following points **10**

1)Block Diagram 2) Five comparative Statements

b) Explain three phase half wave converter with R load

SE (mech), Sem- III, A.T.K.T. 24/06/15. hib 24/06/15

Thermodynamics

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

KT- EXAMINATION, JUNE 2015

Master

Total Marks: 100 Duration: 3 Hours

S.Y.BTech. (MECH) - III **THERMODYNAMICS**

- **Q. no. 1 is compulsory.** Attempt any **four** questions from remaining six questions.
- Answers to all sub questions must be grouped together.
- Make any suitable assumption if needed with proper reasoning.
- Use of Steam Table and Mollier Chart is permitted.

1. a) Define and explain following terms: **10**
   (i) Sub-cooled liquid and saturated liquid line
   (ii) Wet Steam and dryness fraction
   (iii) Superheated steam and degree of superheat
   (iv) Triple point and Critical Point
   (v) Saturation temperature and pressure

   b) A 200-m^3 rigid tank initially contains atmospheric air at 100 kPa and 300 K and is to be used as a storage vessel for compressed air at 1 MPa and 300 K. Compressed air is to be supplied by a compressor that takes in atmospheric air at P_0 = 100 kPa and T_0 = 300 K. Determine the minimum work requirement for this process. **10**

2. (a) Discuss the following terms: **10**
   (i) Principle of increase of entropy
   (ii) Reactive and Non- reactive system
   (iii) Diesel Cycle
   (iv) Irreversibility and entropy generation
   (v) Mollier Chart

   (b) What is Zeroth law of thermodynamics? State its significance in thermal system analysis. By making suitable assumptions, write mathematical representation of the first law applied to a closed and an open system. Apply steady flow energy equation to a compressor and a heat exchanger and develop equation for them. **10**

3. a) Write the statement of first and second law of thermodynamics and state their relevance in the thermodynamics. **10**

   b) Two steady flows of air enter into a control volume. One is 0.025 kg/s flow at 350 kPa, 150°C, state 1, and the other enters at 450 kPa, 15°C, state 2. A single flow of air exits at 100 kPa, −40°C, state 3. The control volume rejects 1 kW heat to the surroundings and produces 4 kW of power. Neglect kinetic energies and determine the mass flow rate at state 2. **10**

4. a) Derive an expression to estimate exergy of an open and closed system. **10**

   b) Define energy and prove that it is a property. **10**
   3 kg of air at 1.5 bar pressure and 77°C temperature at state 1 is compressed polytropically to a state 2 at pressure 7.5bar, index of compression being 1.2. It is then cooled at constant temperature to its original state 1. Find the net work done and heat transferred.

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Thermodynamics

5. a) Define and explain following terms – 10
   (i) Complete and incomplete combustion
   (ii) Heat of formation and heat of reaction
   (iii) Higher and lower heating value of a fuel
   (iv) Adiabatic flame temperature

   b) Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. (a) Assuming ideal processes, find per kg of steam the net work and the cycle efficiency. (b) If the turbine and the pump have each 80% efficiency, find the percentage reduction in the net work and cycle efficiency. 10

6. a) Differentiate between an air standard cycle and actual cycle? Briefly explain Brayton cycle and derive expression for optimum pressure ratio. 10

   b) A computer in a closed room of volume 200 m^3 dissipates energy at a rate of 10 kW. The room has 50 kg wood, 25 kg steel and air, with all material at 300 K, 100 kPa. Assuming all the mass heats up uniformly, how long will it take to increase the temperature 10°C? Assume 1.38 kJ/kg °C and 0.46 kJ/kg °C as sp. heat of wood and steel respectively. 10

7. (a) Show that the efficiency of the Otto cycle depends only on the compression ratio. List all assumption used in analysis. 8

   (b) What is air-fuel ratio? What do you mean by lean mixture and reach mixture? 12
   One mole of CH_4 and 3 mole of O_2 reacts in a closed chamber at 300K and 1 atm. and complete combustion takes place. If final temperature is 1800K, determine-
   - Final pressure of the tank
   - Heat transfer during this process

Species	$\bar{h}_f^0$ (kJ/kmole)	$\bar{h}_{298}$ (kJ/kmole)	$\bar{h}_{1800}$ (kJ/kmole)
CH_4	-74,831	----	-----
CO_2	-396,546	4027.5	18391.5
$H_2O(g)$	-241,854	4258.0	15433.0
O_2	0	3725.1	13485.0

SE(Mech), Sem- III, A.Y. K.T,
Strength of Materials

Lib
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BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)
MUNSHI NAGAR, ANDHERI (WEST), MUMBAI- 400 058

Mech (Civil)

KT-EXAMINATION

CLASS/SEM: **S.E.(~~Mech~~) Sem III**

SUBJECT: **Strength of Materials**

Total Marks: 100

Duration: 3 Hour

Date: June 2015

- Attempt any FIVE out of seven questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary.

Master

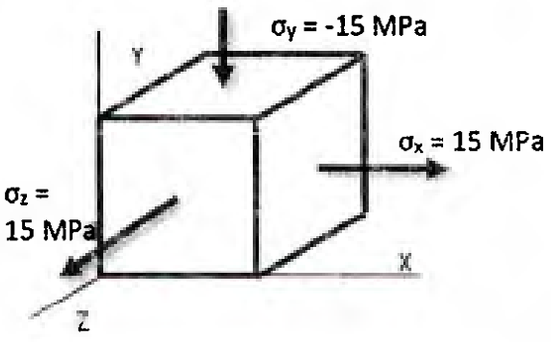
1. a) Define following terms: **(5)**
   a. Ultimate tensile strength
   b. Modulus of rigidity
   c. Hoop stress
   d. Volumetric strain
   e. Poisson's ratio

   b) A steel strip of rectangular cross-section 12 mm thick is bent to the arc of circle until the steel just yields at the top surface. Find the radius of curvature of the neutral surface if the yield stress of material is 240 MPa. Consider E as 200,000 MPa. If the width of strip is 50 mm, calculate the bending moment applied on the strip to achieve the above mentioned curvature. **(5)**

   c) Draw a neat sketch of typical stress-strain diagram for mild steel. Indicate important terms related to the mechanical properties of steel on the diagram. **(5)**

   d) A bolt in tension has a ratio of area at root of thread to that of shank area equal to 0.80. Find the maximum tension that can be safely transmitted through the bolt of 32 mm diameter if the yield strength of bolt material is 250 MPa. Consider factor of safety as 1.5. **(5)**

2. a) A solid cube of side 100 mm is subjected to tri-axial stresses as shown in the figure. Calculate the strain and change in lengths in all directions. $E = 200$ GPa, $\nu = 0.3$. **(8)**



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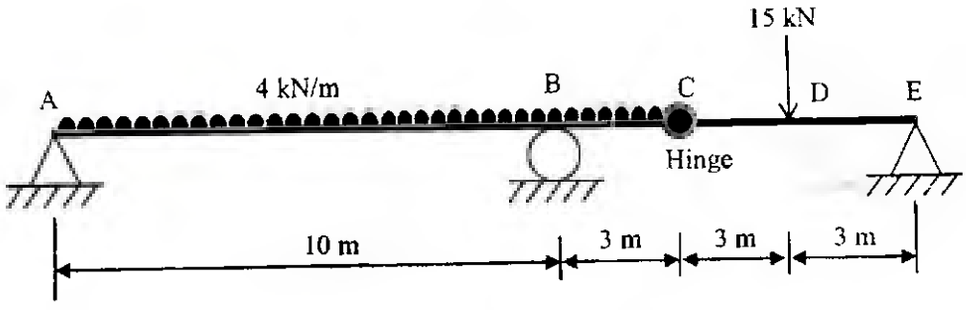
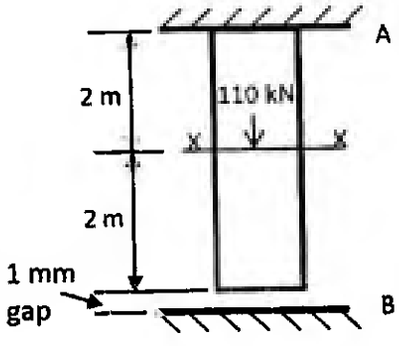
SE (Mech), Sem- III, A.T.K.T. 25/6/17.
Strength of Materials

b) Draw shear force and bending moment diagram for the beam ABCDE with internal hinge at C as shown in the figure. **(8)**



c) A spherical vessel, 1500 mm in diameter is subjected to an internal pressure of 2 MPa. Find the thickness of plate required if the maximum stress is not to exceed 150 MPa, assuming joint efficiency of weld joints in vessel as 0.7. **(4)**

3. a) A steel bar of area 550 mm^2 and 4 m length is supported at end A and loaded at section XX as shown in figure. The support exists at end B but with just 1 mm gap as shown in the figure. Determine the reactions at the supports if E = 200 GPa. Also determine the total displacement of section XX. **(8)**



b) A shaft ABCD (AB = 0.6 m; BC = 1.2 m; CD = 0.6 m) transmits power such that 24 kW is supplied at A and 16 kW at B while three-fourth of the total power is taken off by machines at C and the rest at D. The shaft over the lengths AB and CD consists of solid circular steel section 60 mm in diameter and that over the portion BC has a solid steel core 60 mm diameter encased in a bronze sleeve 10 mm thick. If the shaft is running at 400 rpm, determine the maximum shear stresses in steel and bronze. Take $G_{steel} = 2G_{bronze}$. **(12)**

4. a) A vertical steel rod, 1.5 m long, is rigidly secured at its upper end and a weight of 200 N is allowed to slide freely on the rod through a distance of 50 mm on the stop at the lower end. The upper 750 mm length of the rod has diameter of 30 mm while the remaining lower length has diameter of 15 mm. Calculate the maximum instantaneous stress and elongation of the rod and also the strain energy at maximum elongation. Take E = 200 GPa. **(8)**

b) An I-section 500 mm x 250 mm having flange thickness of 20 mm and web thickness of 10 mm is subjected to shear force of 500 kN. Determine the maximum and minimum shear stress in the web. Also calculate the percentage of vertical shear carried only by the web of the beam. **(12)**

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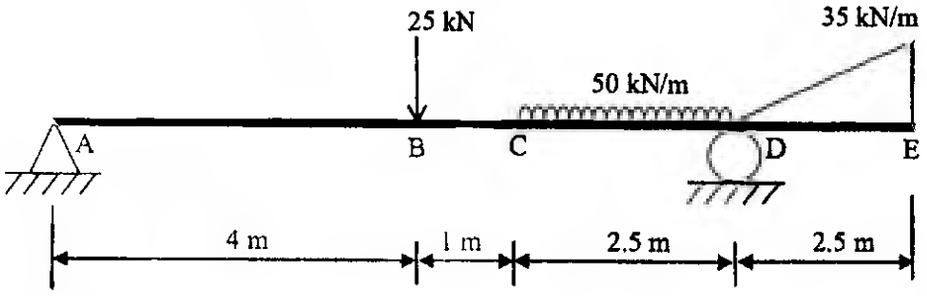
SE (Mech), Sem- III, A.T.K.T, 23/6/15.
Strength of Materials.

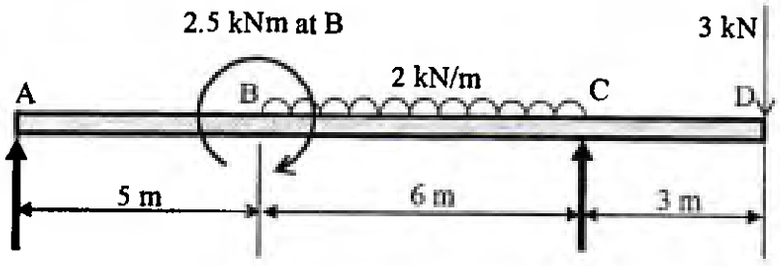
5. a) Draw the shear force and bending moment diagram for the beam ABCDE shown in the figure. **(14)**



b) At a certain cross-section of a shaft 80 mm in diameter, there is bending moment of 6 kNm and a twisting moment of 8 kNm. Calculate the maximum and minimum direct stresses induced in the section. (6)

6. a) A copper rod of 24 mm diameter is enclosed within a steel tube 32 mm internal diameter and 4 mm thick. The ends of rod and tube are rigidly connected together by driving a 10 mm diameter pin transversely. The assembly is then heated together through 30° C. Find the stress in each metal. Also calculate the shear stress induced in the pin. $\alpha_{steel} = 12 \times 10^{-6}$ /°C, $\alpha_{copper} = 16 \times 10^{-6}$ /°C, $E_{steel} = 200$ GPa and $E_{copper} = 110$ GPa. **(8)**

b) An overhanging beam ABCD is loaded as shown in figure. Determine the deflection of beam at point D using Macaulay's method. Take E = 200 GPa and I = 3×10^8 mm^4. **(12)**



7. a) At a point in a material subjected to two dimensional stresses, one of the principal stresses is 90 MPa, tensile. On a plane at 60° to this principal plane, the normal stress is 10 MPa, compressive. Determine the other principal stress. Draw a freehand Mohr circle representation of the stress state at the point. **(6)**

b) Calculate the thickness of wall necessary for a thick walled cylindrical shell of internal diameter 140 mm to withstand internal pressure of 50 MPa. The maximum permissible stress is 125 MPa. **(5)**

c) State the assumptions made during the derivation of classical bending stress formula. **(5)**

d) Prove that volumetric strain is given by the sum of linear strains measured along three orthogonal directions of a coordinate system. **(4)**

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SE(Mech), Sem-III, A.T.K.T. (Old), Applied Mathematics-III

Lib 22/06/15

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

June 2015

Total Marks: **100** Mech ~~Civil~~ / Old / ATKT

Duration: **3 Hours**

CLASS/SEM: **S.E ~~(MECHANICAL)~~/III**

SUBJECT: **APPLIED MATHEMATICS III**

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.

Master

Q.1 (a) Evaluate $\int_A^B (3x^2y-2xy)dx+(x^3-x^2)dy$ along $y^2=x$ from $A(0,0)$ to $B(4,2)$. **6**

(b) Reduce the following matrix to normal form and hence find its rank **6**

$$A=\begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 16 & 4 & 12 & 15 \end{bmatrix}$$

(c) Evaluate $\oint_C \frac{z+4}{z^2+2z+5}dz$, where C is the circle $|z+1-i|=2$ **8**

Q.2 (a) Evaluate $\iint_S \overline{F}\cdot\hat{n}ds$, where $\overline{F}=(3x-yz)\hat{i}+(6y+5xz)\hat{j}+(4z-7xy)\hat{k}$ and S is the surface of the sphere $x^2+y^2+z^2-2x-4y+4z=0$ **6**

(b) Evaluate $\int_i^{2-i}(3xy+iy^2)dz$, along the straight line joining the points $z=i$ and $z=2-i$ **6**

(c) find $L^{-1}\left\{\tan^{-1}\left(\frac{2}{s^2}\right)\right\}$ **8**

Q.3 (a) Prove that the matrix $A=\frac{1}{2}\begin{bmatrix} \sqrt{2} & -i\sqrt{2} & 0 \\ i\sqrt{2} & -\sqrt{2} & 0 \\ 0 & 0 & 2 \end{bmatrix}$ is unitary. **6**

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Applied Mathematics - III

(b) Evaluate $\int_0^\infty e^{-3t} t \sin t \, dt$ 6

(c) Obtain all Taylor's and Laurent's series expansions of $f(z) = \frac{3z+4}{z^2-7z+6}$ about $z=0$ indicating the region of convergence 8

Q.4 (a) Evaluate $\oint_C (3x-7y)dx + (3x+5y)dy$ where C is the rectangle whose sides are $x=-1,\ x=1,\ y=-2,\ y=2$ 6

(b) Evaluate $L^{-1}\left\{\frac{s^2+6}{(s+1)^2(s-2)}\right\}$ 6

(c) Find Eigen values and corresponding Eigen vectors of A , where 8

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$

Q.5 (a) Evaluate $\oint_C \frac{z-1}{(z-2)(z+1)^2} dz$ where $C: |z-i| = 3$ 6

(b) Verify Cayley Hamilton Theorem for the following matrix A and find A^{-1}, if it exists. 6

$$\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$$

(c) (i) If $L\{f(t)\} = \frac{s}{2s^2-3s-4}$, find $L\{e^{-3t} f(2t)\}$ (ii) Evaluate $L\left\{\int_0^t e^u \frac{\sin u}{u} du\right\}$ 8

6(a) Determine constants a, b, c if $A = \frac{1}{3}\begin{bmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{bmatrix}$ is orthogonal 6

SE (Mech), Sem - III, D.T.K.T. (Old), 22/C/15
Applied Mathematics - III

(b) Evaluate $\oint_C z^4 e^{y/z} dz$ where $C: |z| = 1$ **6**

(c) Using method of Laplace Transform, solve the following differential equation **8**

$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4e^{2t}$ where $y(0) = -3,\ y'(0) = 5$

7(a) Find Laplace transform of the function $f(t) = te^{2t}\sin t$ **6**

(b) Test the consistency of the following equations and solve them if they are consistent **6**

$2x + y - z = 2$
$x - 2y + z = 5$
$x + y + 2z = 3$

(c) Verify Gauss Divergence Theorem for $\overline{F} = (x^2 - yz)\hat{i} + (y^2 - xz)\hat{j} + (z^2 - xy)\hat{k}$ over the surface **8**

of the cuboid $0 \le x \le a,\ 0 \le y \le b,\ 0 \le z \le c$