BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

GOVERNMENT AIDED AUTONOMOUS INSTITUTE

ANDHERI (WEST), MUMBAI - 400 058.

RE-EXAM (ODD Semester)

June 2016

Max. Marks: 100	**Duration: 04 hrs**
Class: S.Y. B.Tech Mechanical	**Semester: III**
Name of Course: Machine Drawing	**Program: B.Tech Mechanical Engg.**
Course Code: BTM - 303	

Instructions: 1. Question no. 1 is Compulsory
2. Attempt any four questions out of remaining six.
3. Use First Angle Method of projections for answering.
3. Figures to right indicate full marks
4. Assume suitable dimensions if necessary
5. Use only drawing sheets for answering.

Master file.

Q. 1 (a)	Draw Free hand sketches of the following: (i) Gib Headed Key & Flat Saddle Key (ii) Square Nut & Hexagonal Nut	10
(b)	Draw free hand sketches of any three types of weld joints.	06
(c)	~~Show Conventional representation of Internal & External Thread~~	04
Q. 2 (a)	A square hole of 35 mm side is cut in a cylindrical shaft 75 mm diameter and 125 mm long. The axis of the hole intersects that of the shaft at right angles. All faces of the hole are inclined at 45° to the H.P. Draw three views of the shaft when the plane of the two axes are parallel to the V.P.	10
(b)	Fig. 1 shows the details of knuckle joint. Draw the following views of: (A) Eye End (i) Sectional Front View (ii) Side View (B) Fork End (i) Sectional Front View (ii) Side View	10
Q. 3 (a)	Fig. 2 shows Flanged Coupling. Draw to some suitable scale the following views: (a) Front view – full in section (b) Side View	14
(b)	Draw free hand sketches of following (i) B.S.W Thread (ii) Acme Thread	06

Q. 4	Fig. 3. shows the assembly of Foot Step bearing. Identify the following parts and (a) Body (i) Front view full in section (ii) Top view (b) Shaft (i) Front view full in section (ii) Top view	20
Q. 5	Fig. 4 shows details of Universal Coupling. Imagine the parts assembled together and draw the following views: (a) Front view full in section (b) Side view Show the tolerances and surface finish wherever required.	20
Q. 6	Fig. 5 shows the assembly of Gun metal Stop valve. Draw the following views of: (a) Body – (i) Sectional Front View (ii) Side View (b) Cover – (i) Sectional Front View (ii) Side View	20
Q. 7	Fig. 6 shows details of Tool Post. Imagine the parts assembled and draw the foll: (a) Sectional Front View (b) Top View	20

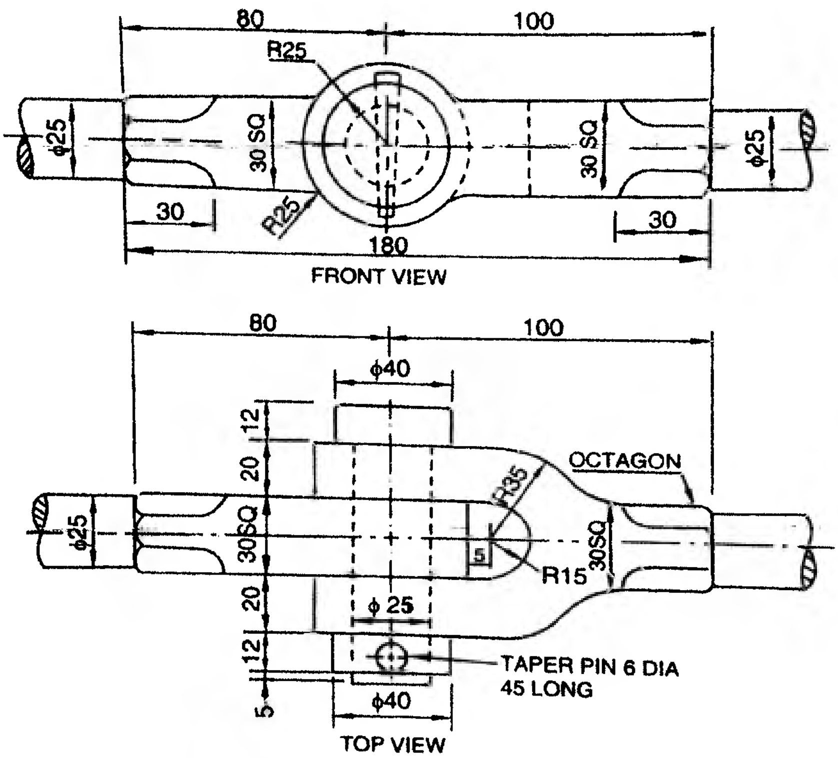


Figure 1: Knuckle Joint

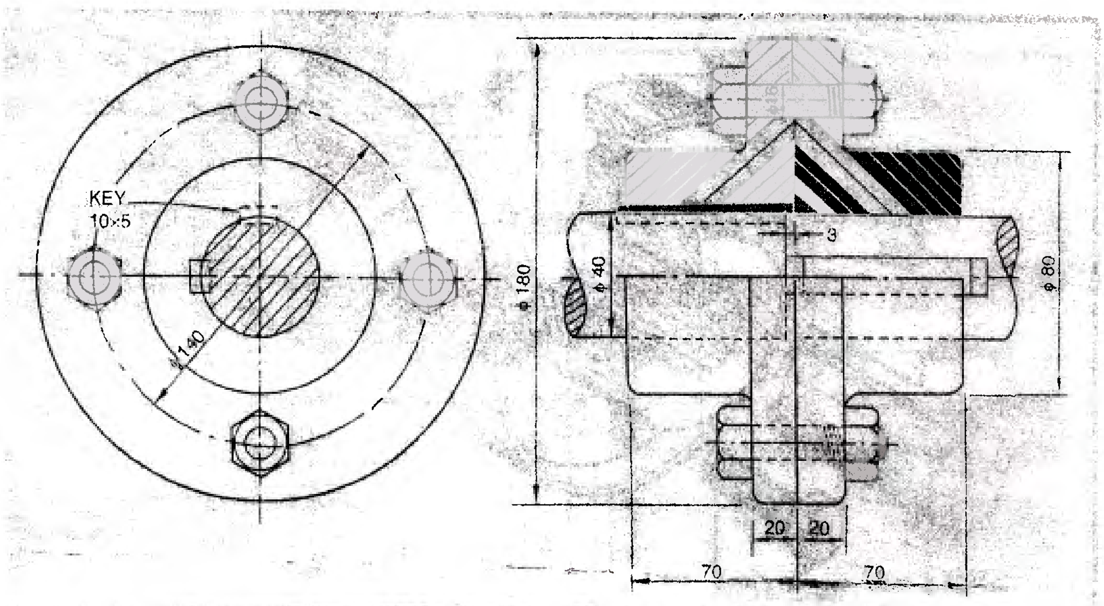


Fig. 2 FlangedCoupling

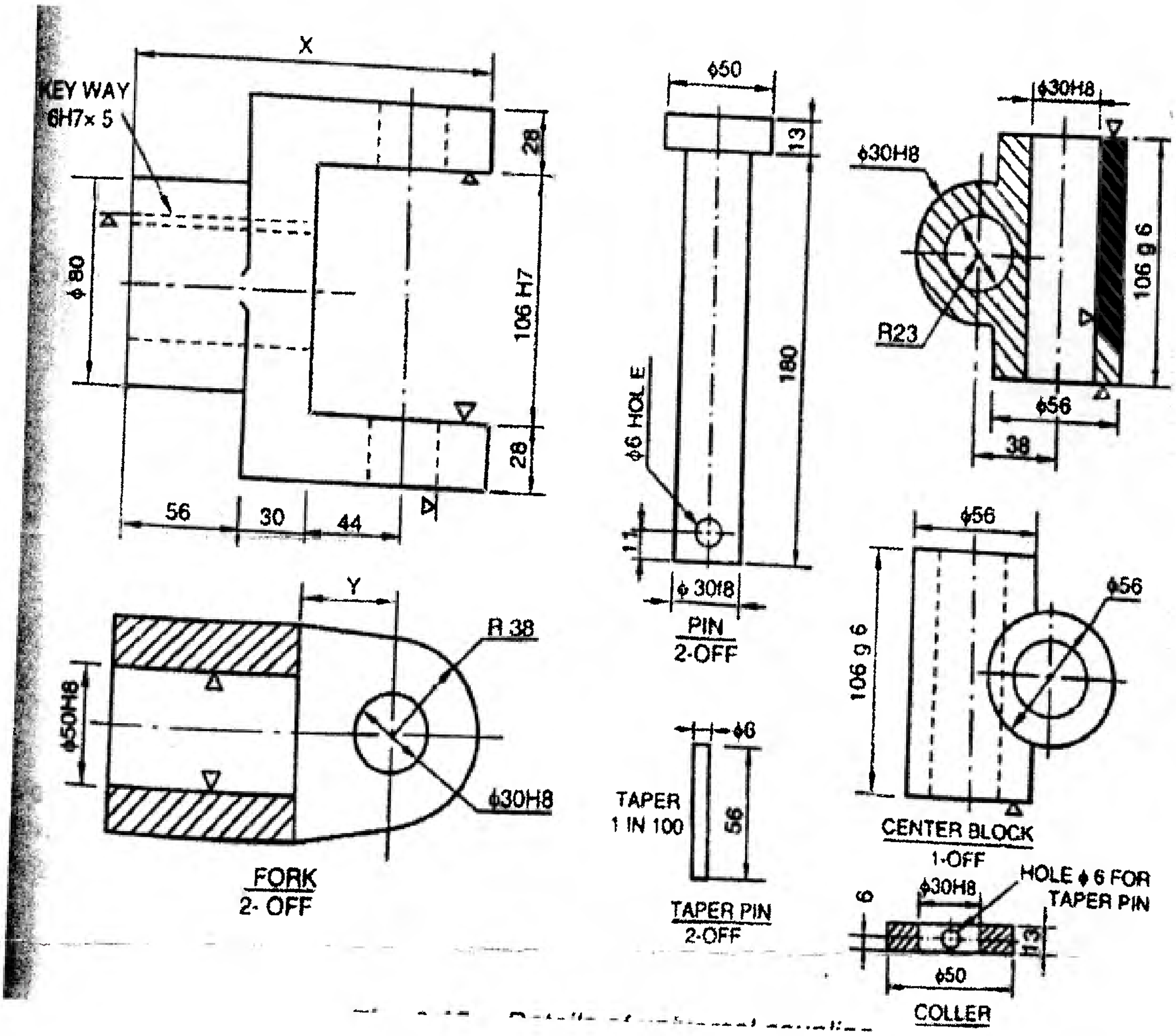


Fig. 4 Universal Coupling

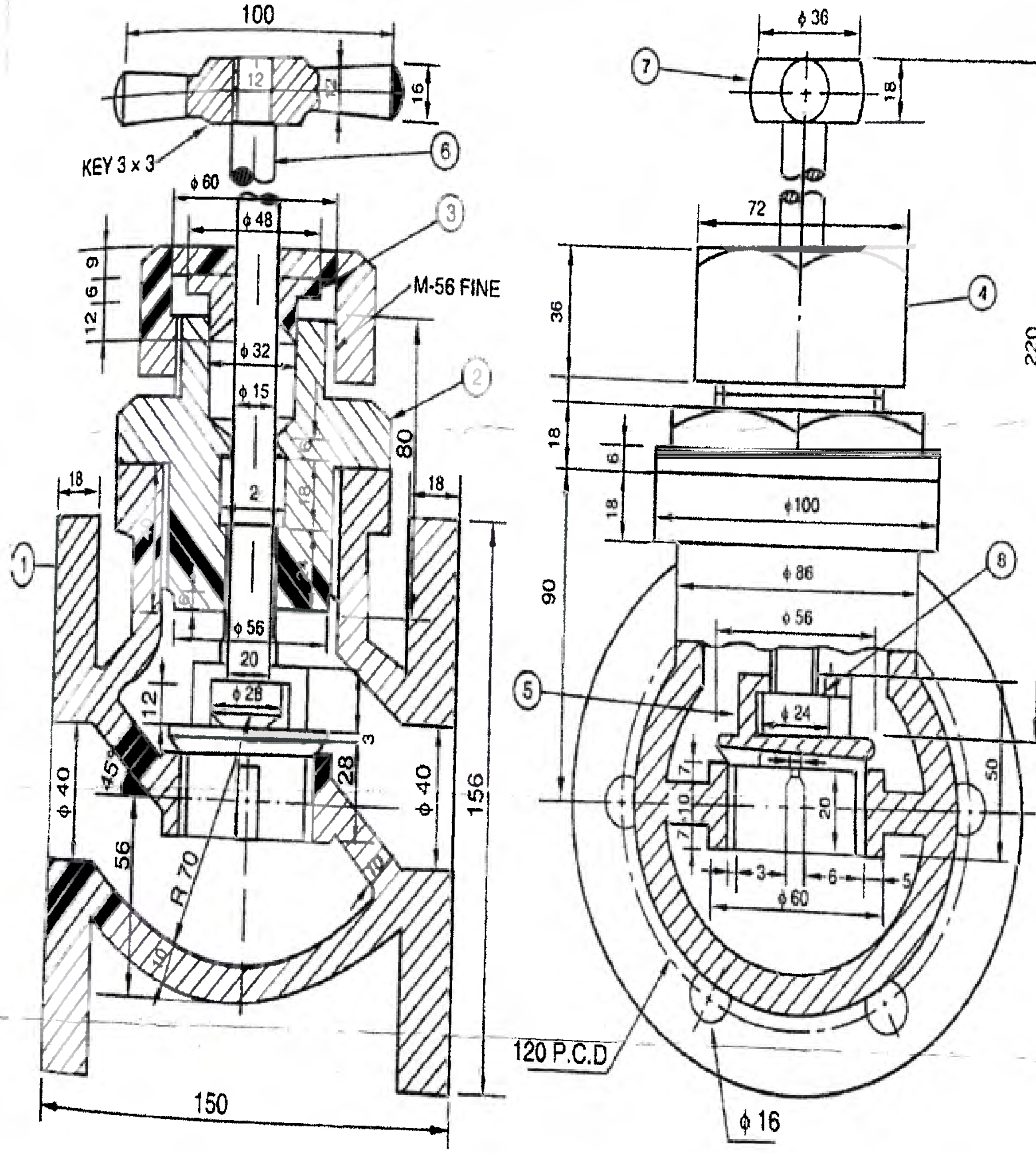
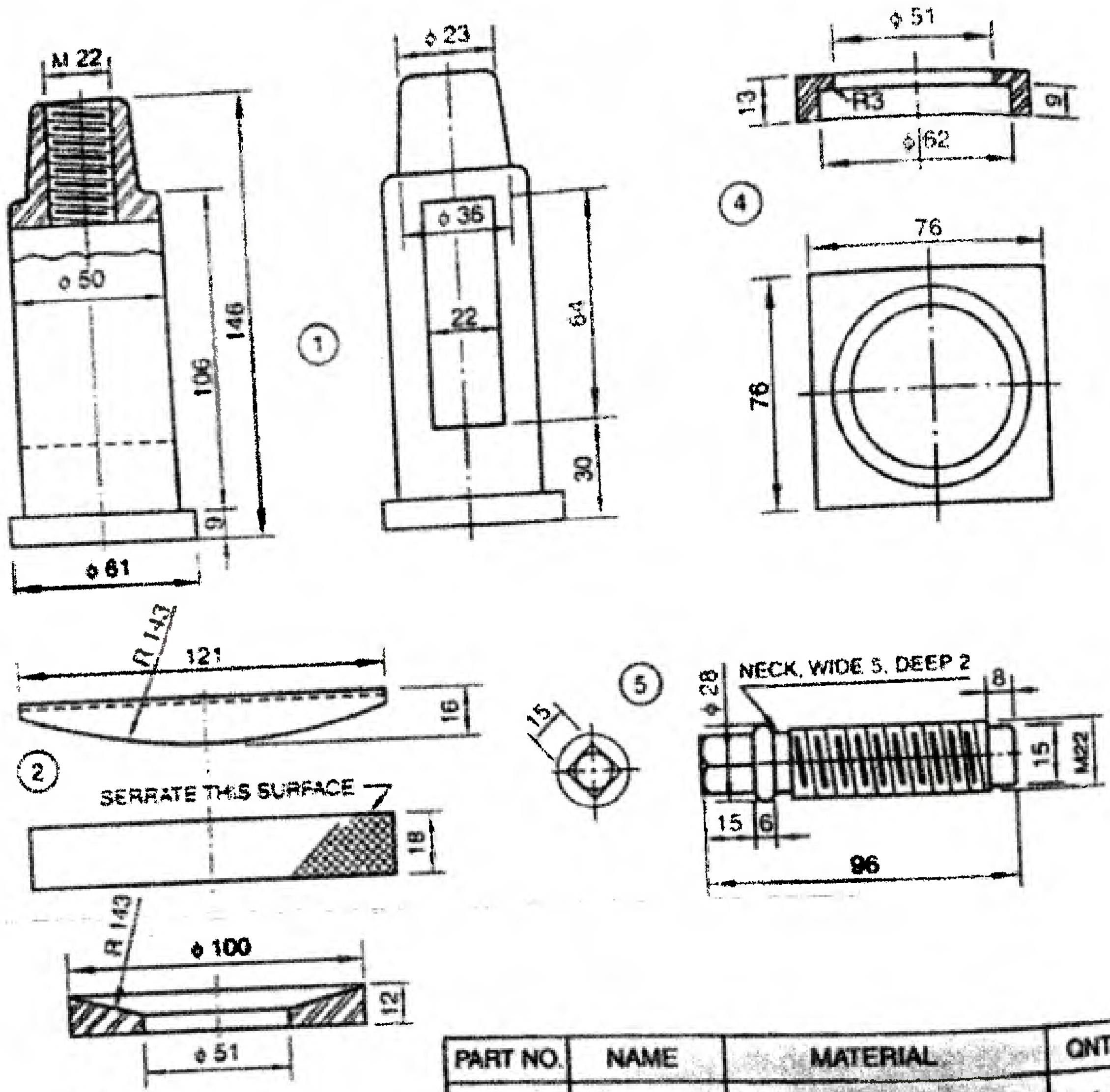
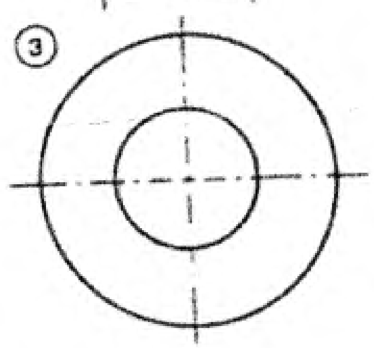


Fig. 5 Gun Metal Stop Valve

Sr. No.	Part Name	Material	Nos.
1	Body	G.M.	1
2	Cover	G.M.	1
3	Gland	G.M.	1
4	Gland Nut	G.M.	1
5	Valve	G.M.	1
6	Spindle	G.M.	1
7	Handle	G.M.	1
8	Split Pin	M.S.	1





PART NO.	NAME	MATERIAL	QNT.
1	BODY	MEDIUM CARBON STEEL	1
2	WEDGE	MEDIUM CARBON STEEL	1
3	RING	MEDIUM CARBON STEEL	1
4	BLOCK	COLD ROLLED STEEL	1
5	SCREW	TOOL STEEL	1

Fig. 6 Tool Post Details

lib section
22/6/2016

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

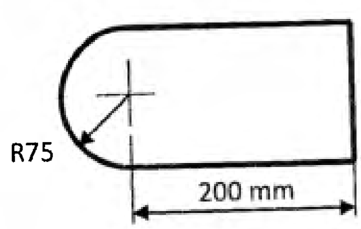
Re-Examination
June 2016

Duration: **3 Hours**
Max. Marks: **100**
Program: **B.Tech. in Mechanical Engineering**
Class: **S.Y.B.Tech.** Semester: **III**
Course Code: **BTM302**
Name of the Course: **Strength of Materials**

Instructions:
- Question no. **1** is **compulsory**. Attempt any **four** out of remaining six questions.
- Answers to all sub questions should be grouped together.
- Assume suitable data if necessary.

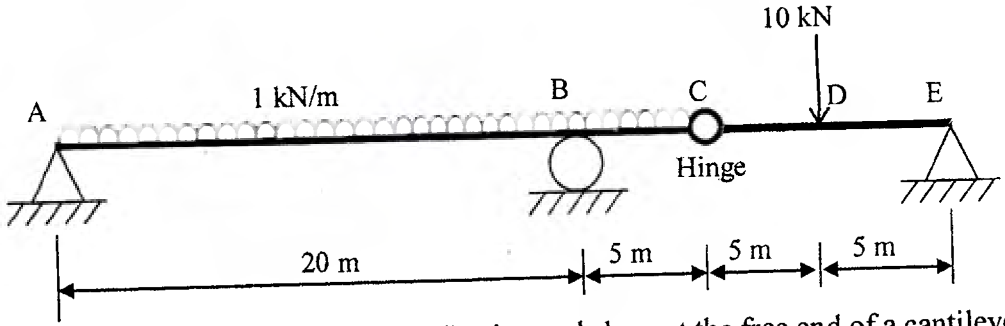
Master file.

			Max. marks	CO No.	Module No.
Q1	a)	Define following terms: (i) Poisson's ratio, (ii) Shear modulus, (iii) Shear stress, (iv) Axial strain.	(4)	1,3	1
	b)	A rectangular beam section 25 mm wide and 100 mm depth is subjected to a moment of 4 kNm. Determine the maximum stress in the beam. Also calculate the radius of curvature of neutral axis at this section. Consider E = 2×10^5 N/mm^2.	(4)	2	2
	c)	How shear force and bending moment diagrams are useful to mechanical engineers? Explain the usefulness with the help of few practical examples. What sign convention is adopted by you while drawing these diagrams? What will happen of someone follows another sign convention?	(4)	1	3
	d)	A hollow turbine shaft transmits 15 MW at 320 rpm. If the internal diameter of the shaft is 100 mm, determine the minimum required external diameter for the shaft if allowable shear stress is 150 MPa.	(4)	2	4
	e)	Construct Mohr circle diagram for any point on outside surface of loaded components in following cases: (i) a steel bar subjected to pure tensile load, (ii) a steel shaft subjected to pure torque, (iii) a rubber rod subjected to pure bending moment, (iv) cylinder subjected to internal pressure.	(4)	2	5
Q2	a)	A 2 mm thick plate is to be punched of a shape shown in figure. Determine the minimum punching force to be applied on a punch. The ultimate shear strength of plate is 100 MPa. What is the corresponding compressive stress in the punch?	(5)	2	2
	b)	A circular shaft transmits 50 kW at 600 rpm. It is supported in bearings 5 meters apart and at 2 meters from one bearing, it carries a rotor exerting a transverse load of 30 kN on the shaft. Determine a suitable diameter for the	(7)	2	5



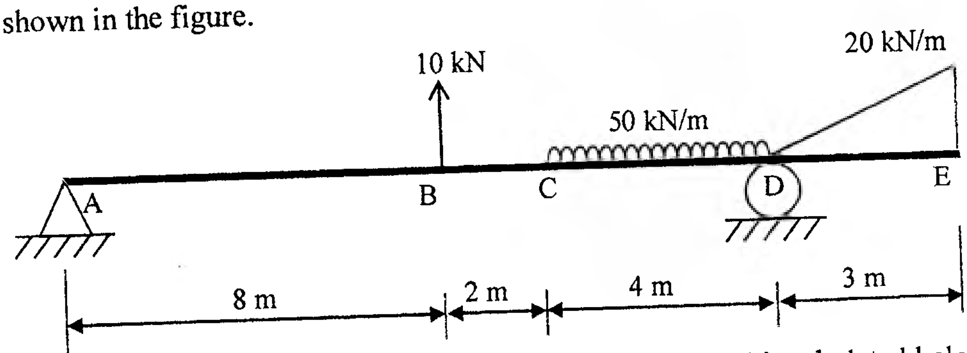
shaft taking into account both bending and torsional stresses, if (i) the maximum direct stress is not to exceed 100 MPa, (ii) the maximum shear stress is not to exceed 50 MPa.

c) Draw shear force and bending moment diagram for the beam ABCDE with internal hinge at C as shown in the figure. **(8)** *1,2* *3*



Q3 a) Formulate the expression for deflection and slope at the free end of a cantilever beam (length l and area moment of inertia I) subjected to point load W at its free end. Use double integration method. **(5)** *2* *6*

b) Draw the shear force and bending moment diagram for the beam ABCDE shown in the figure. **(15)** *1,2* *3*



Q4 a) Stress-strain data of a tensile test carried on structural steel is tabulated below. **(5)** *3* *1*

σ (MPa)	200	400	500	550	620	650	670	680
ε (mm/mm)	0.0012	0.0024	0.0028	0.0030	0.0050	0.0060	0.008	0.010

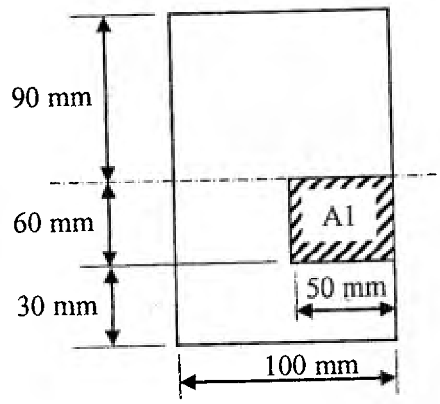
Plot the stress-strain data on graph paper and obtain the value of 0.2% proof stress by offset line method and 0.5% proof stress by total extension method.

b) An unequal angle 200 mm x 100 mm, thickness of metal 10 mm, with the longer leg vertical is used as a simply supported beam and carries a load of 14 kN/m over a span of 4 meters. Find the maximum shear stress and sketch the distribution of shear stress across the section. **(10)** *2* *4*

c) Calculate the thickness of wall necessary for a thick walled cylindrical shell of internal diameter 250 mm to withstand internal pressure of 30 MPa. The maximum permissible stress is 100 MPa. **(5)** *2* *7*

Q5 a) A steel rod with 300 mm² cross sectional area is stretched between two points by applying tensile load of 20 kN at 20°C. If the two points are held fixed, what will be the stress in the rod at 40°C ? At what temperature will the stress be zero? Consider E = 200 GPa and $\alpha = 12 \times 10^{-6}$ mm/mm/°C. Discuss **(8)** *1,2* *2* how you will analyze the problem if only half-length of rod is heated to 40°C while maintaining remaining half-length at 20°C. (7) 2 4

b) A beam has rectangular cross section as shown in figure. It is subjected to sagging bending moment of 100 kNm, about its x-axis. Find the tensile force on the shaded area 'A1' below mid-plane. (5) 2 5



c) At a point in a material subjected to two dimensional stresses, one of the principal stresses is 100 MPa, tensile. On a plane at 50° to this principal plane, the normal stress is 20 MPa, compressive. Determine the other principal stress. Draw a freehand Mohr circle representation of the stress state.

Q6 a) What is volumetric strain? Which type of engineering applications would require computation of volumetric strain. Prove that volumetric strain is given by the sum of linear strains measured along three orthogonal directions. (5) *1* *1*

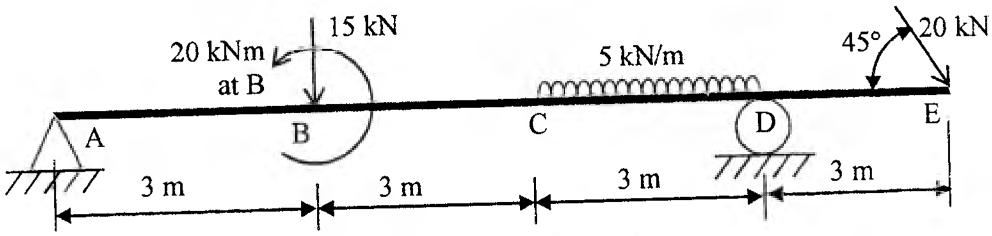
b) A horizontal steel shaft ACDB of solid circular section, 100 mm external diameter, is fixed at its ends A and B. AC=CD=DB = 4 meters. Twisting moments of 50 kNm, clockwise and 25 kNm, anti-clockwise are applied at C and D respectively. Determine the fixing moments at A and B and the maximum shear stress in the shaft. Take $G = 0.8 \times 10^5$ N/mm^2. (7) *2* *4*

c) Define thick and thin cylinders in the context of components subjected to pressure loading. State the Lame's equations for analysis of stresses in thick cylinder. Explain how these equations can be employed for design of thick cylinders in order to limit stresses and deformations within specified limits. Propose a method to evaluate stresses in an internally pressurized thick cylinder with its wall thickness varying across cylinder's length. (8) *2* *7*

Q7 a) A hollow shaft 100 mm outside diameter and 50 mm inside diameter, 1500 mm long, is rotating at 60 rpm. The shaft is driven by electric motor and a shoe brake is provided for stoppage. The shaft is carrying a rotor and the combined mass moment of inertia for shaft plus rotor is 85 kg-m^2. The shaft motion is suddenly stopped by tripping the motor and applying brakes. Calculate the maximum instantaneous stress induced in the shaft using energy method. (7) *1,2* *4*

b) What are principal stresses and how these are used for prediction of failures? (3) 2 5

c) Calculate the transverse deflection of beam ABCDE shown in the figure at location 'E' using Macaulay's method. E = 200 GPa and I = 2 x10^{-5} m^4. (10) 2 6



---------- oXo ----------

Library
25/06/16

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
Endsem Kt examination.
June 2016

Duration: 03 hours
Program:Mechanical

Max. Marks: 100
Class: S.Y.Btech Semester: III
NameoftheCourse:Applied Mathematics-III
CourseCode : BTM301

Instructions:
1) Answers to sub questions are to be grouped together otherwise **NO MARKS WILL BE AWARDED.**
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary and draw proper figures where ever required.
4) Answer the questions in detail.
5) Attempt any five out of seven questions.

Master file.

Q No.		Max marks	Course outcome	Module number
Q1a)	Evaluate $L\left\{(t+2)^2 e^t\right\}$	6	1	1
b)	Evaluate $\oint_c \frac{\sin^2 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ where c is the circle $\|z\|=1$	6	2	4
c)	Verify Green's theorem in the plane for $\oint_c (3x^2-8y^2)dx+(4y-6xy)dy$ where C is the boundary of region defined by $x=0, y=0$ & $x+y=1$.	8	3	3
Q2 a)	Evaluate using residue theorem $\oint_c \frac{z}{(z-1)(z-2)^2} dz$ $C=\|z-2\|=\frac{1}{2}$	6	2	4
b)	If $A=\begin{pmatrix}-1 & -2 & 3\\ -2 & 1 & 1\\ 4 & -5 & 2\end{pmatrix}$ then verify $A(\text{adj}A)=(\text{adj}A)A=\|A\|I$	6	4	5
c)	Prove that $\int_0^\infty e^{-2t}\sin^3 t\, dt=\frac{6}{65}$	8	1	1

Q3 a)	Evaluate using residue theorem $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$	6	2	4
b)	Evaluate $L^{-1}\left\{\frac{3s+7}{s^2-2s-3}\right\}$	6	1	2
c)	Show that $A=\frac{1}{2}\begin{bmatrix}\sqrt{2} & -i\sqrt{2} & 0\\ i\sqrt{2} & -\sqrt{2} & 0\\ 0 & 0 & 2\end{bmatrix}$ is unitary and hence find A^{-1}	8	4	5
Q4 a)	Find the rank by reducing to normal form $A=\begin{pmatrix}2 & 3 & -1 & -1\\ 1 & -1 & -2 & -4\\ 3 & 1 & 3 & -2\\ 6 & 3 & 0 & -7\end{pmatrix}$	6	4	6
b)	Evaluate $L\left\{e^{-2t}\frac{\sin 2t\cosh t}{t}\right\}$	6	1	1
c)	Verify Stoke's theorem for the vector field $\vec{F}=(x^2-y^2)\hat{i}+2xy\hat{j}$ over the box bounded by planes $x=0, x=1, y=1, z=1$ if the face $z=0$ is cut.	8	3	3
Q5 a)	Let $A=\begin{vmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{vmatrix}$ Find a similarity transformation that diagonalises matrix A.	6	4	7
b)	If $A=\frac{1}{3}\begin{pmatrix}-2 & 1 & 2\\ 2 & 2 & 1\\ 1 & -2 & 2\end{pmatrix}$ prove that A is orthogonal and hence find A^{-1}	6	4	5
c)	Solve using Laplace transforms $y''+y=t$ Given $y(0)=1$ $y'(0)=-2$	8	1	2
Q6 a)	If $A=\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$, then express $A^5-4A^4-7A^3+11A^2-A-10I$ in terms of A, using Cayley -Hamilton theorem	6	4	6
b)	Evaluate $L^{-1}\left\{\log\left(1+\frac{1}{s^2}\right)\right\}$	6	1	2
c)	Find all the eigen values and eigenvectors of the matrix $A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$	8	4	6

Q 7 a)	Solve using convolution theorem $L^{-1}\left\{\dfrac{s}{(s^2+4)(s^2+1)}\right\}$	6	1	2
b)	Test for consistency and solve $5x+3y+7z=4$ $3x+26y+2z=9$ $7x+2y+10z=5$	6	4	6
c)	Verify Divergence Theorem for $\vec{F}=(x^2-yz)\hat{i}+(y^2-zx)\hat{j}+(z^2-xy)\hat{k}$ taken over the rectangular parallelepiped $0\leq x\leq 1, 0\leq y\leq 1, 0\leq z\leq 1$.	8	3	3

Library

24/06/16

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

Re- Examination, June 2016

S.Y.B.Tech., Sem-III **B.Tech. in Mechanical Engineering**

Course: **THERMODYNAMICS (BTM 305)** **Duration: 3 Hours**

Max. Marks: 100

Master file.

Instructions:

- Answer any **FIVE** from seven questions.
- Answers to all sub questions should be grouped together
- Make suitable assumption if needed with proper reasoning
- Figures on right in square bracket shows maximum marks for a particular sub-question.

1. Briefly discuss **any five** of the following: [20]
   (i) Irreversibility and entropy generation
   (ii) Reactive and Non- reactive system
   (iii) Air standard cycle for gas turbine system
   (iv) Principle of increase of entropy
   (v) Mollier Chart and its use
   (vi) Thermodynamic temperature scale

2. (A) Write the statement of second law of thermodynamics and prove their equivalence. [10]

   (B) One kg of H_2O at -10°C is brought into contact with a heat reservoir at 100°C. When the water has reached 100°C, find : [10]
   (i) Entropy change of water ;
   (ii) Entropy change of the heat reservoir ;
   (iii) Entropy change of the universe.
   If water is heated from -10°C to 100°C by first bringing it in contact with a reservoir at 100°C and then with a reservoir at 120°C, what will the entropy change of the universe be? Explain how water might be heated from 0°C to 100°C with almost no change in the entropy of the universe. Interpret the situation and write your observation and comment based on calculation.

3. (A) 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]

   (B) Prove that internal energy 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.

4. (A) What is a Carnot cycle? Explain why it overestimates the thermal efficiency compared to an engine producing power output. Is it possible to reduce the degree of overestimation? List down the possible ways to do this. [10]

(B) A motor of 2 KW is used to operate a heat pump. It should keep a chicken hatchery at 30°C which loses energy at a rate of 0.5 kW per degree difference to the colder ambient. The heat pump has a coefficient of performance that is 50% of a Carnot heat pump. What is the minimum ambient temperature for which the heat pump is sufficient? [10]

5. (A) Define exergy? Derive an expression to estimate exergy of an open system. [10]

(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) 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) Classify fuel and explain the meaning of equivalent ratio with reference to combustion? 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- [10]

- 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

7. (A) Differentiate between an air standard cycle and actual cycle? Briefly explain Brayton cycle and derive expression for optimum pressure ratio. [10]

(B) Show that the efficiency of the Otto cycle depends only on the compression ratio. List all assumption used in analysis. [10]