Code : 1G531

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Mechanics of Solids

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Draw stress - strain curve for a ductile material subjected to tension and explain about the salient points on it. 7M

   b) A tension test is conducted on a steel bar of gauge length 55 mm and diameter 10 mm. The bar during the test elongates to 80 mm. A maximum load of 80 kN may be applied on the bar but it yields at 35 kN and finally breaks at 40 kN. Find the following parameters. (i) Yield strength; (ii) Ultimate strength; (iii) Strength at the point of failure; (iv) Actual strength at the point of failure when the diameter is reduced to 5 mm; (v) Percentage elongation; and (vi) Percentage reduction in area. 7M

2. A simply supported beam of length 10 m carries the uniformly distributed load and two point loads as shown in Figure.1. Draw the shear force (S.F) and bending moment (B.M) diagrams for the beam. Also, calculate the magnitude and location of the maximum shear force and bending moment.

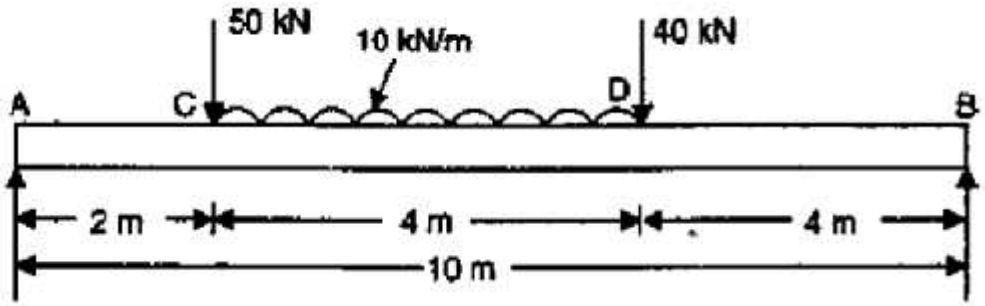

Figure. 1 14M

3. The tension flange of a cast iron I- section beam is 240 mm wide and 50 mm deep, the compression flange is 100 mm wide and 20 mm deep whereas the web is 300 mm x 30 mm. Determine the load per meter run which can be carried over a 4 m span by a simply supported beam if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension. 14M

4. A simply supported beam of 2 m span carries a uniformly distributed load of 140 kN per meter over the whole span. The cross-section of the beam is a T-section with a flange width of 120 mm, web and flange thickness of 20 mm and overall depth of 160 mm. Determine the maximum shear stress in the beam. Also, draw the shear stress distribution for the section. 14M

5. a) State the assumptions made in the theory of torsion and derive torsion equation. 7M

   b) Two shafts of the same material and of same lengths are subjected to a same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts. 7M

6. A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Determine the following (i) Deflection under each load; (ii) Slope under each load; (iii) Maximum deflection; and (iv) the point at which the maximum deflection occurs. Take E = $2x10^5$ N/mm^2, I = $85x10^6$ mm^4. 14M

7. Figure. 2 shows a built-up column of length 5 m consisting of a 150 mm x 70 mm I-section joist with 90 mm wide and 5 mm thick plate riveted to each flange. For a factor of safety of 3, find the safe load, which the column can carry, if its one end is fixed and the other end hinged. The properties of the joist are: A = $2.7x10^{-3}$ m^2, I_{XX} = 8.702 x 10^{-6} m^4, I_{YY} = 5.825 x 10^{-7} m^4. The Rankine constants are 320 MPa and 1/7500.

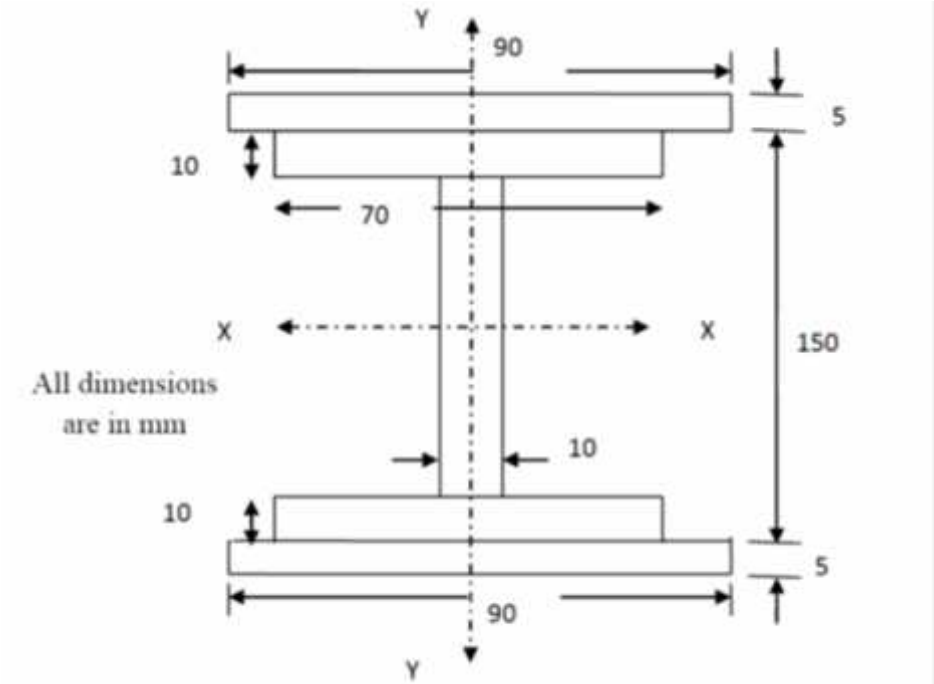

Figure. 2

14M

8. a) A thin cylindrical shell of inside diameter 1.5 m is made of 10 mm thick steel plate. It is of 4 m length and is closed at its both ends. The shell is subjected to an internal fluid pressure of 2 MPa. Determine the change in length, the change in diameter, the change in volume, and circumferential and longitudinal stresses induced in the cylinder. Take modulus of elasticity of the steel is 210 GPa and the Poisson's ratio is 0.3. 7M

   b) Find the thickness of metal necessary for a cylindrical shell of internal diameter 150 mm to withstand an internal pressure of 50 N/mm^2. The maximum hoop stress in the section is not to exceed 150 N/mm^2. 7M

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Code : 1G533

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Thermodynamics

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Define quasi static process. Derive expression for work done during a quasi-static process. 7M

   b) To a closed system 150 KJ of work is supplied. If the initial volume is 0.6 m^3 and the pressure of the system changes as p=8 - 4V where p is in bar and V is in m^3, determine the final volume and pressure of the system. 7M

2. a) State first law of thermodynamics. Prove that internal energy is a property of the system. 7M

   b) An air compressor with water jacket compresses 28.3 litres/min. of air with an initial specific volume of 730 litres/Kg. The enthalpy of the air is increased by 105 KJ/Kg. Transfer of heat to cooling water and surroundings is at a rate of 189 KJ/min. Assuming steady flow and neglecting changes in KE and PE, find the power required to drive the compressor. 7M

3. a) What is the limitation of first law of thermodynamics? Write Kelvin-Planck and Clausius statements of second law of thermodynamics. 7M

   b) Establish the equivalence of Kelvin-Planck and Clausius statements. 7M

4. a) Define: PMM-1, PMM-2, Third law of thermodynamics, and PMM-3. 7M

   b) 0.04 m^3 of nitrogen contained in a cylinder is initially at 1 bar and 15^0C. The gas is compressed by piston isothermally and reversibly until the pressure is 5 bar. Calculate (i) the change of entropy, (ii) the heat flow and (iii) work done. Assume N_2 acts as a perfect gas with M= 28 Kg/Kg-mole. 7M

5. a) Define: Dryness fraction, enthalpy and entropy of steam. Name the devices used to measure dryness fraction of wet steam. 7M

   b) Steam initially at 1.5 MPa, 300^0c expands reversibly and adiabatically in a steam turbine at 40^0c. Determine the ideal work output of the turbine per Kg of steam. 7M

6. a) State Vander waals equation of state. What are its limitations? 7M

   b) Derive Maxwell's relations. 7M

7. a) What is Dalton's law of partial pressure and Gibb's theorem? 7M

   b) Two vessels, A and B, both containing Nitrogen, are connected by a valve which is opened to allow the contents to mix and achieve an equilibrium temperature of 27^0 C. Before mixing, the following information is known about the gases in the two vessels.

Vessel A	**Vessel B**
p = 1.5 MPa	p = 0.6 MPa
t = 50^0 C	t = 20^0 C
Contents = 0.5 Kg mol	Contents = 2.5 Kg

   Calculate the final equilibrium pressure, and the amount of heat transferred to the surroundings. If the vessel had been perfectly insulated, calculate the final temperature and pressure which would have been reached. Take γ = 1.4. 7M

8. a) Compare Otto, Diesel and Dual combustion cycles. 7M

   b) An engine working on diesel cycle has a compression ratio of 15 and cut-off takes place at 5% of the stroke. Find the air standard efficiency. 7M

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Code : 1G237

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Electrical Engineering and Electronics Engineering

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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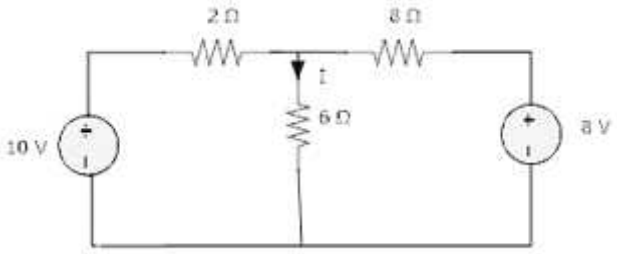
1. a) Define active elements, passive elements, unilateral and bilateral elements with suitable examples. 6M

   b) Find the loop currents and current I in the circuit shown below.



8M

2. a) With neat sketch explain the operation of a three point starter. 7M

   b) Derive the expression for torque developed by a D.C. motor from fundamentals. 7M

3. a) Explain the operation of a transformer using relevant diagrams. 6M

   b) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively, and the corresponding leakage reactances are 1.1 Ω and 0.035 Ω respectively. Find the voltage regulation and the secondary terminal voltage for full load having a power factor of 0.8 lagging. The supply voltage is 2200 V. 8M

4. a) Describe the steps to find regulation of an alternator by synchronous impedance method. 8M

   b) Draw and explain the torque –slip characteristics of a three-phase induction motor. 6M

5. a) A crystal diode having internal resistance of 20 Ω is used for half-wave rectification. If the applied voltage is 50sin ωt and load resistance is 800 Ω, find dc output current, dc output voltage and rectification efficiency. 7M

   b) Derive the expression for average output voltage of a diode bridge rectifier with necessary diagrams. 7M

6. a) Draw the equivalent circuit of a CE amplifier and derive suitable expressions for current gain, voltage gain and power gain. 8M

   b) Draw the characteristics of CE, CB and CC configurations of a BJT. 6M

7. a) Explain the principle of induction heating with necessary diagrams. 8M

   b) Briefly explain any three applications of ultrasonics. 6M

8. Draw the block diagram of CRO and explain the working of each component. 14M

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Code : 1G534

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Machine Drawing

(Mechanical Engineering)

Max. Marks: 70 **Time: 04 Hours**

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Section-I

Answer any *two* of the following **2x4=8M**

1. Sectional views are used quite often when drawing assemblies. Why?
2. Sketch all screw thread forms.
3. How do you dimension the following? Explain with the sketches
   - (i) Chamfers
   - (ii) Angle of spacing between circular holes
   - (iii) Counter sinks
   - (iv) External screw threads

Section-II

Answer any *two* of the following **2X10=20M**

4. Draw the top view and sectional front view of single riveted but joint with double cover plates. The thickness of the plate is 9mm. show at least three rivets. Indicate all the dimensions. Use snap headed rivets.
5. Draw the following views of a SOCKET and SPIGOT COTTER JOINT used for joining two rods of diameter 20mm:
   a) Sectional front view
   b) A view looking from socket end
6. Draw the following views of a foot step bearing shown in Figure 1.:
   a) Sectional front view and
   b) Top view.

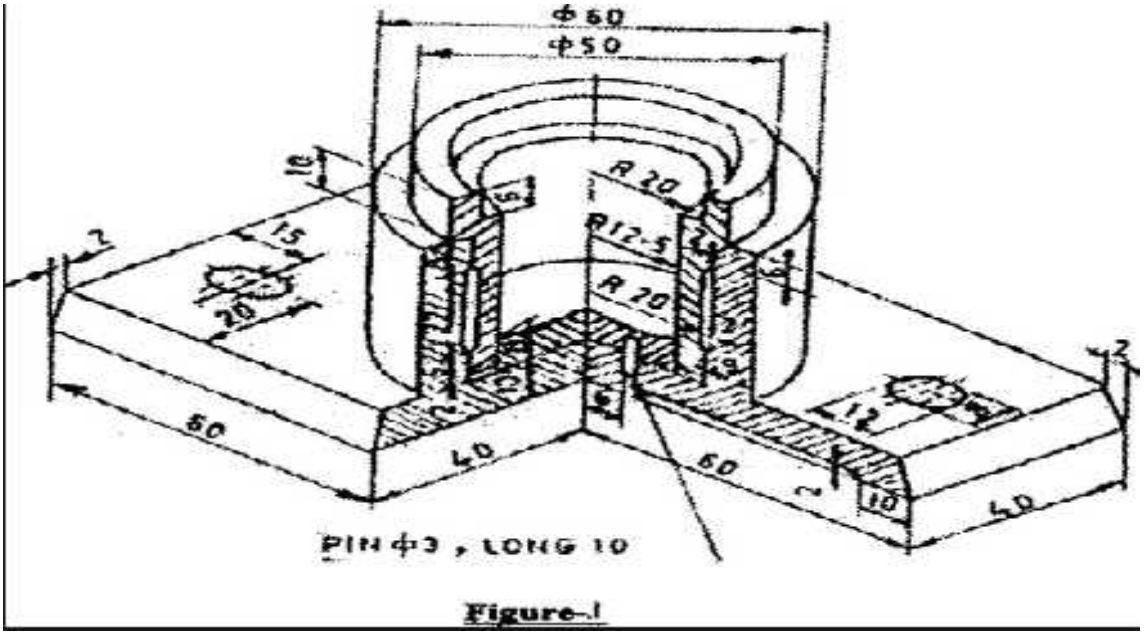

Figure-I

Section-III
Answer the following question 1X42=42M

7. The views and dimensions of all parts of Cross head along with exploded view is shown below. Assemble them and draw sectional front view, top vie and side views.

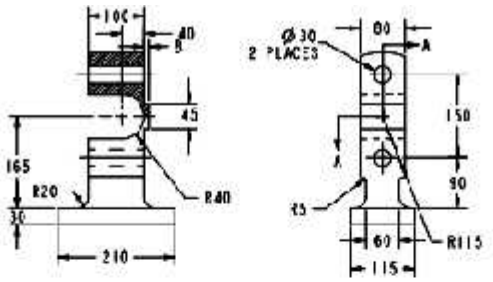

Figure *Front view and the right-side view of the Body*

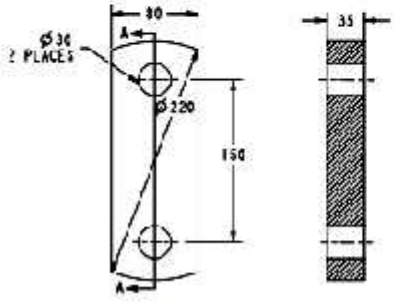

Figure *Dimensions of Keep Plate*

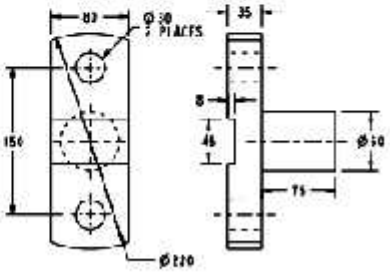

Figure *Dimensions of Piston Rod*

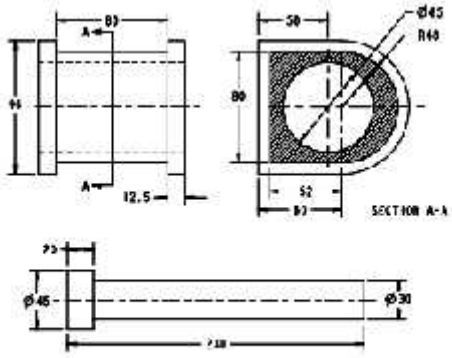

Figure *Dimensions of the Brasses and Bolt*

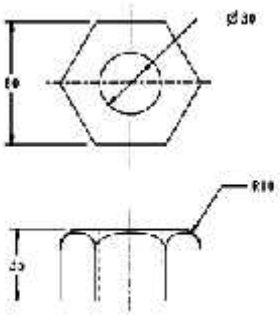

Figure *Dimensions of Nut*

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Code : 1GC31

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Mathematics -II

(Common to CE & ME)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1 a) Prove that the sum of the eigen values of a square matrix A is equal to the trace of the matrix A 4M

b) Find the eigen values & eigen vectors of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ 10M

2. a) Find the Fourier series of the periodic function defined as

$$f(x)=\begin{cases} -\text{®}, & -\text{®} < x < 0 \\ x, & 0 < x < \text{®} \end{cases}$$ 8M

b) Find the half – range Fourier cosine series for $f(x)=x$ in $0<x<2$ 6M

3. a) Form the partial differential equation by eliminating h,k from $(x-h)^2+(y-k)^2+z^2=a^2$ 7M

b) Solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ where $u(x,0)=6e^{-3x}$ 7M

4. a) Find a real root of $xe^x-\cos x=0$ using Newton – Raphson method 7M

b) Find $y(1.6)$ using Newton's forward difference interpolation formula from the table.

x	1.0	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

7M

5. Given that $y'=y-x$, $y(0)=2$, find $y(0.1)$ and $y(0.2)$ using Runge – Kutta method taking $\mathrm{h}=0.1$ 14M

6. a) Evaluate $\int_0^2 e^{-x^2}dx$ using Simpson's rule taking $\mathrm{h}=0.25$ 7M

b) Given that

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
$\log x$	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Evaluate $\int_4^{5.2} \log x dx$ by Simpson's $\frac{3}{8}$ rule. 7M

7. a) S.T. the function $f(z)=\sqrt{|xy|}$ is not analytic at the origin, although Cauchy-Riemann equations are satisfied at that point. 7M

b) Find K such that $f(x,y)=x^3+3Kxy^2$ may be harmonic and find its conjugate. 7M

8. a) Evaluate $\int_c \frac{\log z\ dz}{(z-1)^3}$ where $c:|z-1|=\frac{1}{2}$ 7M

b) Expand $\log z$ by Taylor's series about $z=1$ 7M

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Code : 1G532

R-13

II B.Tech. I Semester Regular Examinations Nov/Dec 2014

Metallurgy and Material Science

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1.	a)	What is unit cell? List the different lattice parameters for different structures.	4M
	b)	What are the method of grain size measurement? Explain any two.	10M
2.	a)	What is an alloy? Explain intermediate alloy phase with neat sketch.	7M
	b)	Describe the substitutional solid solution with neat sketch.	7M
3.	a)	Explain the procedure for construction of an equilibrium diagram.	7M
	b)	Describe the eutectoid and peritectoid reactions	7M
4.	a)	Describe the structure and properties of malleable cast iron	7M
	b)	Explain the properties and applications of Martensitic stain less steel	7M
5.	a)	Define Hardening and depth of hardenability. Explain hardenability with variation of carbon content.	7M
	b)	Explain the effect of alloying elements on ferrite.	7M
6.		What are the properties and applications of different Aluminum Alloys?	14M
7.		What is fiber reinforced composite? Explain the preparation of any fiber reinforced composite and also list its applications in industry.	14M
8.		Explain the open Hearth process for steel making with neat sketch. Also mention its advantages and disadvantages.	14M

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