S.Y.B.Tech. Sem III - Applied Mathematics - III

LiD - Re-Exam 04-01-16

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

End Semester RE-Examination.

November 2015

Max. Marks: 100 Duration: 03 hours

Class: S.Y.Btech Semester: III Program: Mechanical

Name of the Course: Applied Mathematics III Course Code : BTM301

Instructions:

Master file.

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Each question has a 6-6-8 marks break up.
4. Assume suitable data if necessary.

Question No		Maximum Marks
Q1(a)	Find $\mathcal{L}\left\{\frac{\cos 2t \sin t}{e^t}\right\}$	
(b)	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 $y = \sqrt{x}$ & $y = x^2$.	
(c)	Evaluate $\int_c (x + 3iy)dz$ along the straight line joining $z = 0$ to $z = 1 - i$.	
Q2(a)	Evaluate: $L^{-1}\left\{\frac{3s+1}{(s+1)^4}\right\}$	
(b)	Find the eigen values and the corresponding eigenvectors of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 1 \\ 3 & 2 & 3 \end{bmatrix}$	
(c)	Use residue calculus to evaluate the following integral $\int_0^{2\pi} \frac{\cos^2\theta}{5 + 4\cos\theta} d\theta$	
Q3(a)	For what values of λ and μ the equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ Have i) No solution ii) A unique solution iii) Infinite number of solutions	

i)

(b) Evaluate $\oint_c \frac{e^{-2z}}{(z+1)^3} dz$ c: $|z| = 2$

(c) Show that $\int_0^\infty e^{-2t} \sin^3 t \, dt = \frac{6}{65}$

Q4(a) If $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$ Show that $A^* A$ is a Hermitian matrix, where A^* is the conjugate transpose of A

(b) Evaluate $\mathcal{L}\left\{e^{-2t} \frac{\sin 2t \cosh t}{t}\right\}$

(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 parallelopiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$.

Q5(a) Evaluate the complex integral $\int_c \frac{dz}{\cosh(z)}$ where c is $|z| = 2$

(b) Find the characteristic equation of the matrix. $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$

Verify Cayley – Hamilton theorem and hence evaluate the inverse of matrix.

(c) Find $\mathcal{L}^{-1}\left\{\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}\right\}$

Q6(a) Prove using convolution theorem

$$\mathcal{L}^{-1}\left\{\frac{1}{(s^2 + a^2)^2}\right\} = \frac{1}{2a^3}(\sin at - at \cos at)$$

(b) Reduce to normal form the following matrix $B = \begin{bmatrix} 1 & 2 & 1 & 2 \\ 0 & 2 & 1 & 1 \\ 2 & 6 & 3 & 5 \\ 2 & 4 & -2 & 4 \end{bmatrix}$

(c) Verify Stoke's theorem for the vector field $\vec{F} = (2x - y)\hat{i} - yz^2 \hat{j} - y^2 z \hat{k}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$ bounded by its projection on the XY-plane.

Q7(a) Evaluate: $\mathcal{L}^{-1}\left\{\log\left|\frac{s^2 + b^2}{s^2 + a^2}\right|\right\}$

(b) Find Laplace transforms of $f(t) = \sqrt{1 + \sin t}$

(c) Prove using residue theory $\int_0^\infty \frac{dx}{(x^2 + a^2)(x^2 + b^2)} = \frac{\pi}{ab(a+b)}$

$(a > 0, b > 0)$

Re. Exam Lib
09-01-16

S.Y.B.Tech.(Mech) sem III
Manufacturing Science-I.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Semester Re-Exam

January 2016

Max. Marks: 100 Duration: 3 hours

Class: S.Y.B.TECH. Semester: III Program: Mechanical Engineering

Name of the Course: **Manufacturing Science –I** Course Code : BTM 306

Master file.

Instructions:

1. **Question No 1 is compulsory.**
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Max Marks
Q1(a)	Describe in brief "Plastic injection molding process" and "Transfer molding process" with help of schematic sketch?	8
(b)	Consider two plates are welded using two parallel and one transverse fillet weld bed as shown in figure 1. A tensile load of magnitude 100 KN applied to assembly of which top plate has following dimensions (width=200 mm and thickness=10 mm). If 'allowable tensile stress' of filler metal (weld bed) is 80MPa. Calculate the length 'L' (in mm) of parallel fillet weld?	6

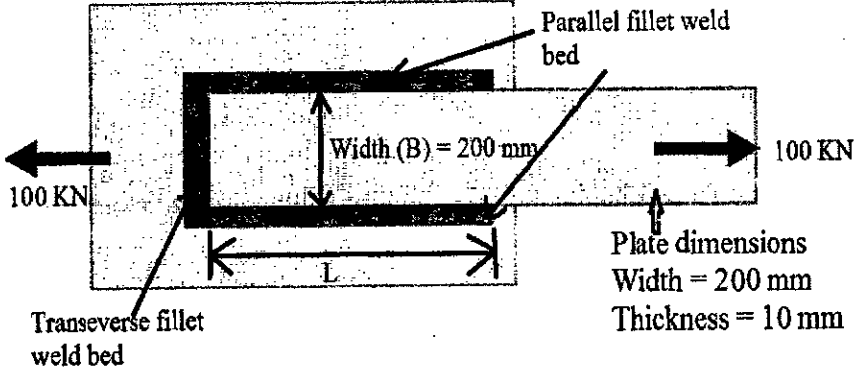


Figure 1

(c)	Answer the following question with **one or two points** only; i) What is material removal mechanism of ultrasonic machining and which type of work piece material can be machined using such?....(3M) ii) If complex shape has to be machined in high strength temperature resistant alloy nontraditional machining process can be used is.....? & what is material removal mechanism of that process? (3M)	6

S.Y.B.Tech. (Mech) Sem III
Manufacturing Science-I. Dt- 09/01/16

Q2(a)	Explain with neat schematic sketch working principle of External Centreless grinding machine? (4M) Answer the following question with one or two points only; i) To have fine finish on Brass & soft bronze suitable abrasive grit material is .....? Abrasive grit material on grinding wheel should have ..... grain size? (2M) ii) For rough grinding operation of high speed steel material grinding wheel structure must be.....? Abrasive grits can be used are.....? (2M)	8
(b)	Explain super abrasive grinding wheel compositional *specification*? Explain each alpha numeric terms in details which describes grinding wheel? What are different work piece materials can be machined using such wheels?	8
(c)	Explain tool room lathe and draw its block diagram of its different parts?	4
Q3(a)	A cast steel block having length of 900 mm and with 660 mm have thickness of 100 mm. Finish size of block required to have to be of 900X660X80 mm^3. For each pass allowable depth of cut for single point tool is 4 mm. Cutting speed maintained is 300 mm/min & return stroke is 450 mm/min. For first two cuts, transverse feed is 5 mm/cutting stroke & for remaining cuts, transverse feed is 3 mm/cutting stroke. Consider approach and over run distance of tool is 5 mm each. Find how long the job will take to complete?	8
(b)	Draw neat schematic sketch & explain of Multi spindle and Gang d rilling machine? Explain *specific* applications of it?	8
(c)	Draw neat schematic block diagram of universal dividing head & explain its working?	4
Q4(a)	What are different modes of indexing? Explain the working of any one mode of indexing and draw its kinematic system?	8
(b)	For drilling through hole of diameter 20 mm in mild steel work piece having thickness of 30 mm with HSS spiral fluted drill tool. Half of drill point angle is 55°, cutting velocity is 25 m/min, feed is 0.5 mm/rev, and approach and overrun distances for drill tool is 2 mm each. Calculate total time required to drill through hole? Draw well labeled sketch of work piece indicating working principle of drilling operation?	6
(c)	Explain with neat schematic sketch Gas metal arc welding process and its advantages?	6
Q5(a)	Draw neat schematic sketch of shaper machine? Explain working principle of shaper machine with schematic sketch? Also describe or draw kinematic system of shaper machine?	8
(b)	Explain basics of centrifugal casting process and its characteristics? Give its classification and explain any of its subtype with schematic sketch?	9
(c)	Draw and explain parts/structure of carriage unit of conventional lathe machine?	3
Q6(a)	Explain different advantages of CNC lathe machine?	2
(b)	Determine total time required for plain milling of top face and side milling of other four faces of Aluminum block having length of 300 mm, width 60 mm and height of 45 mm? *Helical fluted plain HSS milling cutter* of diameter 70 mm, length 75 mm and have 6 teeth used for plain milling of top surface &	10

S.Y.B.Tech. (Mech) Sem III
Manufacturing Science - I. Dt. 09/01/16.

Helical fluted solid carbide End milling cutter of diameter 24 mm, length 70 mm and have 6 teeth used for side surface milling. Approach distance and over run distance are 5 mm for tools, cutting velocity 35 m/min and feed is 0.45 mm/tooth.

(c) Explain with neat schematic sketch Electron beam welding process along with operating setup requirement, its advantages & disadvantages? 8

Q7(a) Explain in brief different work holding devices can be used on milling machine? 4

(b) Calculate total machining time to turn steel cylindrical rod of diameter 105 mm X length 200 mm into finish component as shown in figure 2? Finish component has dimensions as shown in figure 2. For, Part A- Cutting velocity is 40 m/min, feed is 0.4 mm/rev & depth of cut is 1.25 mm for both outer diameter (O.D) turning and face turning operation. For, Part B- Cutting velocity is 45 m/min, feed is 0.5 mm/rev & depth of cut is 1.25 mm for outer diameter (O.D) turning. (Note - For calculating machining time of each next pass of outer diameter (O.D) turning, consider existing diameter of work piece at that instant) 10

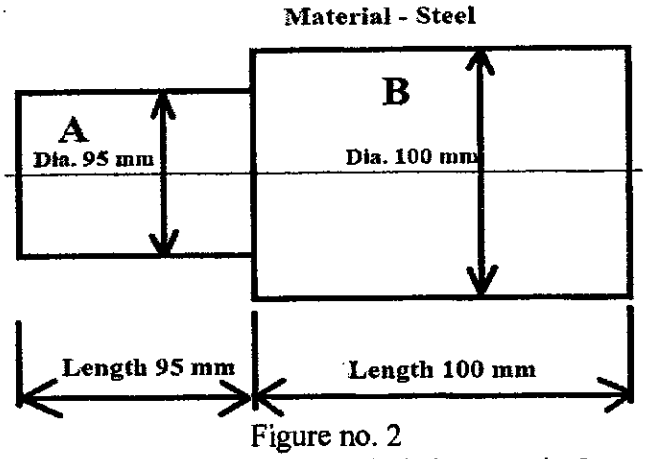


Figure no. 2

(c) Explain classification of lathe machines with their examples? 6

Lib - Re-E
07-01-16

S.Y.B.Tech. (Mech) sem III
Material Science.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

Re- Exam

January 2016

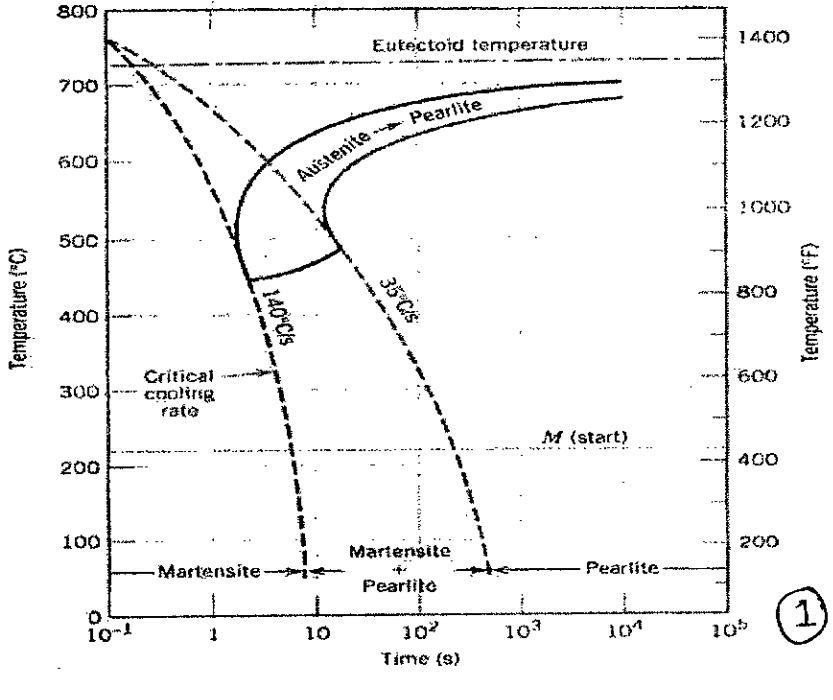
Max. Marks: 100 Duration: 3 hours
Class: S.Y.B.Tech. Semester: III Program: B.Tech. Mechanical Engineering
Name of the Course: Material Science Course Code : BTM304

Instructions:

Master file.

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Maximum Marks
Q1(a)	Processing, structure, properties and performance are the four components of the discipline of material science. Explain these components and the inter-relation between them using a suitable example.	05
(b)	Discuss briefly the various recycling issues associated with materials	05
(c)	With neat sketches, explain the various stages in the solidification of a polycrystalline specimen	05
(d)	What are CCT curves? Explain its significance. Refer the CCT curve below for eutectoid steel and answer the following questions (i) If a steel component of eutectoid composition, initially at 800°C is cooled to room temperature at a rate greater than the critical cooling rate, what would be the phase present in the component? What would be the mechanical properties of the steel component be? (ii) If a steel component of eutectoid composition, initially at 800°C is cooled to room temperature at a cooling rate of 15°C, what would be the phase present in the component? What would be the mechanical properties of the steel component be?	05



(1)

S.Y.B.Tech. (Mech) sem III
Material science - Dt. 07/01/16.

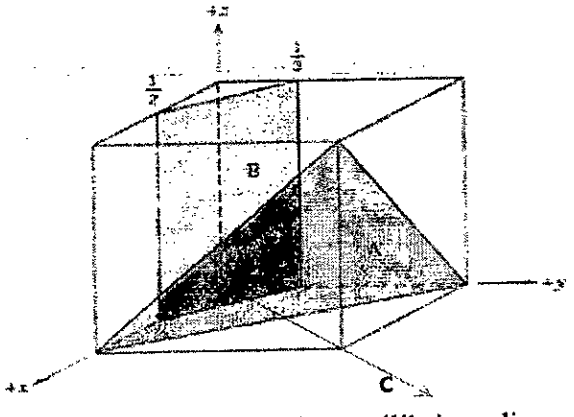
Q2(a) What is material science? Discuss the three criteria that are important in the materials selection process. 05

(b) Economics of engineering a component/system depends on three factors: component design, material usage, and manufacturing costs. Explain these components in brief. 06

(c) Explain Frenkel and Schottky defect with sketches 04

(d) For a 99.65 wt% Fe–0.35 wt% C alloy at a temperature just below the eutectoid, determine the following: 05
(i) The fractions of total ferrite and cementite phases
(ii) The fractions of the proeutectoid ferrite and pearlite
(iii) The fraction of eutectoid ferrite

Q3(a) If the unit cell shown in figure has a BCC crystal structure, determine the Miller indices for the plane 'B' and the direction indices for direction shown by 'C'. Also calculate the planar density at plane 'A' 06

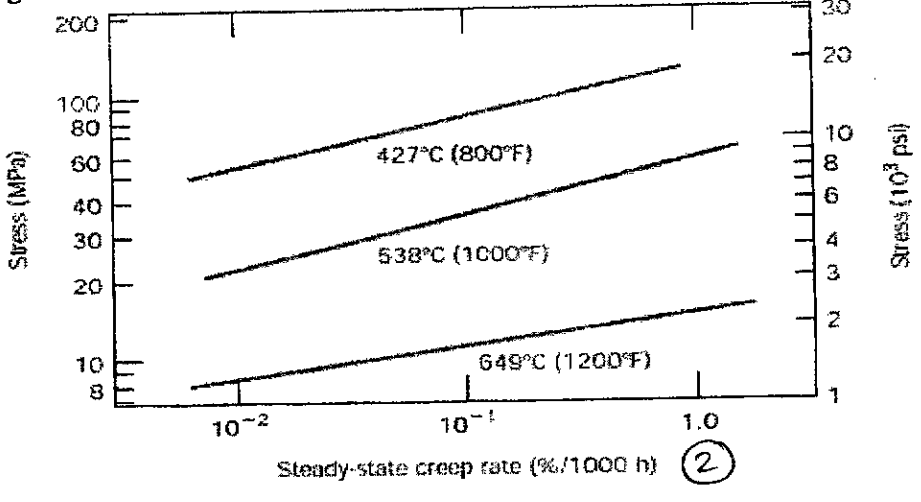


(b) The various points on the equilibrium diagram for Cu-Ni system are as tabulated below 08

Weight % Ni	0	20	40	60	80	100
Liquidous temp °C	1084	1200	1275	1345	1440	1455
Solidus temp °C	1084	1165	1235	1310	1380	1455

Plot the diagram to scale and calculate for 70% Ni alloy,
i. Composition of first solid crystallizing out from liquid
ii. Amounts of solid and liquid at 1360°C

(c) For a cylindrical low carbon–nickel alloy originally 10 mm in diameter and 500 mm long, what tensile load is necessary to produce a total elongation of 3.2 mm after 10,000 h at 427°C? Assume that the sum of instantaneous and primary creep elongations is 0.8 mm. 06



(2)

S.Y.B.Tech. (Mech) Sem III
Material Science – Dt. 07/01/16.

Q4(a)	Estimate the theoretical fracture strength of a brittle material if it is known that fracture occurs by the propagation of an elliptically shaped surface crack of length 0.25 mm and having a tip radius of curvature of 1.2×10^{-3} mm when a stress of 1200 MPa is applied.	04
(b)	For both FCC and BCC crystal structures, there are two different types of interstitial sites. In each case, one site is larger than the other, and is normally occupied by impurity atoms. For both FCC and BCC crystal structures, compute the radius 'r' of an impurity atom that will just fit into the larger interstitial site; in terms of the atomic radius 'R' of the host atom.	08
(c)	Classify alloying elements. Discuss the effects of addition of substitutional alloying elements on ferrite hardness and on tempering with graphs.	08
Q5(a)	What are low carbon steels, medium carbon steel, high carbon steels and stainless steels? State the properties and application of each	08
(b)	Explain nitriding. State its advantages and disadvantages as compared to carburizing	06
(c)	Classify composites and briefly explain each component of the classification	06
Q6(a)	State and explain Hume Rothery's rule for solid solubility	06
(b)	What are the properties of Chromium? List four chromium alloys and state the composition and one typical application of each alloy.	08
(c)	Compute the weight of soda ash and limestone that must be added to 125 kg of quartz (SiO_2) to yield a glass of composition 78 wt% SiO_2, 17 wt% Na_2O, and 5 wt% CaO. The atomic weights of the atoms are as follows: Na=22.99g/mol, C = 12.01g/mol, O = 16g/mol, Ca = 40.08g/mol	06
Q7(a)	Sketch portions of a linear polypropylene molecule that are (i) syndiotactic, (ii) atactic, and (iii) isotactic.	06
(b)	Discuss the influence of the following elements on steel (i) Sulphur, (ii) Phosphorus, (iii) Silicon, (iv) Manganese (v) Chromium	10
(c)	Explain whether it is possible to heat treat low carbon steels.	04

Re-Exam - Lib
08-01-16

S.Y.B.Tech. (Mech) Sem III
Thermodynamics.

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

RE- EXAMINATION, JANUARY 2016

Total Marks: 100 | Duration: 3 Hours

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

- Answer any **FIVE** 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.

Master file.

1. a) Define and explain following terms: **10**
   (i) System and surrounding
   (ii) Path and Process
   (iii) Heat transfer and work transfer
   (iv) Sensible heat and latent heat
   (v) Critical Point and Triple point of a pure substance

   b) A fluid at a pressure of 3 bar, and with specific volume of 0.18 m^3/kg, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law, $p = C/v^2$, where C is a constant. Calculate the work done by the fluid on the piston. If temperature changes from 120°C to 70°C, find the amount of heat transfer involved during process. **10**

2. (a) Write the statement of fundamental laws of thermodynamics and use them to explain to a real thermal system. **10**

   (b) In an air compressor air flows steadily at the rate of 0.5 kg/s through an air compressor. It enters the compressor at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m^3/kg and leaves at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/s. Using law of thermodynamics, calculate: **10**
   (i) The power required to drive the compressor,
   (ii) The inlet and output pipe cross-sectional areas.

3. (a) Write down the general energy equation for steady flow system and use it to develop equation for following systems (mention all assumption made for each case separately): **10**
   (i) Centrifugal water pump,
   (ii) Steam nozzle,
   (iii) Steam turbine, and
   (iv) Gas turbine.

   (b) Discuss the following terms: **10**
   (i) Principle of increase of entropy
   (ii) Sub-cooled liquid, superheated steam and wet steam
   (iii) Reheat Rankine cycle

S.Y.B Tech. (Mech) sem III
Thermodynamics. Dt. 08/01/16

4. (a) Derive an expression for to estimate of exergy of a closed thermal system. **10**

(b) A rigid cylinder of volume 0.028 m^3 contains steam at 80 bar and 350°C. The cylinder is cooled until the pressure is 50 bar. Using steam table calculate: **10**
(i) The state of steam after cooling ;
(ii) The amount of heat rejected by the steam.

5. (a) Show that the efficiency of the Otto cycle depends only on the compression ratio. List all assumption used in analysis. **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 each have 80% efficiency, find the percentage reduction in the net work and cycle efficiency. **10**

6. (a) Define and explain following terms – **10**
(i) Air Fuel Ratio
(ii) Calorific value of the fuel
(iii) Incomplete combustion
(iv) Adiabatic flame temperature

(b) A fuel ($C_{10}H_{22}$) is burnt using an air-fuel ratio of 13: 1 by weight. Determine the complete volumetric analysis of the products of combustion, assuming that the whole amount of hydrogen burns to form water vapour and there is neither any free oxygen nor any free carbon. The carbon burns to CO_2 and CO. **10**

6. (a) What is gas turbine? Describe its working and list down its important application. Briefly explain Brayton cycle and derive expression for its thermal efficiency. **10**

(b) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 101.325 kPa, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume $W_T = 2.5W_C$, where W_T and W_C are the turbine and the compressor work respectively. Take $\gamma = 1.4$. **10**

Lib 05-01-16 – Re-Exam.

S.Y.B.Tech. (Mech) sem III
Strength of Material.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

Re-Examination
December 2015

Max. Marks: **100** Duration: **3 Hour**

Class: **S.Y.B.Tech.** Semester: **III** Program: **B.Tech. in Mechanical Engineering**

Name of the Course: **Strength of Materials** Course Code : **BTM302**

Instructions:

1. Question No 1 is **compulsory**. Attempt any four questions out of remaining six.
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary

Master file.

Q1 a) Explain following terms in brief: (i) Poisson's ratio, (ii) Section modulus and (iii) Shear stress. **(3)**

b) A solid bar of diameter 25 mm is joined to a hollow tube of 20 mm inside diameter. The assembly is subjected to an axial load of 100 kN. Determine the external diameter of the tube so that the stress in both the segments is the same. **(3)**

c) Draw shear force and bending moment diagrams for a cantilever beam of length ℓ subjected to uniformly distributed load w. **(3)**

d) Write classical formula governing stress and deformation of a body subjected to torsion and define each of the term involved. **(2)**

e) Construct Mohr circle diagram for following cases: (i) a steel bar subjected to pure axial load, (ii) a steel shaft subjected to pure torque. **(3)**

f) Discuss situations where engineers would need to compute deformation of machine components. Give appropriate examples from real life. **(3)**

g) 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. **(3)**

Q2 a) The stress-strain data of a tensile test carried on structural steel is tabulated below. **(5)**

σ (MPa)	180	410	520	540	620	660	670	680
ε (mm/mm)	0.001	0.002	0.0025	0.0030	0.0045	0.006	0.008	0.010

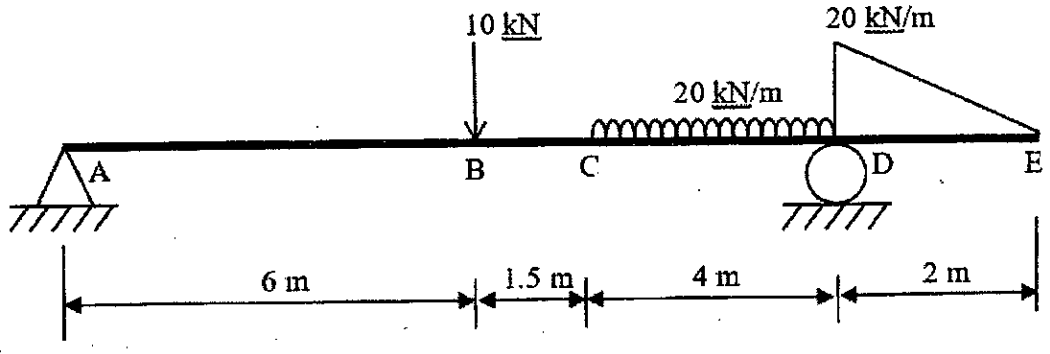
Plot the stress-strain data on graph paper and obtain the value of 0.2% proof stress by offset line method. Also calculate value of modulus of elasticity.

b) A thick walled cylinder 180 mm internal diameter and 45 mm wall thickness contains fluid at a pressure of 80 MPa. Calculate the maximum and minimum values of the hoop stress in the material. Sketch variation of hoop stress across the thickness of wall. **(4)**

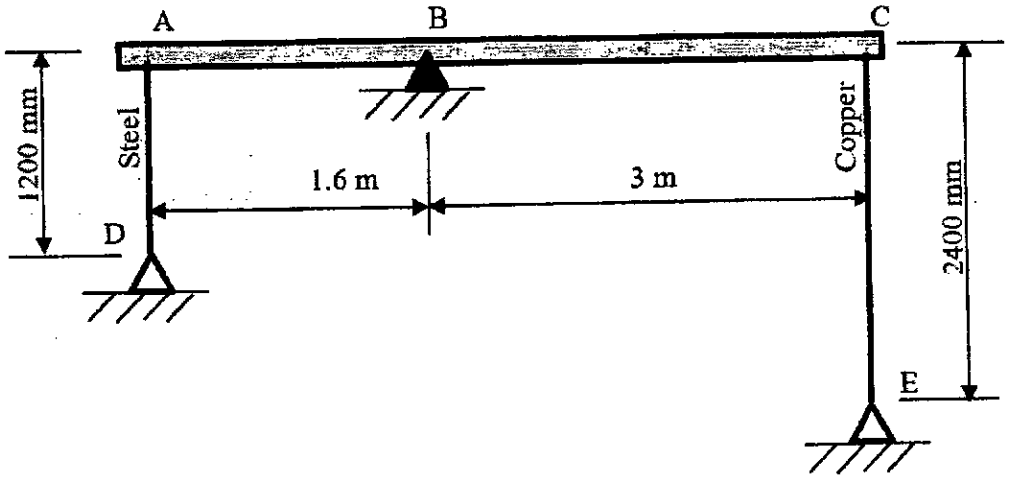
(1)

S.Y.B.Tech. (Mech) sem III
Strength of Material. Dt. 05/01/16.

c) Draw the shear force and bending moment diagram for the beam ABCDE shown in the figure. **(11)**

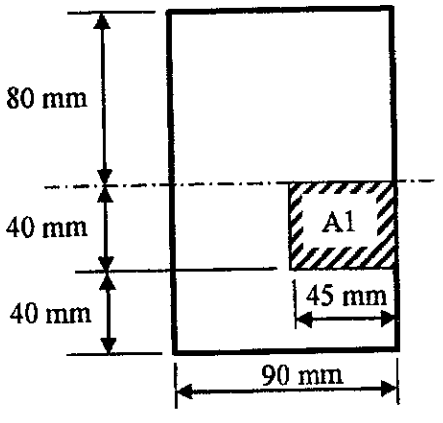


Q3 a) A light rigid bar ABC is supported at B by hinge. Two wires one of iron and other of copper are attached at ends A and C of the bar. The other end of these wires is fixed at hinges at D and E. The assembly is as shown in the figure. Before fixing these wires to hinges D and E, the copper wire is found 5 mm less in length. If it is pulled and attached to support E, determine the stresses induced in wires and reaction at the support. For steel wire: A = 150 mm^2 and E = 200 GPa. For copper wire: A = 400 mm^2 and E = 120 GPa. **(10)**



b) Show that the stain energy stored in a solid shaft of diameter D subjected to torque T is given as $\frac{\tau^2}{4G} \times volume\ of\ shaft$; where τ is maximum shear stress caused by torque T and G is shear modulus. **(5)**

c) A beam has rectangular cross section as shown in figure. It is subjected to sagging bending moment of 30 kNm, about its x-axis. Find the tensile force on the shaded area 'A1' below mid-plane. **(5)**

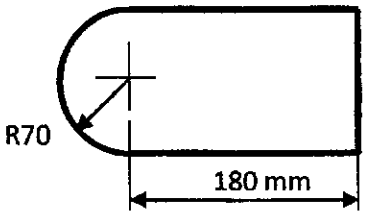


(2)

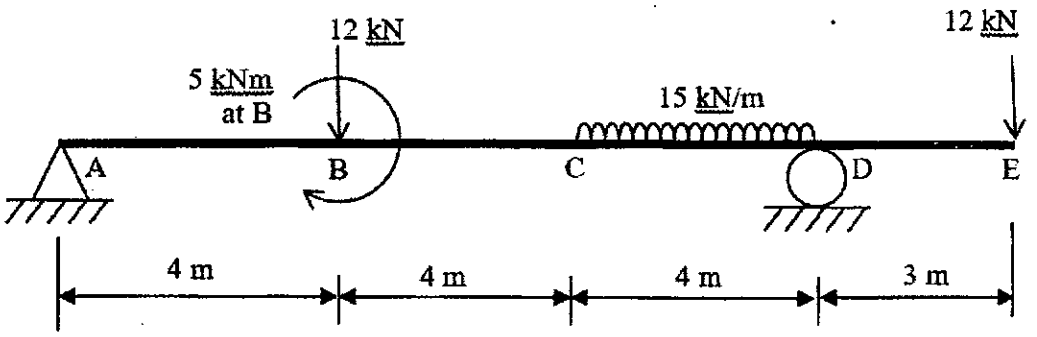
S.Y.B Tech. (Mech) Sem III
Strength of Material - D7 - 05/01/16.

Q4 a) A hollow shaft is subjected to torque of 300 kNm and a bending moment of 250 kNm. The internal diameter of shaft is one-third of the external diameter. If the maximum shear stress in not to exceed 100 MPa, find diameter of the shaft. **(5)**

b) A 3 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 200 MPa. What is the corresponding compressive stress in the punch? **(4)**



c) Calculate the transverse deflection of beam ABCDE shown in the figure at location 'E' using Macaulay's method. Consider modulus of elasticity = 200 GPa and I = 3.5×10^{-5} m^4. **(11)**

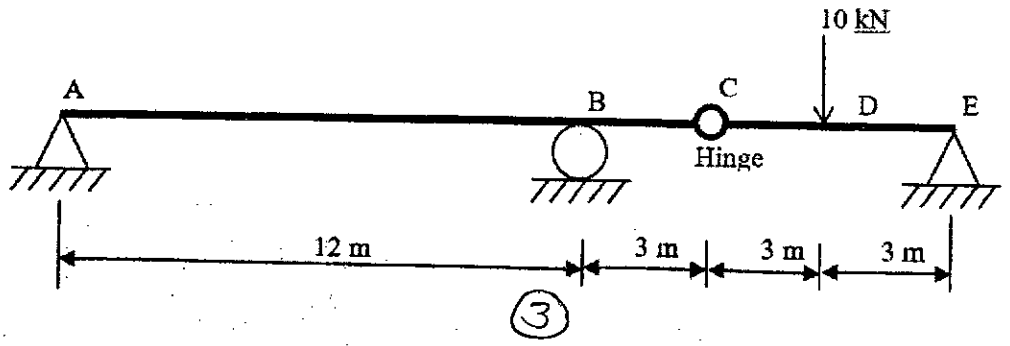


Q5 a) Develop the expression for deflection and slope at the free end of a cantilever beam (length *l* and area moment of inertia *I*) subjected to a point load *W* acting at its free end. Use integration method. **(8)**
If cross section of beam varies arbitrarily from the fixed end to the free end, how would you compute deflection and slope at free end?

b) An I-section 600 mm x 300 mm having flange thickness of 25 mm and web thickness of 12 mm is subjected to shear force of 700 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)**

Q6 a) A steel rod with 250 mm^2 cross sectional area is stretched between two points by applying tensile load of 10 kN at 25°C. If the two points are held fixed, what will be the stress in the rod at 35°C ? At what temperature will the stress be zero? Consider E = 200 GPa and $\alpha = 12 \times 10^{-6}$ mm/mm/°C. **(5)**

b) Draw shear force and bending moment diagram for the beam ABCDE with internal hinge at C as shown in the figure. **(5)**



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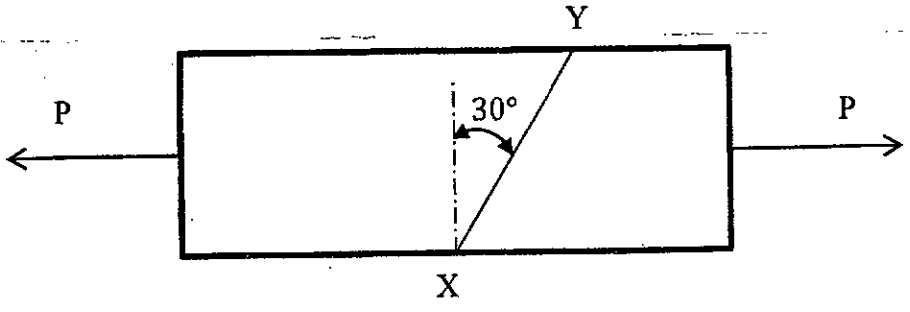
S.Y.B.Tech. (Mech) Sem III
Strength of Material. Dt. 05/01/16.

c) A reactor vessel shell of 3000 mm inside diameter and thickness of 32 mm has straight length of 10 m. It is holding reactants at internal pressure of 1.2 MPa. Calculate the change in diameter, length and volume of shell under pressure. Use thin cylinder theory. E = 200 GPa, Poisson's ratio = 0.3. **(10)**

Q7 a) A rectangular bar of cross-sectional area 5000 mm^2 is subjected to a tensile load P as shown in the figure. The permissible normal and shear stresses on the oblique plane XY are given as 12 MPa and 6 MPa respectively. Determine the safe value of load P. **(7)**



b) A composite shaft, consisting of a solid brass rod 20 mm diameter encased in a steel tube 22 mm inside diameter and 28 mm outside diameter is subjected to a pure torque of 100 Nm. Assuming that the angle of twist for a given length of shafting is the same, evaluate the maximum shear stresses in steel and brass. Also calculate the angle of twist per meter length of the shaft. Consider $G_{brass} = 4 \times 10^4$ MPa and $G_{steel} = 8 \times 10^4$ MPa. **(8)**

c) Explain following terms in brief. **(5)**
   (i) Young's modulus
   (ii) Bulk modulus
   (iii) Principal stress
   (iv) Proof resilience
   (v) Strain energy stored during impact loading

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S.Y.B.Tech. Sem III
Applied Mathematics - III

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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Semester Exam
November 2015

Max. Marks: 100 Duration: 03 hours
Class: S.Y.Btech Semester: III Program:Mechanical
Name of the Course: Applied Mathematics III Course Code : BTM301

Instructions:

Master file.

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Each question has a 6-6-8 marks break up.
4. Assume suitable data if necessary.

Question No		Maximum Marks
Q1(a)	Find Laplace transforms of $f(t) = t\left(\frac{\sin t}{e^t}\right)^2$	
(b)	Evaluate by Green's thm $\oint_c e^{-x}(\sin y\,dx + \cos y\,dy)$ where C is the rectangle with vertices (0, 0), (π/0) (π, π/2) & (0, π/2).	
(c)	Evaluate $\int_0^{2+i} (\bar{z})^2$ along a. The real axis to 2 and then vertically to 2 + i. b. Along the line 2y = x	
Q2(a)	Evaluate $L^{-1}\left\{\frac{1}{S^3(S-1)}\right\}$	
(b)	Find the eigen values and the corresponding eigenvectors of the matrix $\begin{bmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 4 & 5 & -2 \end{bmatrix}$	
(c)	Use residue calculus to evaluate the following integral $\int_0^{2\pi} \frac{1}{5-4\sin\theta}\,d\theta$	
Q3(a)	For what values of 'a' and 'b' the equations $x + 2y + 3z = 4$ $x + 3y + 4z = 5$ $x + 3y + az = b$ Have i) No solution ii) A unique solution iii) Infinite number of solutions	

(b) Evaluate $\oint_c \frac{\sin^2 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ where c is the circle $|z|=1$ Date. 16/11/15

(c) Prove that $\int_0^\infty \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$

Q4(a) If $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$ Show that A^*A is a Hermitian matrix, where A^* is the conjugate transpose of A

(b) Evaluate $\mathcal{L}\left\{e^{-2t}\frac{\sin 2t \cosh t}{t}\right\}$

(c) Verify Divergence Theorem for $\vec{F} = 4x\,\hat{i} - 2y^2\,\hat{j} + z^2\,\hat{k}$ taken over the bounded by the cylinder $x^2 + y^2 = 4, z = 0, z = 3$

Q5(a) Evaluate the complex integral $\int_c \frac{dz}{\cosh(z)}$ where c is $|z| = 2$

(b) Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. Verify Cayley – Hamilton theorem and hence evaluate the inverse of matrix.

(c) Evaluate: $\mathcal{L}^{-1}\left\{\frac{s^2+2s+3}{(s^2+2s+2)(s^2+2s+5)}\right\}$

Q6(a) Prove using convolution theorem

$$\mathcal{L}^{-1}\left\{\frac{s^2}{(s^2+a^2)^2}\right\} = \frac{1}{2a}(\sin at + at\cos at)$$

(b) Reduce to normal form the following matrix $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}$

(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 $x = 0, x = a, y = b, z = C$ if the face $z = 0$ is cut.

Q7(a) Evaluate: $\mathcal{L}^{-1}\left\{\log\left|\frac{s^2+b^2}{s^2+a^2}\right|\right\}$

(b) Find Laplace transforms of $f(t) = \sin\sqrt{t}$

(c) Evaluate $\int_{-\infty}^{\infty} \frac{x^2\,dx}{(x^2+1)(x^2+4)}$

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S.Y.B.Tech. Sem III
Strength of Materials.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Semester Examination
November 2015

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

Instructions:
1. Question No 1 is **compulsory**. Attempt any four questions out of remaining six.
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary

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Q1 a) Define following terms: (i) Modulus of elasticity, (ii) Yield strength, (iii) Ultimate tensile strength. **(3)**

b) A steel rod 120 mm in diameter is subjected to axial compressive force of 800 kN. If E = 200 GPa and ν = 0.29, calculate change in diameter of the rod. Also calculate axial stress and strain in the rod. **(3)**

c) Describe the sign convention which you will follow when drawing the shear force and bending moment diagrams. Review changes, if any, which can arise in subsequent calculations using these diagrams if someone follows a different sign convention. **(3)**

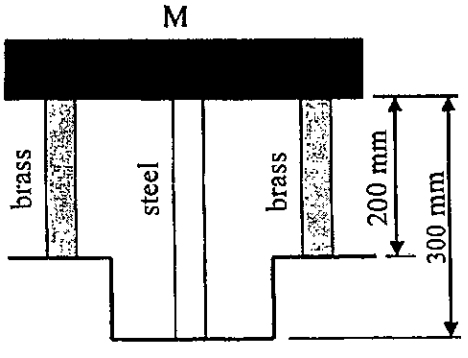
d) State assumptions made during development of classical bending equation. **(3)**

e) Explain how Mohr circle is applied for analysis of two-dimensional stress state in a body. **(3)**

f) Identify any two machine components in which limiting deflections will be highly critical for meeting their functional requirement. Support your answer with neat sketch of the components with loading and their original and deformed shapes. **(2)**

g) Describe any two thick walled pressurized components employed in industry. Explain Lame's formulae for computation of stresses in thick walled cylinders. **(3)**

Q2 a) Two brass rods and one steel rod, each of 30 mm diameter, together support a mass M at room temperature as shown in figure. E for brass is 110 GPa and that for steel is 200 GPa. If permissible stresses in brass and steel are respectively 80 MPa and 120 MPa, determine the maximum mass which the assembly can support. **(11)**



Assess the behaviour of the assembly and changes that would occur in the stresses induced in brass and steel rods

(1)

S.Y.B.Tech. Sem III
Strength of Materials. Date 18/11/15

if the entire assembly is uniformly heated to 100°C. Consider the mass as fixed to at the top of the rods. The rods are firmly anchored at their base.

b) A circular shaft transmits 30 kW at 400 rpm. It is supported in bearings 6 meters apart and at 2 meters from one bearing, it carries a rotor exerting a transverse load of 15 kN on the shaft. Determine a suitable diameter for the shaft taking into account both bending and torsional stresses if the maximum shear stress is not to exceed 40 MPa. **(5)**

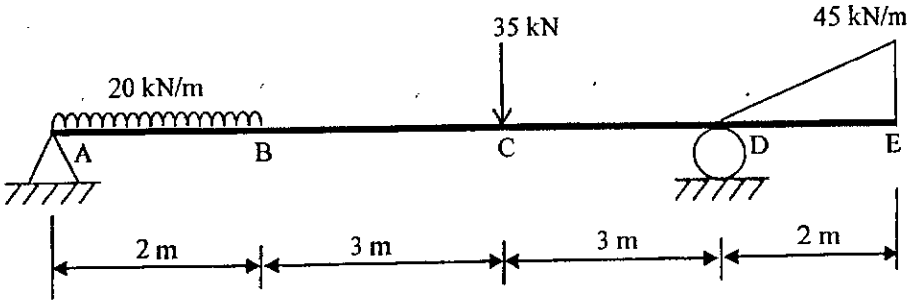
c) A thick walled cylinder 350 mm internal diameter and 75 mm wall thickness contains fluid at a pressure of 100 MPa. Calculate the maximum and minimum values of the hoop and radial stress in the cylinder. Sketch variation of hoop and radial stress across the thickness of wall. **(4)**

Q3 a) The stress-strain data of a tensile test carried on structural steel is tabulated below. **(5)**

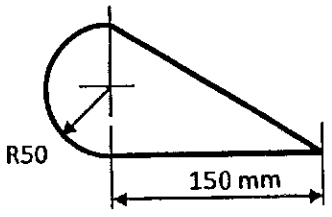
σ (MPa)	200	400	500	550	620	650	660	670
ε (mm/mm)	0.001	0.002	0.0025	0.0030	0.0045	0.006	0.008	0.010

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.

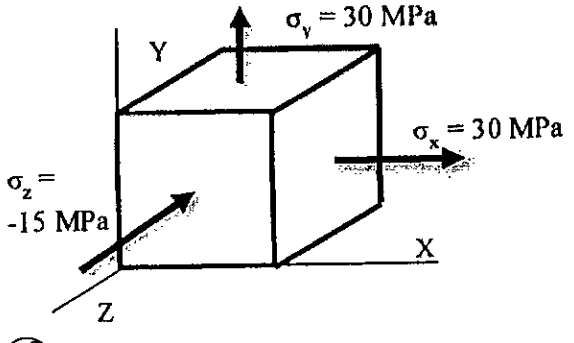
b) Draw the shear force and bending moment diagram for the beam ABCDE shown in the figure. **(11)**



c) A 3 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 250 MPa. What is the corresponding compressive stress in the punch? **(4)**



Q4 a) A solid cube of side 150 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, ν = 0.3. **(4)**



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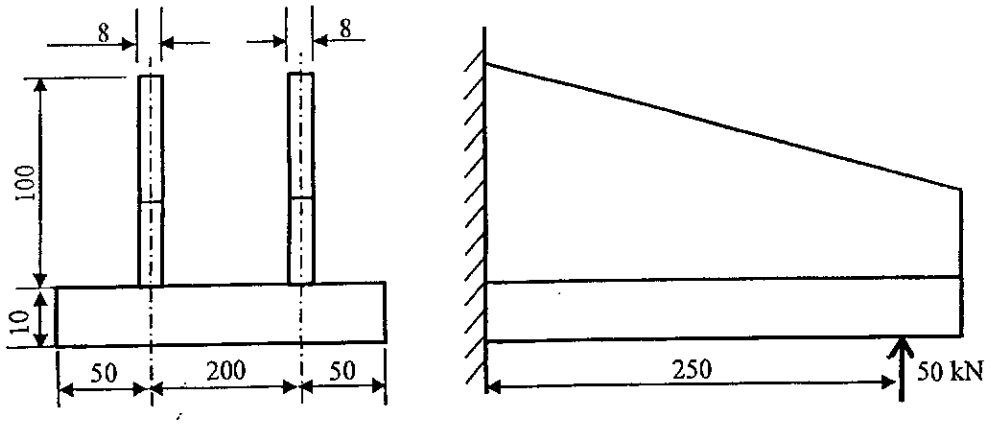
S.Y.B.Tech. Sem III
Strength of Materials. Date - 18/11/15.

b) Figure shows dimensions of a welded steel bracket which acts as a cantilever. Determine the greatest stress due to bending produced at the fixed end of the bracket by the load shown. **(8)**

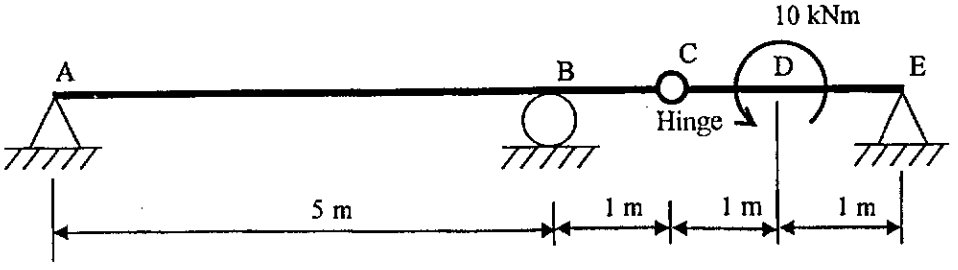


c) Formulate the expression for deflection and slope at the free end of a cantilever beam (length l and area moment of inertia I) subjected to uniformly distributed load w. Use integration method. If I of beam varies non-linearly from the highest value at fixed end to the lowest value at free end, propose a methodology to compute deflection and slope at free end. **(8)**

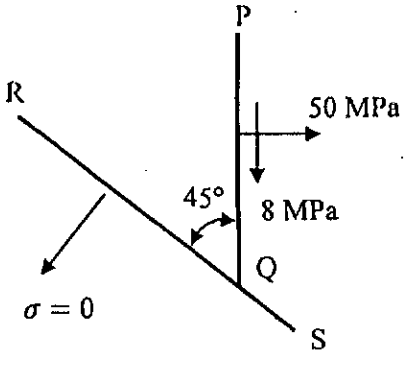
Q5 a) Show that the stain energy stored in a hollow shaft (inside diameter D_i and outside diameter D_o) subjected to torque T is given as $\frac{\tau^2}{4G}\frac{{D_o}^2+{D_i}^2}{{D_o}^2} \times volume\ of\ shaft$ **(5)**

where τ is maximum shear stress caused by torque T and G is shear modulus.

b) Develop shear force and bending moment diagram for beam ABCDE with internal hinge at C **(5)**



c) Figure shows two planes PQ and RS inclined to one another at 45°. On the plane PQ, there is tensile stress of 50 MPa and shear stress of 8 MPa. On plane RS, the normal stress is zero and shear stress has unknown value. Determine the value of this shear stress, the principal stresses and their position with respect to plane PQ. Construct Mohr circle (free hand sketch) for the stress state. **(10)**



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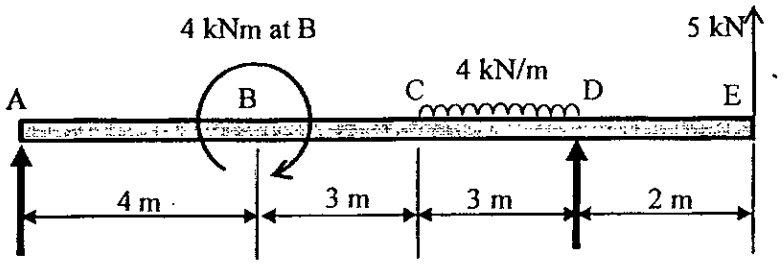
Strength of Material. Dt. 18/11/15

Q6 a) An unequal angle 300 mm x 150 mm, thickness of metal 15 mm, with the longer leg vertical is used as a simply supported beam and carries a load of 30 kN/m over a span of 6 meters. Find the maximum shear stress and sketch the distribution of shear stress across the section. **(10)**

Briefly assess the influence of section orientation, i.e., longer leg horizontal or any other orientation instead of vertical, on the magnitude of induced maximum shear stress. Support your assessment using appropriate theory.

b) An overhanging beam ABCDE is loaded as shown in figure. Determine the deflection of beam at point E using Macaulay's method. Take E = 200 GPa and I= 2 x 10^8 mm^4. **(10)**



Q7 a) A brittle steel rod is heated to 200°C and then suddenly clamped at both ends. On gradual cooling, the bar breaks at 150°C. Determine the breaking stress of this steel. Consider E = 200 GPa, α = 12 x 10^{-6} mm/mm/°C. **(5)**

If the rod is suddenly cooled by spraying with jets of cold water on its surface, contrast the nature of stresses in this situation against those induced during gradual cooling case.

b) A horizontal steel shaft ACB of hollow circular section, 200 mm external diameter, 100 mm internal diameter is fixed at its ends A and B. AC = CB = 5 meters. Twisting moment of 50 kNm, clockwise is applied at C. Determine the fixing moments at A and B, the maximum shear stress and the maximum angle of twist in the shaft. Take G = 0.8 x 10^5 N/mm^2. **(5)**

c) A cylindrical shell, 1000 mm in diameter, thickness of metal 16 mm and 3.5 m long, is subjected to internal pressure of 1.8 MPa. Calculate the change in diameter, length and volume of shell under pressure. Use thin cylinder theory. **(10)**

E = 200 GPa, Poisson's ratio = 0.3.

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S.Y.B.Tech. Mech. Sem III
Material Science.

23/11/2015

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Semester Exam
November 2015

Max. Marks: 100 Duration: 3 hours
Class: S.Y.B.Tech. Semester: III Program: B.Tech. Mechanical Engineering
Name of the Course: Material Science Course Code : BTM304

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

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Question No		Maximum Marks
Q1(a)	Draw a neat labeled Iron- Iron carbide diagram. Explain eutectic and eutectoid reactions with reference to this diagram (no need to draw microstructures).	10
(b)	Discuss three criteria that are important in the materials selection process.	04
(c)	Draw a schematic 'life cycle model of a material' and briefly describe its various stages.	06
Q2(a)	Explain the slow cooling of an iron carbon alloy containing 1.8 wt%C, when cooled from 1600°C to room temperature. Draw neat labeled microstructures at each stage.	08
(b)	Need for better performances of existing technologies demands an improvement in materials/material properties. List such typical needs and requirements that are expected of modern materials.	06
(c)	Define Creep. Draw a typical creep curve. Explain each stage in detail.	06
Q3(a)	Discuss environmental and social issues of material usage	06
(b)	Explain pack carburizing. State its advantages and disadvantages(2 points each) The initial carbon content of the steel gear is 0.25 wt%, whereas the surface concentration is to be maintained at 1.20 wt%. For this treatment to be effective, a carbon content of 0.80 wt% must be established at a position 0.5 mm below the surface. If the treatment is to be carried out at 950°C and the diffusion coefficient for carbon in iron at this temperature is $1.6 \times 10^{-11} m^2/s$; calculate the time required in hours.(refer table 1 on page 3)	10
(c)	Explain laminar composites with neat sketches.	04
Q4(a)	Explain beachmarks and striations with neat sketches.	10
	If a 12.5mm diameter cylindrical rod fabricated from a 2014-T6 alloy is subjected to a repeated tension-compression load cycling along its axis, compute the maximum and minimum loads that may be applied to yield a fatigue life of 1.0×10^6 cycles. Assume that the stress amplitude plotted on the vertical axis was taken for a mean stress of 50 MPa. (refer figure 1 on page 3)	

S.Y.B.Tech. Mech. Sem III
Material Science. Dt. 23/11/15

(b) Why are chromium and aluminum added to steels? 04

(c) Explain vacancy, self-interstitialicy and substitutional impurity point defects with neat sketches. 06

Q5(a) Draw neat labeled microstructures of white cast iron, grey cast iron, nodular cast iron, malleable cast iron and state an application of each 10

(b) Explain the various stages in cup-and-cone fracture with neat sketches. 06

(c) Identify the solute and the solvent in an alloy that consists of 97 wt% aluminum and 3 wt% copper. Also determine the composition in atom percent if A_{Cu}=63.55g/mol and A_{Al}=29.98g/mol. 04

Q6(a) Compare an annealed steel specimen and a normalized steel specimen based on the tensile strength, structure of pearlite, grain size distribution and internal stresses. 04

(b) What are the properties of Nickel? 08
List four nickel alloys and state the composition and one typical application of each alloy.

(c) A continuous and aligned glass fiber-reinforced composite consists of 40vol% of glass fibers having a modulus of elasticity of 69GPa and 60vol% of a polyester resin that, when hardened, displays a modulus of 3.4GPa. 08
(i) Compute the modulus of elasticity of this composite in the longitudinal direction.
(ii) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fiber and matrix phases.
(iii) Determine the strain that is sustained by each phase when the stress in part ii is applied.
(iv) Compute the elastic modulus of the composite if the stress is applied perpendicular to the direction of fiber alignment.

Q7(a) Classify ceramics (on the basis of application) and briefly explain each component with an example 08

(b) If alloying elements were to be categorized based on their relationship with Carbon, to which groups would Si, Ni, Cu and Al belong? 08

If alloying elements were to be categorized based on their relationship with allotropic forms of iron, to which groups would Si, Ni, Cu and Al belong?

Discuss the effects of Si and Ni on eutectoid temperature and composition with neat sketches.

(c) Using the isothermal transformation diagram for an iron–carbon alloy of eutectoid composition, specify the nature of the final microstructure (in terms of micro constituents present and mechanical properties) of a small specimen that has been rapidly cooled from 800°C to 250°C , held for 100s, and then quenched to room temperature. Sketch and label the microstructure. (refer figure 2 on page 3) 04

S.Y.B.Tech. Mech. Sem III

Material science. Dt. 23/11/15

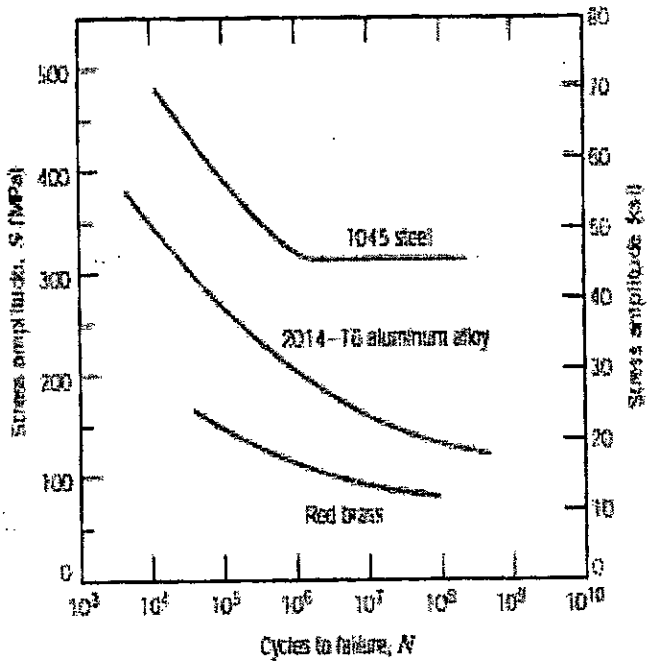

Figure 1: Stress amplitude 'S 'in MPa versus the logarithm of the number of cycles to fatigue failure of metals for red brass, an aluminum alloy and a plain carbon steel

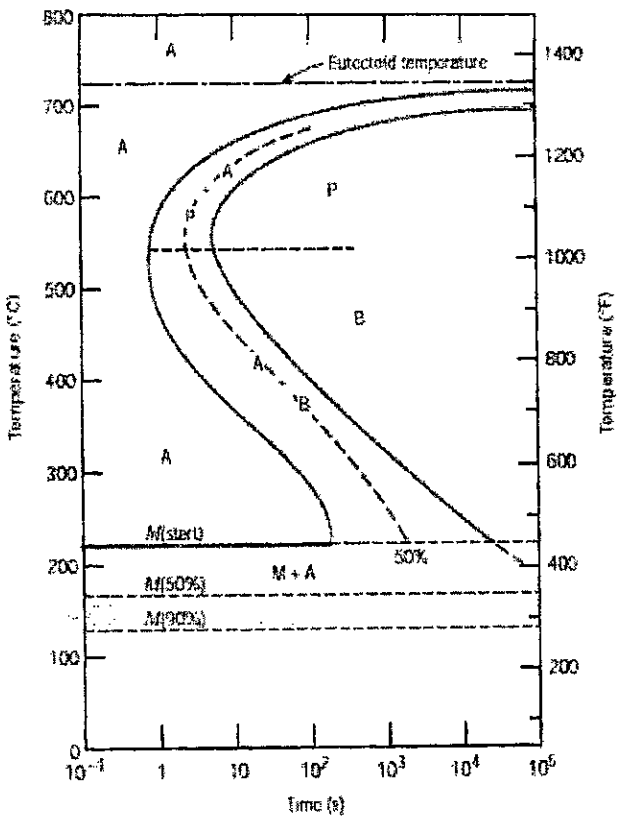

Figure 2: The isothermal transformation diagram for an iron-carbon alloy of eutectoid composition

Table 1: Tabulation of error function values

x	erf(x)	x	erf(x)	x	erf(x)
0	0	0.55	0.5633	1.3	0.934
0.025	0.0282	0.6	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.642	1.5	0.9661
0.1	0.1125	0.7	0.6778	1.6	0.9763
0.15	0.168	0.75	0.7112	1.7	0.9838
0.2	0.2227	0.8	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.3	0.3286	0.9	0.7969	2	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.4	0.4284	1	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.5	0.5205	1.2	0.9103	2.8	0.9999

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S.Y. B.Tech. (Mech), sem - III

Thermodynamics.

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar,Andheri(West),Mumbai 400 058

(A Government Aided Autonomous Institute)

End Semester Examination, November 2015

S Y B.Tech. (Mechanical), SEM-III **BTM 305 -THERMODYNAMICS**

Duration: **3 Hour** Max Marks: **100**

- Answer any **five** (05) questions.
- Figure to the right of questions indicate full marks.
- Make suitable assumption if required.
- Answers to all sub-questions should be grouped together.
- Use of steam table / Mollier chart is permitted.

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1. a) Draw a schematic diagram of a closed gas turbine system and represent it on Ts diagram. Obtain an expression for optimum pressure ratio condition for minimum compressor work in two stage perfect intercooled compression. **08**

b) At the beginning of the compression process of an air-standard Diesel cycle operating with a compression ratio of 18, the temperature is 300 K and the pressure is 0.1 MPa. The cutoff ratio for the cycle is 2. Determine **12**

(a) the temperature and pressure at the end of each process of the cycle,
(b) the thermal efficiency,
(c) the mean effective pressure, in MPa.

2. a) Derive the expression for Carnot cycle efficiency. Discuss its limitations and explain Otto cycle, Diesel cycle and Dual cycle in light of these limitations. **08**

b) A regenerative gas turbine with inter-cooling and reheat operates at steady state. Air enters the compressor at 100 kPa, 300 K with a mass flow rate of 5.807 kg/s. The pressure ratio across the two-stage compressor is 10. The pressure ratio across the two-stage turbine is also 10. The intercooler and reheater each operate at 300 kPa. At the inlets to the turbine stages, the temperature is 1400 K. The temperature at the inlet to the second compressor stage is 300 K. The isentropic efficiency of each compressor and turbine stage is 80%. The regenerator effectiveness is 80%. **12**

Determine

(a) the thermal efficiency,
(b) The work ratio,
(c) the net power developed, in kW.

3. a) Explain the significance of energy and entropy in thermodynamic system analysis. Prove that they are point function of a thermal system. **08**

b) In a steam turbine installation running on ideal Rankine cycle steam leaves the boiler at 10 MPa and 700°C and leaves turbine at 0.005 MPa. For the 50 MW output of the plant and cooling water entering and leaving condenser at 15°C and 30°C respectively determine **12**

(a) the mass flow rate of steam in kg/s
(b) the mass flow rate of condenser cooling water in kg/s
(c) the thermal efficiency of cycle

S.Y.B.Tech. (Mech), Sem III
Thermodynamics Dt- 26/11/15

(d) the ratio of heat supplied and rejected (in boiler and condenser respectively).
Neglet K.E. and P.E. changes.

4. a) Give limitations of Carnot cycle as vapour power cycle and explain how Rankine cycle helps in overcoming them. Also discuss the limitations of maximum and minimum temperatures in a steam power cycle. **08**

b) Determine HHV and LHV of 298K of gaseous n-decane per kilomole of fuel and per kgmole of fuel. If the enthalpy of vaporization of n-decane is 359 kJ/kmole of fuel at 298K, calculate HHV and LHV of liquid n-decane. **12**

Data: $\left(\bar{h}_f^0\right)_{n\text{-}decane(g)} = -249650\ kJ/kmole$, $\left(\bar{h}_f^0\right)_{Water} = -241646\ kJ/kmole$

$\left(\bar{h}_f^0\right)_{CO_2} = -393546\ kJ/kmole$, Latent heat of water =44010 *kJ/kmole*

5. a) Define and distinguish between any **FOUR (04)** of the following. **08**
   i) Stoichiometric air and excess air
   ii) Lean and rich mixture
   iii) Complete and Incomplete combustion
   iv) HHV and LHV
   v) Heat of formation and heat of reaction

b) Steam enters a turbine with a pressure of 30 bar, a temperature of 400°C, and a velocity of 160 m/s. Steam exits as saturated vapor at 100°C with a velocity of 100 m/s. At steady state, the turbine develops work at a rate of 540 kJ per kg of steam flowing through the turbine. Heat transfer between the turbine and its surroundings occurs at an average outer surface temperature of 350 K. Develop a full accounting of the net exergy carried in by the steam, in kJ per unit mass of steam flowing. **12**
Let $T_0 = 25°C$, $P_0 = 1$ atm.

6. a) Derive an expression for thermal efficiency and mean effective pressure of an air standard Otto cycle. List all assumption made in the derivation. **08**

b) A closed system contains air at a pressure 1 bar, temperature 300 K and volume 0.018 m^3. This system undergoes a thermodynamic cycle consisting of the following three processes in series: **12**
   (i) Constant volume heat addition till pressure becomes 5 bar,
   (ii) Constant pressure cooling, and
   (iii) Isothermal heating to initial state.
   Represent the cycle on Ts and Pv plots and evaluate the change in entropy for each process.
   Take $C_p = 0.718$ kJ/kg K and $R = 0.287$ kJ/kg K.

7 a) What do you mean by air standard cycles? Discuss its' significance. **10**
Draw following air standard cycles.
   (a) Rankine cycle with reheating on Pv, hs and Ts diagram
   (b) Brtaton cycle with one perfect intercooler on Pv and Ts diagram

b) Show that for a polytropic process, **10**

$Q = \left(\frac{\gamma - n}{\gamma - 1}\right) W$ Where, Q and W are heat and work interactions and n is polytropic index.

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S.Y.B.Tech. Mech. Sem III
Manufacturing Science - I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Semester Exam

November 2015

Max. Marks: 100 Duration: 3 hours

Class: S.Y.B.TECH. Semester:III Program: Mechanical Engineering

Name of the Course: **Manufacturing Science –I** Course Code : BTM 306

Instructions:

1. **Question No 1 is compulsory.**
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

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Question No			Max Marks
Q1	(a)	What are basic operational steps in sand casting process? Explain each step in brief with example & draw block diagram of entire process?	8
	(b)	For drilling through hole of diameter 16 mm in mild steel workpiece having thickness of 25 mm with HSS spiral fluted drill tool. Half of drill point angle is 55°, cutting velocity is 30 m/min, feed is 0.55 mm/rev, and approach and overrun distances for drill tool is 3 mm each. Calculate total time required to drill through hole? Draw well labeled sketch of workpiece indicating working principle of drilling operation?	6
	(c)	Answer the following question with one or two points only; i) What is material removal mechanism of abrasive jet machining and which type of workpiece material can be machined using such?....(3M) ii) If complex shape has to be machined in *high strength temperature resistant alloy* nontraditional machining process can be used is.....? & what is material removal mechanism of that process? (3M)	6
Q2	(a)	Explain conventional grinding wheel compositional *specification*? Explain each alpha numeric terms in details which describes grinding wheel? What are different workpiece materials can be machined using its subtypes?	8
	(b)	Draw neat schematic sketch of shaper machine? Explain working principle of shaper machine with schematic sketch? Also describe kinematic system of shaper machine?	8
	(c)	Draw neat schematic block diagram of universal dividing head & explain its working?	4
Q3	(a)	A cast steel block having length of 450 mm and with 330 mm have thickness of 100 mm. Finish size of block required to have to be of 450X330X85 mm^3. For each pass allowable depth of cut for single point tool is 3 mm. Cutting speed maintained is 300 mm/min & return stroke is 450 mm/min. For first two cuts,	8

transverse feed is 5 mm/cutting stroke & for remaining cuts, transverse feed is 3 mm/cutting stroke. Consider approach and over run distance of tool is 5 mm each. Find how long the job will take to complete?

(b) Draw neat schematic sketch & explain of Radial drilling machine? Explain specific applications of it? What are different types of radial drilling machine, explain in brief? 8

(c) Explain tool room lathe and draw its block diagram of its different parts? 4

Q4(a) What are different modes of indexing? Explain the working of both modes of indexing and draw their kinematic system? 8

(b) Two plates joined to each other by two **fillet** welded joint of length 150 mm each. If the plate 'A' is subjected to load of 200 kN & other plate fixed at support as shown in figure 1, calculate minimum throat size (length), leg length of transverse fillet weld bead. (Assume both weld beads are having same dimensions). Assume, allowable Tensile stress of weld bead is 110 MPa. If top plate 'A' has thickness of 20 mm, is it feasible to have such throat dimensions of weld bead which can sustain such loading condition? 6

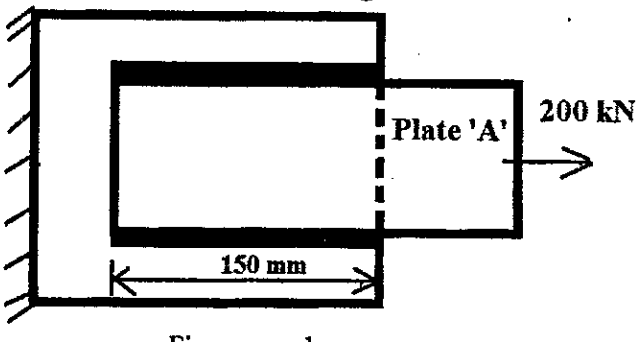

Figure no. 1

(c) Explain with neat schematic sketch submerged arc welding process and its applications? 6

Q5(a) Explain with neat schematic sketch working principle of Extemal Centreless grinding machine? (4M) 8

Answer the following question with one or two points only;

i) To have fine finish on alloy steel & carbon steel suitable abrasive grit material is .....? Abrasive grit material on grinding wheel should have ..... grain size? (2M)

ii) For rough grinding operation of cemented carbide material grinding wheel structure must be.....? Abrasive grits can be used are.....? (2M)

(b) What are different factors affecting performance of gating system? Explain different components of gating system and their function/purpose? Draw well labeled schematic sketch of gating system with positions of chills and chaplets? 9

(c) For *batch* manufacturing of components shown in (figure 3) in one setting with *good accuracy* and *repeatability*, which lathe machine have to be used, state different turning operations need to be performed? 3

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Manufacturing Science-I. Dt. 28/11/15

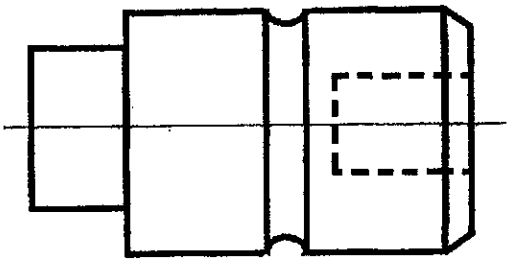

Figure no. 3

Q6(a) Explain different advantages of CNC lathe machine? 2

(b) Calculate total machining time to turn copper cylindrical rod of diameter 75 mm X length 200 mm into finish component as shown in figure 2? Finish component has dimensions as shown in figure 2. For, Part A- Cutting velocity is 50 m/min, feed is 0.5 mm/rev & depth of cut is 1.25 mm for both outer diameter (O.D) turning and face turning operation. For, Part B- Cutting velocity is 35 m/min, feed is 0.4 mm/rev & depth of cut is 1.25 mm for outer diameter (O.D) turning. (Note - For calculating machining time of each next pass of outer diameter (O.D) turning, consider existing diameter of workpiece at that instant) 10

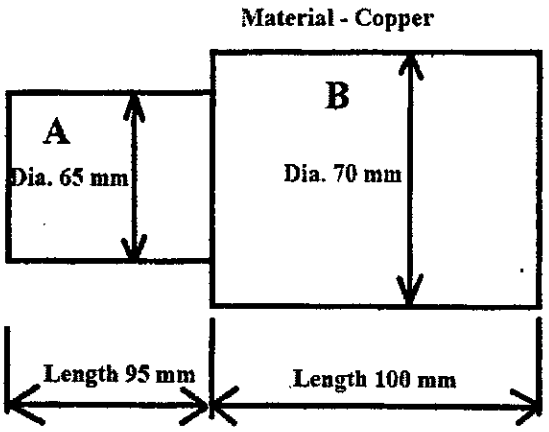

Figure no. 2

(c) Explain with neat schematic sketch Plasma arc welding process, its advantages & disadvantages? 8

Q7(a) Explain classification of lathe machines with their examples? 6

(b) Determine total time required for plain milling of top face and side milling of other four faces of Aluminum block having length of 200 mm, width 50 mm and height of 50 m? *Helical fluted plain HSS milling cutter* of diameter 60 mm, length 75 mm and have 6 teeth used for plain milling of top surface & *Helical fluted solid carbide End milling cutter* of diameter 20 mm, length 75 mm and have 6 teeth used for side surface milling. Approach distance and over run distance are 5 mm for tools, cutting velocity 40 m/min and feed is 0.25 mm/tooth. 10

(c) Draw and explain parts/structure of carriage unit of conventional lathe machine? 4

B.Tech. Mech - Sem III
Machine Drawing.

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GOVERNMENT AIDED AUTONOMOUS INSTITUTE
ANDHERI (WEST), MUMBAI - 400 058.

End Semester Exam

Nov – Dec 2015

Master file.

Max. Marks: 100	**Duration: 04 hrs**
Class: B.Tech Mechanical	**Semester: III**
Name of Course: Machine Drawing	**Program: B.Tech Mechanical Engineering**
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.

Q. 1 (a)	Draw Free hand sketches of the following: (i) Two views of Tapered Gib Headed Key. (ii) Square Nut & Bolt of size M10	 06 04
(b)	Show different Types of Fits via hole basis system.	04
(c)	Draw free hand sketches of any three types of weld joints.	06
Q. 2 (a)	A vertical cone, diameter of base 75 mm and axis 100 mm long, is completely penetrated by a cylinder of 45 mm diameter. The axis of the cylinder is parallel to the H.P. and the V.P. and intersects the axis of the cone at a point 28 mm above the base. Draw projections of solids by cutting plane method.	10
(b)	Fig. 1 shows the assembly of Knuckle Joint. Draw the following: (i) Eye End (Front View & Sectional Top view) (ii) Fork End (Front View & Sectional Top view)	 5 5
Q. 3 (a)	Fig. 2 shows half section view of a protected type flange coupling. Assemble parts and draw to some suitable scale the following views: (a) Front view – full in section (b) End View	 7 7
(b)	Draw free hand sketches of following (i) Acme Thread (ii) Buttress Thread	 03 03
Q. 4 (a)	Fig. 3. shows the details of Foot Step bearing. Imagine the parts assembled together and draw the following views with appropriate scale. (i) Front full view in section (ii) Top view	 08 08
(b)	Draw free hand drawing of conventional representation of Ball Bearing	04

B.Tech. Mech. Sem III - Machine Drawing Dt. 28/11/15

Q. 5 (a)	Fig. 4 shows details of expansion joint. 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. Give the material list also.	 08 08 04
Q. 6 (a)	Fig. 5 shows the details of Steam stop valve. Imagine the parts assembled together and draw the following views: (i) Sectional Front View (ii) Side View	 08 08
(b)	Explain the meaning of following (i) 50 H7/g6 (ii) 30 ± 0.25	 02 02
Q. 7 (a)	Fig. 6 shows assembly of Drill Jig. Draw the Following views for: (a) Jig Plate - (i) Sectional Front View (ii) Top View (b) Base Plate – (i) Sectional Front View (ii) Top View	 06 04 06 04

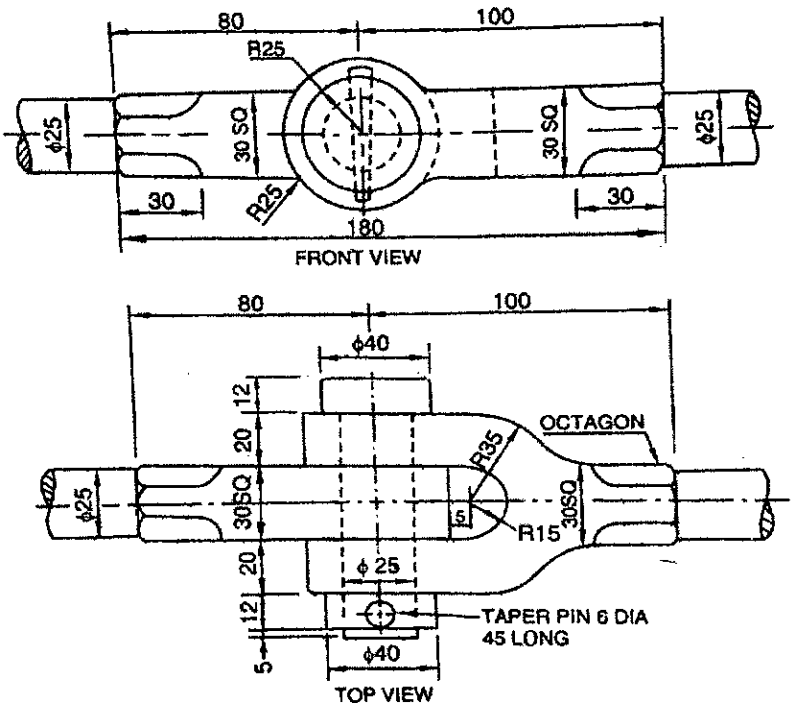

Fig. 1 Knuckle Joint Assembly

(2)

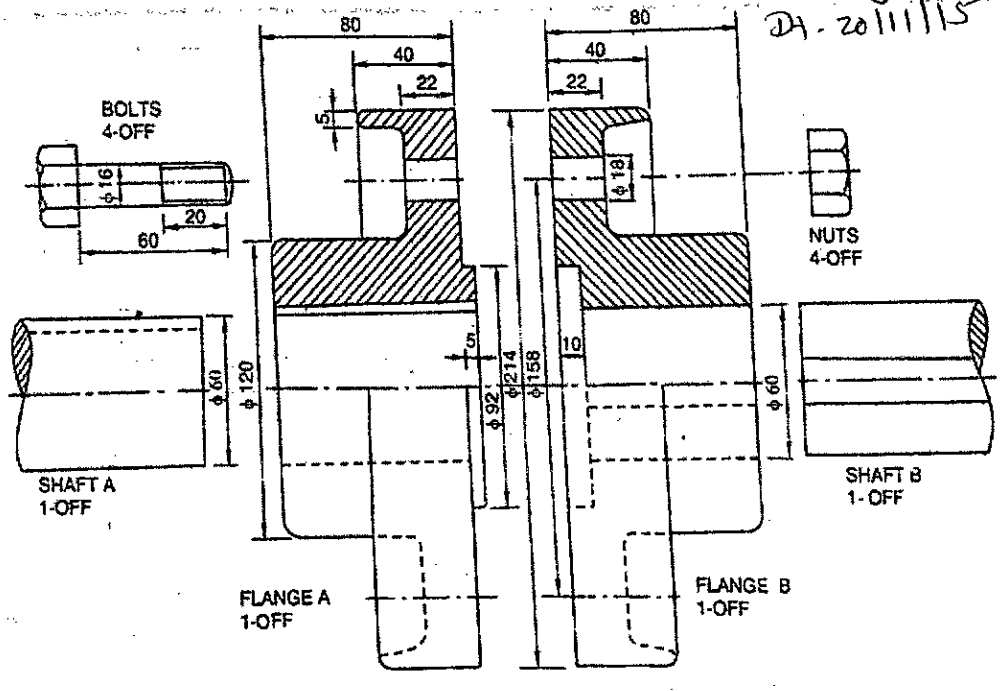

Fig. 2 Protected type Flange

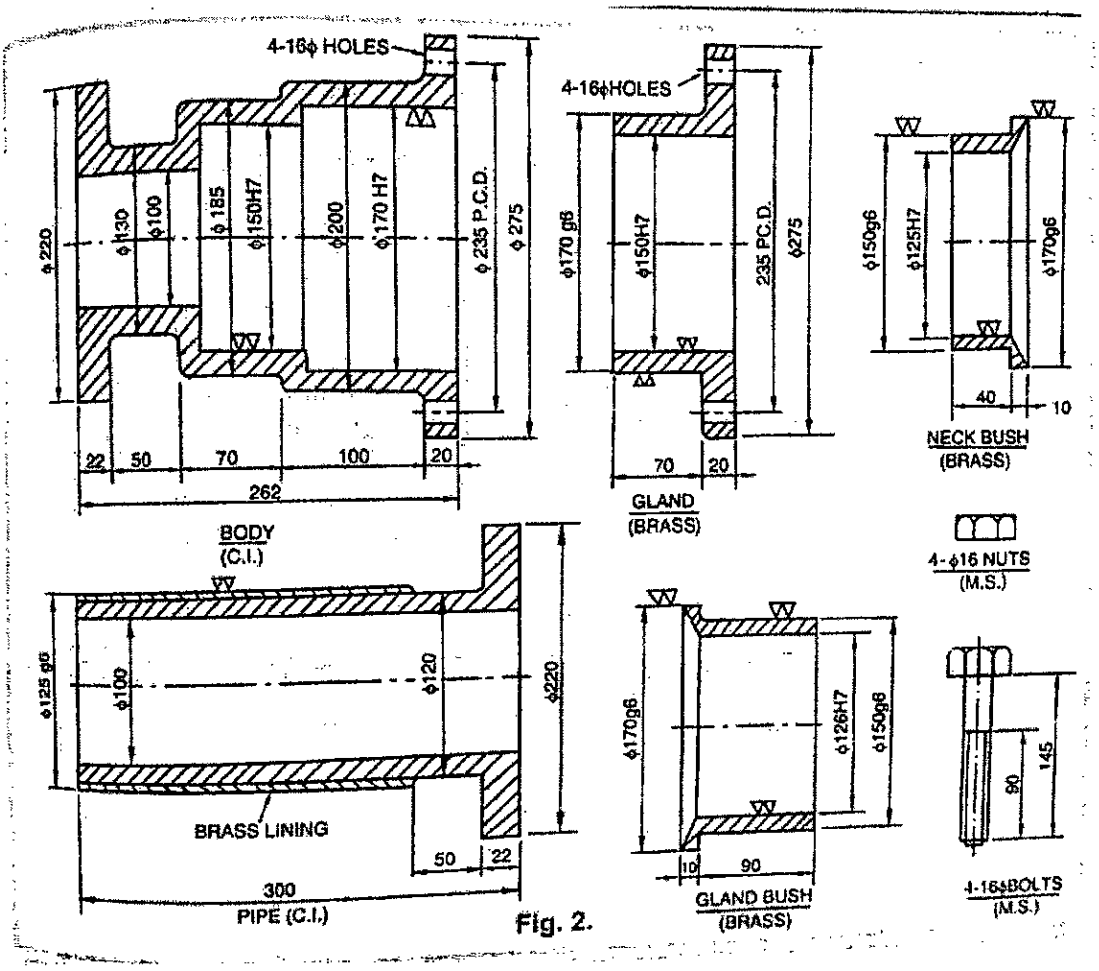

Fig. 2.

Fig. 4 Expansion Joint Details

(3)

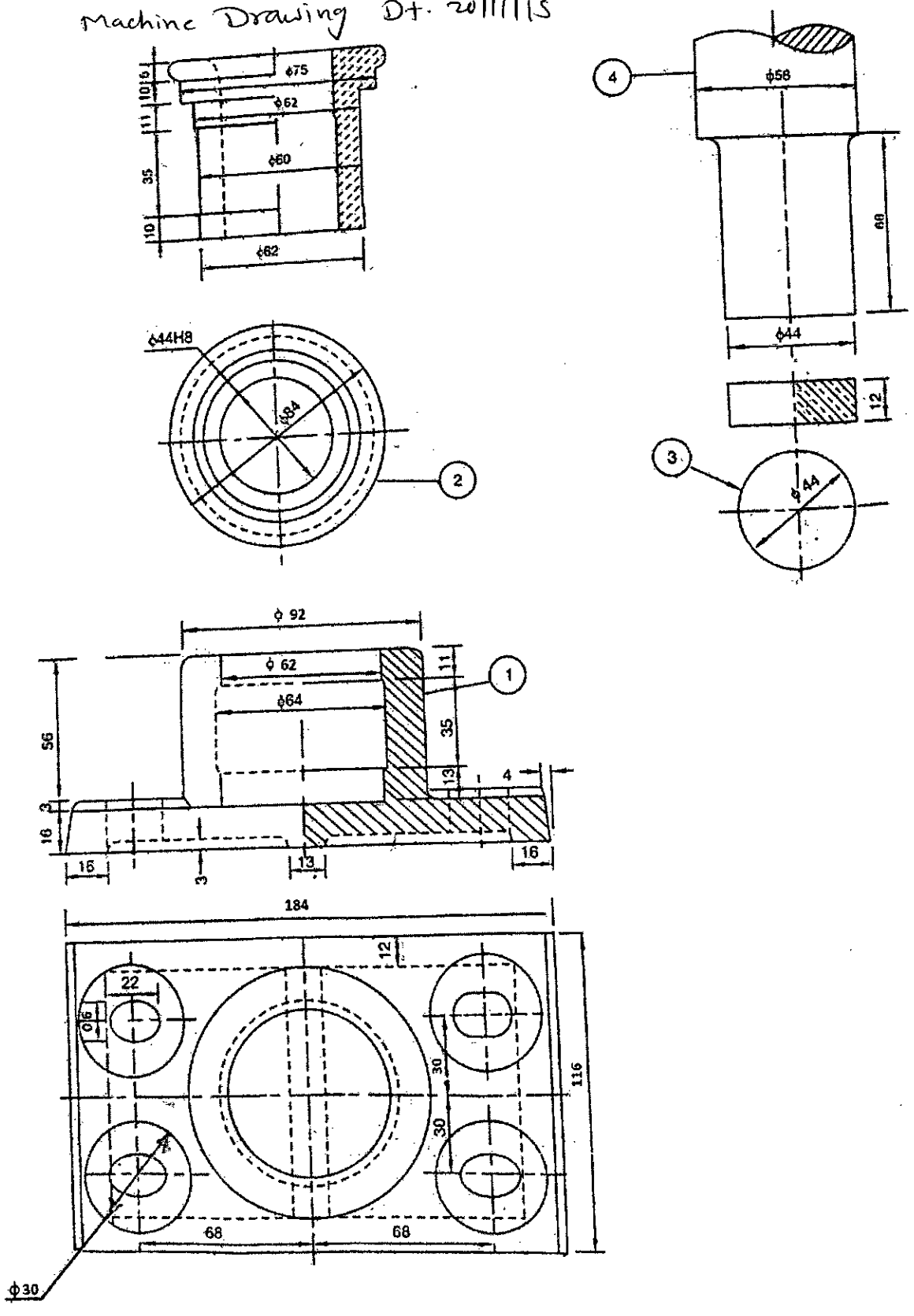

Fig. 3 Foot Step Bearing Details

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Machine Drawing - Dt. - 20/11/15

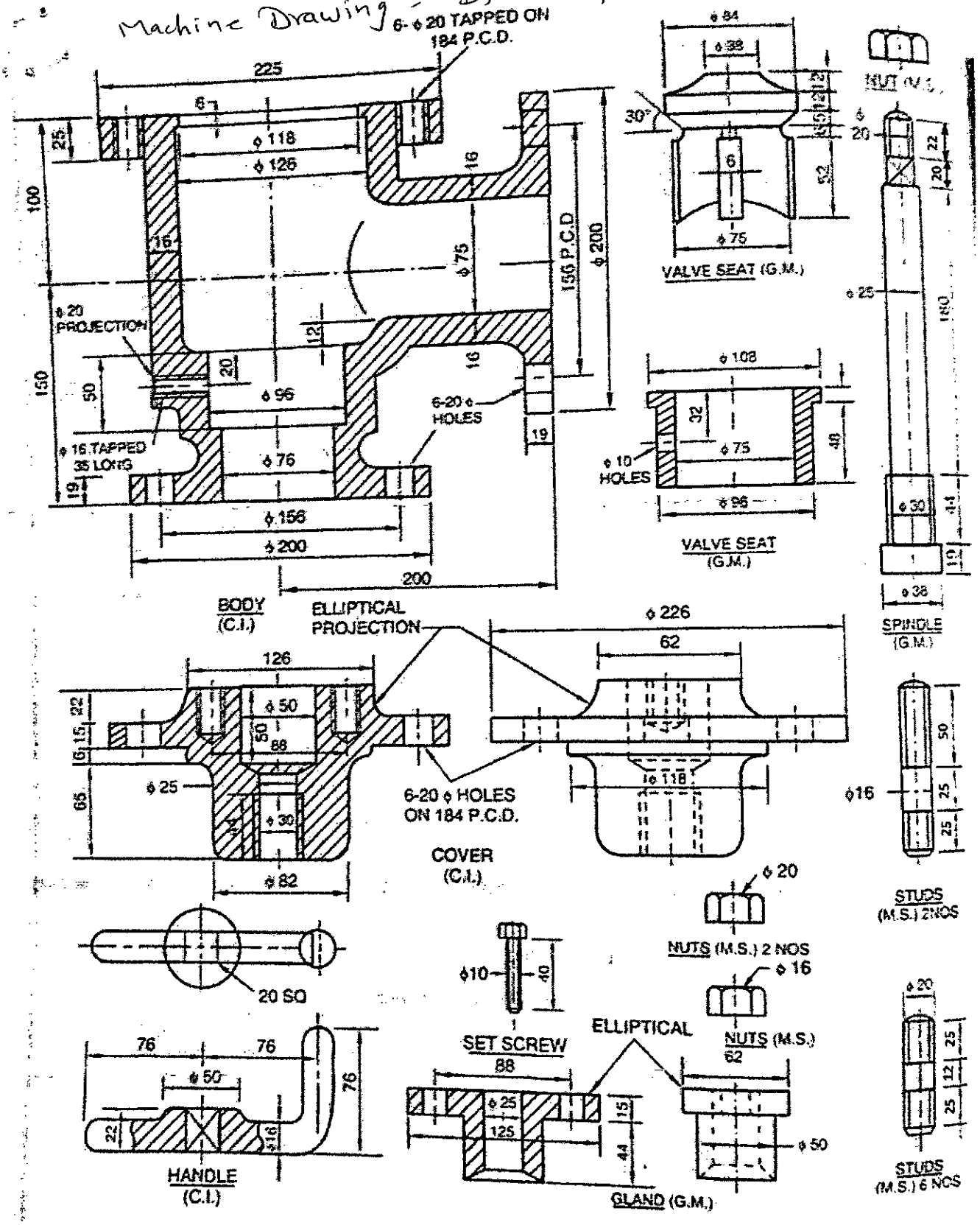

Fig. 5 Steam Stop Valve Details

(5)

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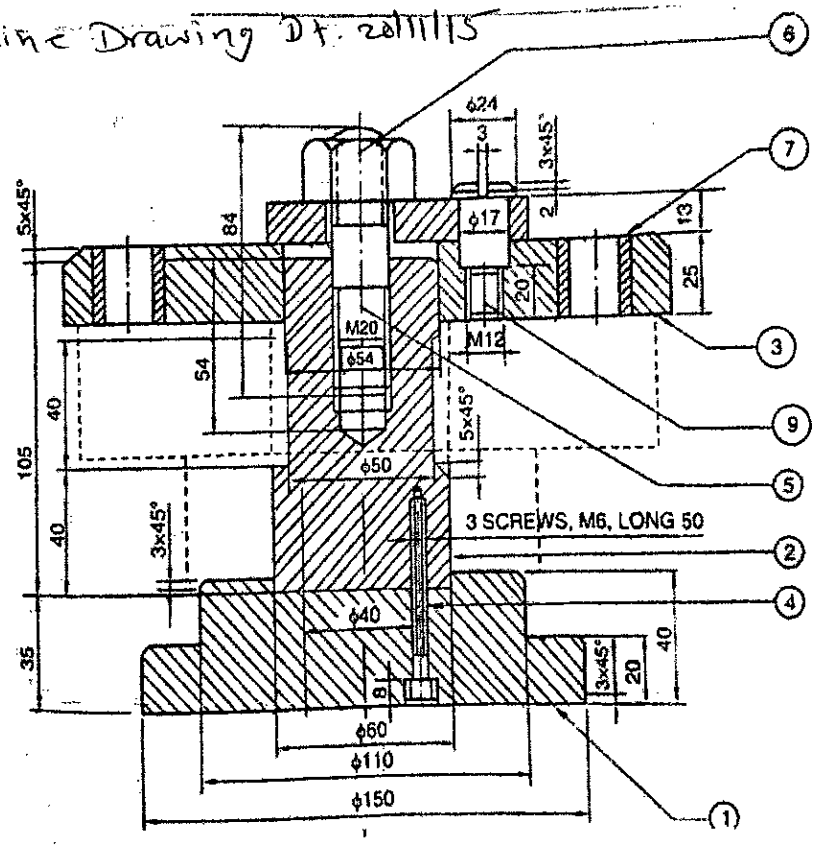
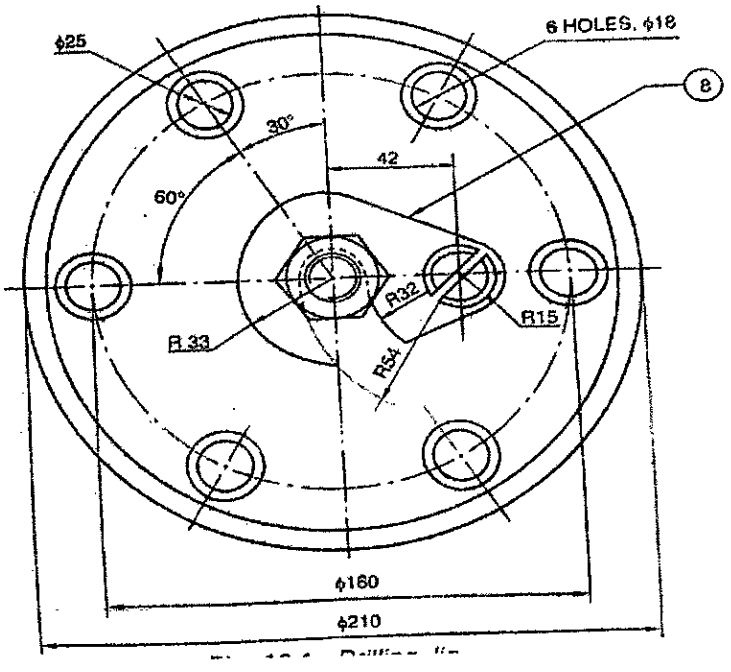
Machine Drawing Dt. 20/11/15





Part No.	Name	Material	No. off
1	BASE PLATE	C.I.	1
2	STEM	M.S.	1
3	JIG PLATE	C.I.	1
4	SCREW	M.S.	3
5	STUD	M.S.	1
6	NUT	M.S.	1
7	BUSH	A.S.	6
8	LATCH WASHER	M.S.	1
9	SCREW	M.S.	1

Fig. 6 Drill Jig Assembly

(6)

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ANDHERI (WEST), MUMBAI - 400 058.

Re – Exam

Dec - Jan 2015

Max. Marks: 100	**Duration: 04 hrs**
Class: S.Y. B.Tech Mechanical	**Semester: III**
Name of Course: Machine Drawing	**Program: B.Tech Mechanical Engineering**
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.

S.Y. B.Tech (mech).
Sem III
Machine Drawing
dt. 6.1.16

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Q. 1 (a) Draw Free hand sketches of the following:

(i) Hollow saddle Key & Flat Saddle Key. 06

(ii) Wing Nut & Capstan Nut 04

(b) Draw free hand sketches of any three types of weld joints. 06

(c) Show different Types of Fits via shaft basis system. 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 Spigot and Socket joint. Assemble the parts together and draw the following:

(i) Sectional Front View 5

(ii) Side View 5

Q. 3 (a) Fig. 2 shows half section view of V-belt Pulley. Draw to some suitable scale the following views:

(a) Front view – full in section 08

(b) Side View 06

(b) Draw free hand sketches of following

(i) B.S.W Thread 03

(ii) Metric Thread 03

Q. 4 Fig. 3. shows the details of Plummer Block. Imagine the parts assembled together and draw the following views with appropriate scale:

(a) Front view right half in section 10

(b) Top view 08

Give Material List 02

Q. 5 Fig. 4 shows details of Stuffing box. Imagine the parts assembled together and draw the following views:

(a) Front view full in section 10

(b) Side view 08

Show the tolerances and surface finish wherever required. 02

Q. 6 Fig. 5 shows the assembly of Gun metal Stop valve. Draw the following views of:

(a) Body – (i) Sectional Front View 06

(ii) Side View 06

(b) Cover – (i) Sectional Front View 04

(ii) Side View 04

Q. 7 Fig. 6 shows details of Drill Jig. Draw the Following views for:

(a) Sectional Front View 08

(b) Top View 08

Show the tolerances and surface finish wherever required. Give the material list also. 04

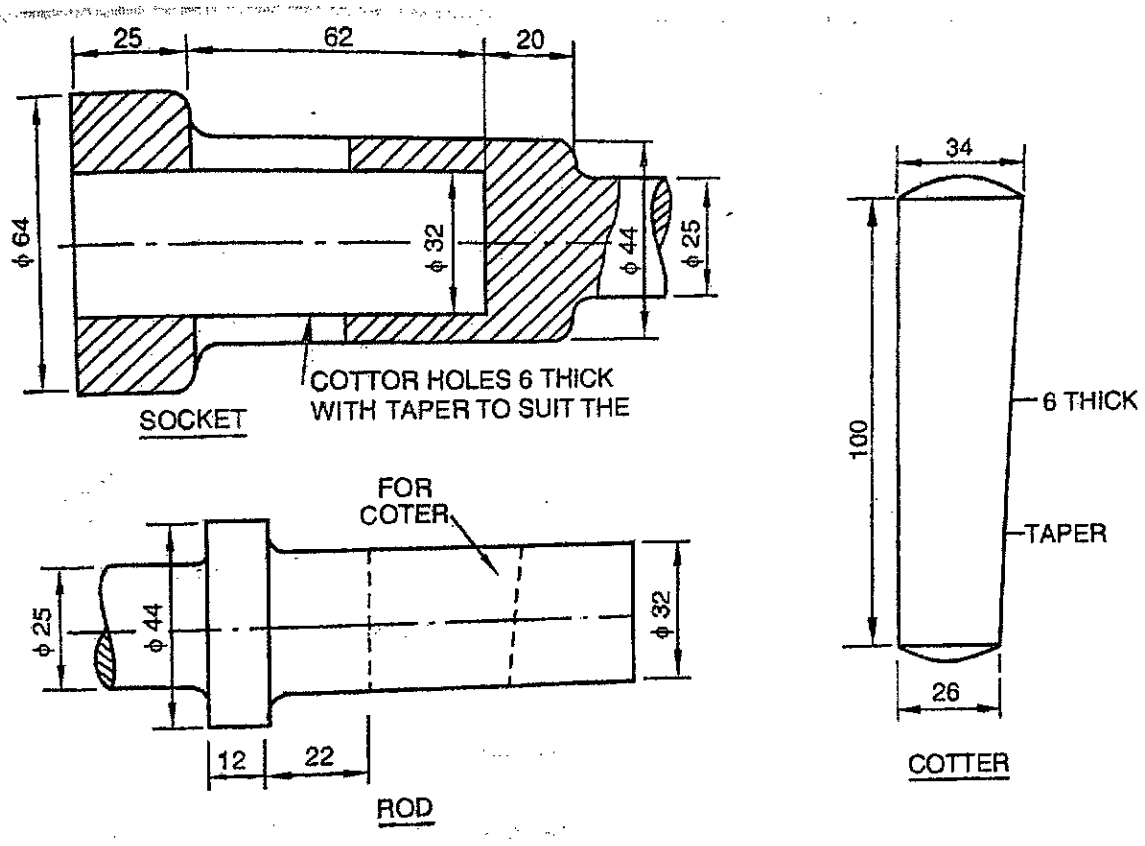


Figure 1: Details of Spigot and Socket Joint

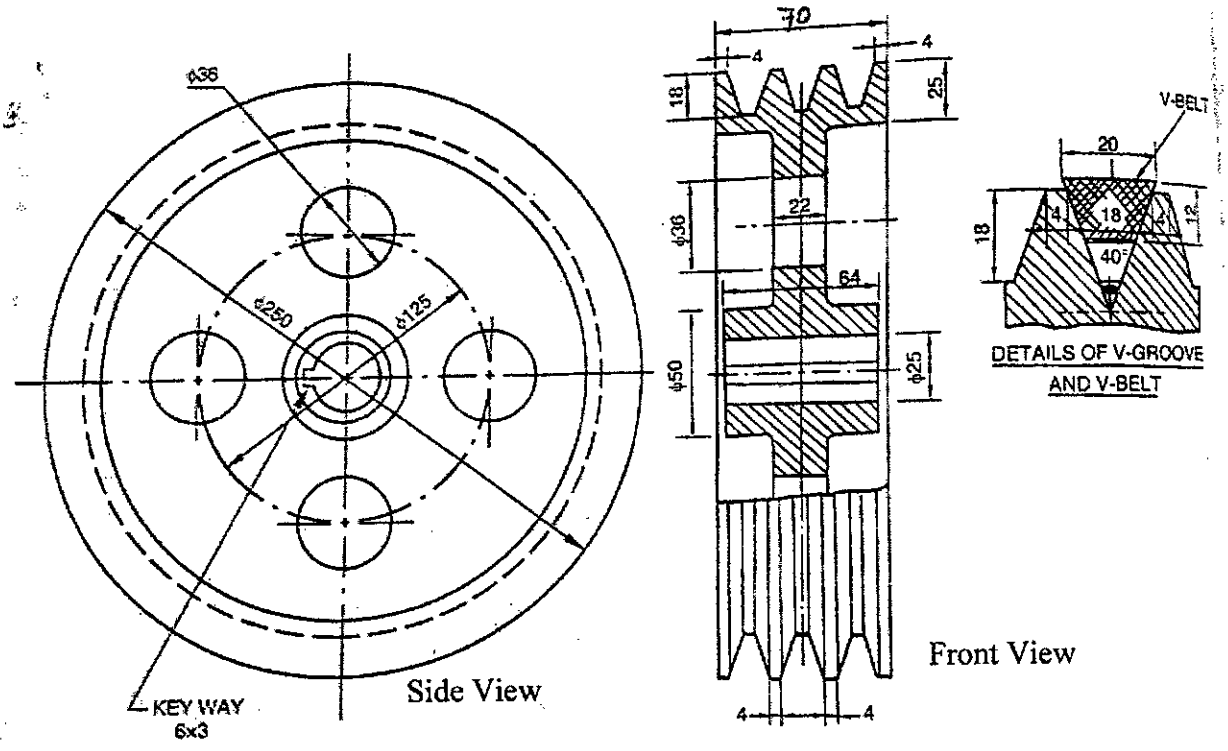


Figure 2: V belt Pulley

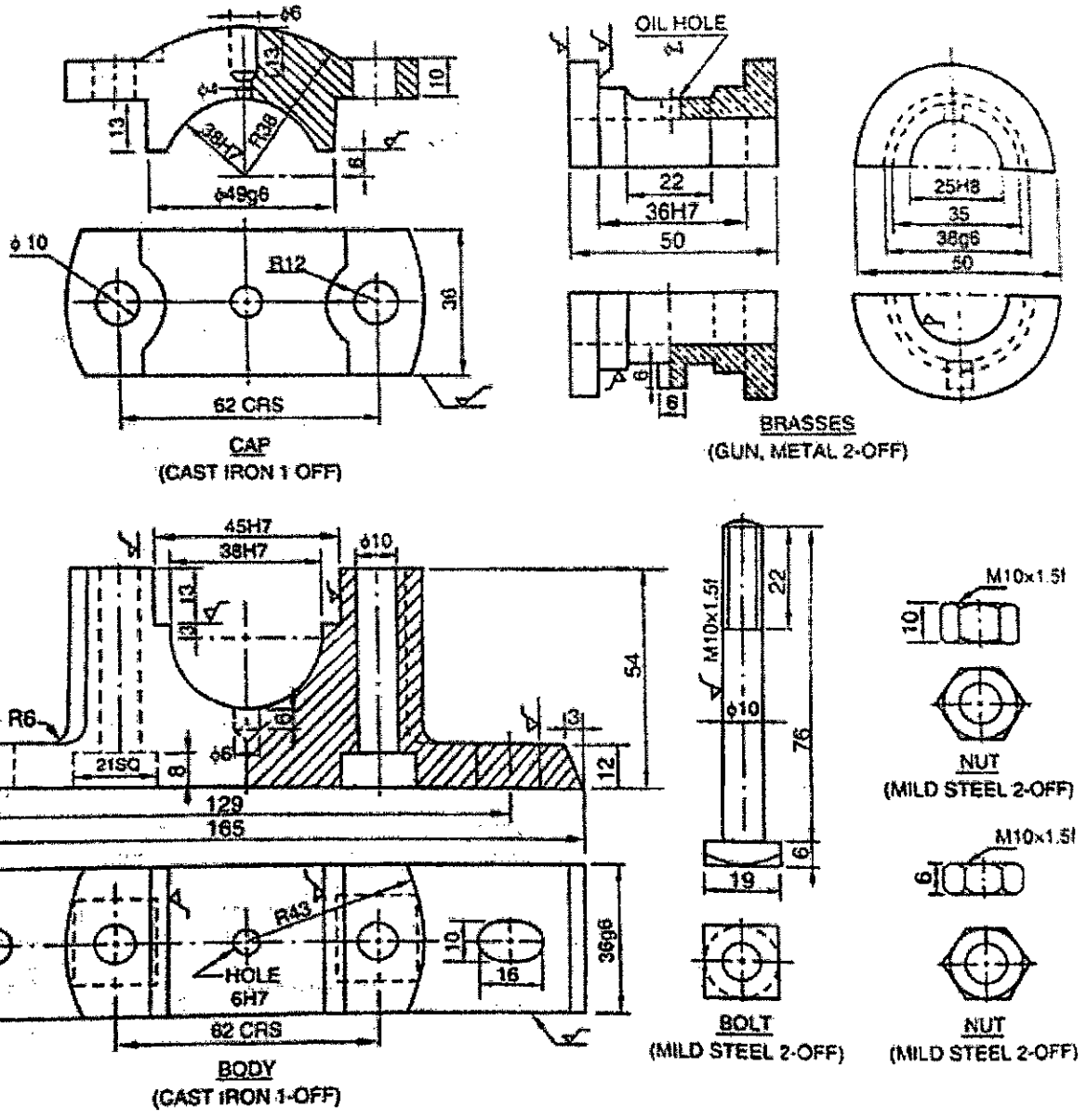
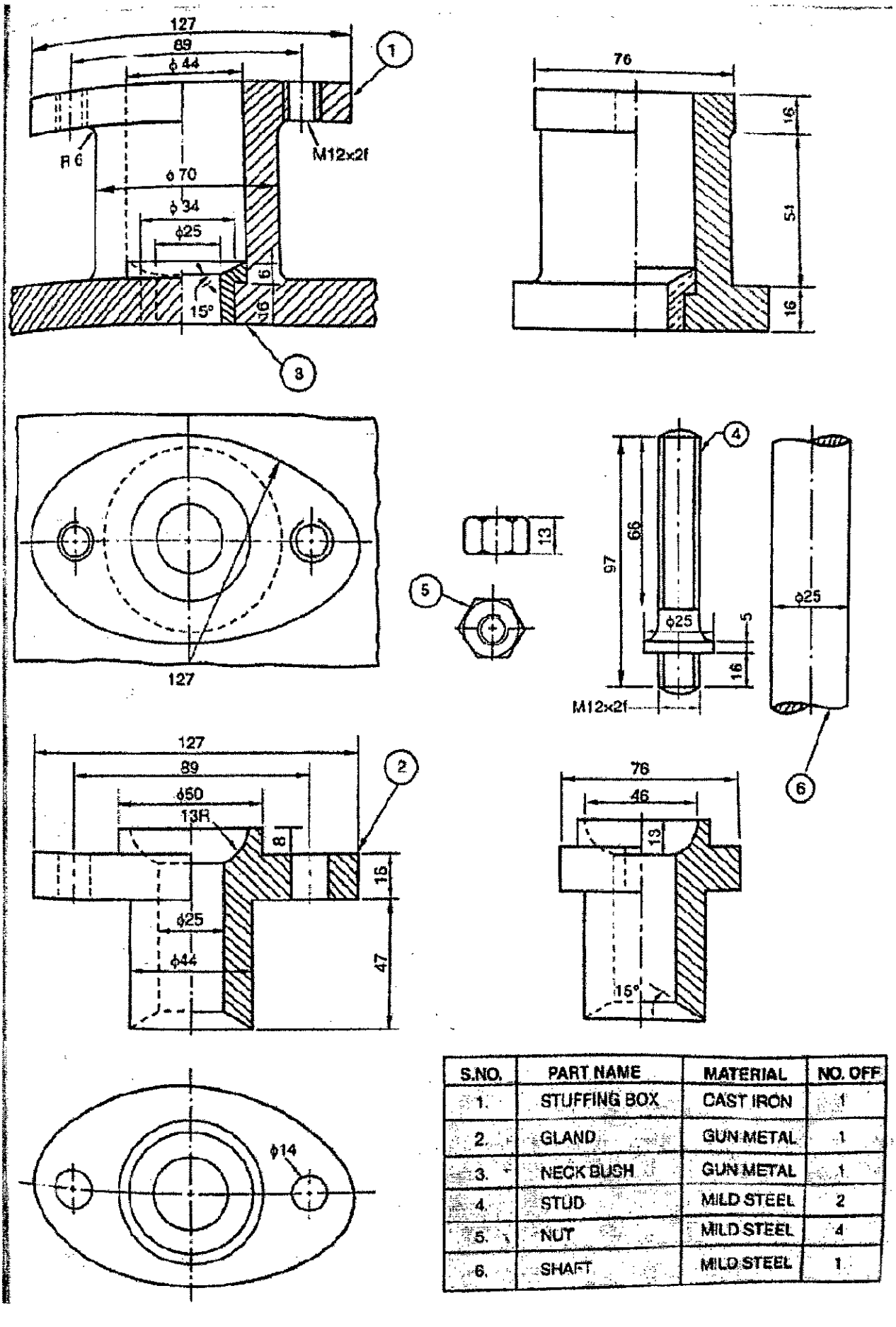


Figure 3: Plummer block details



S.NO.	PART NAME	MATERIAL	NO. OFF
1.	STUFFING BOX	CAST IRON	1
2.	GLAND	GUN METAL	1
3.	NECK BUSH	GUN METAL	1
4.	STUD	MILD STEEL	2
5.	NUT	MILD STEEL	4
6.	SHAFT	MILD STEEL	1

Figure 4: Stuffing Box Details

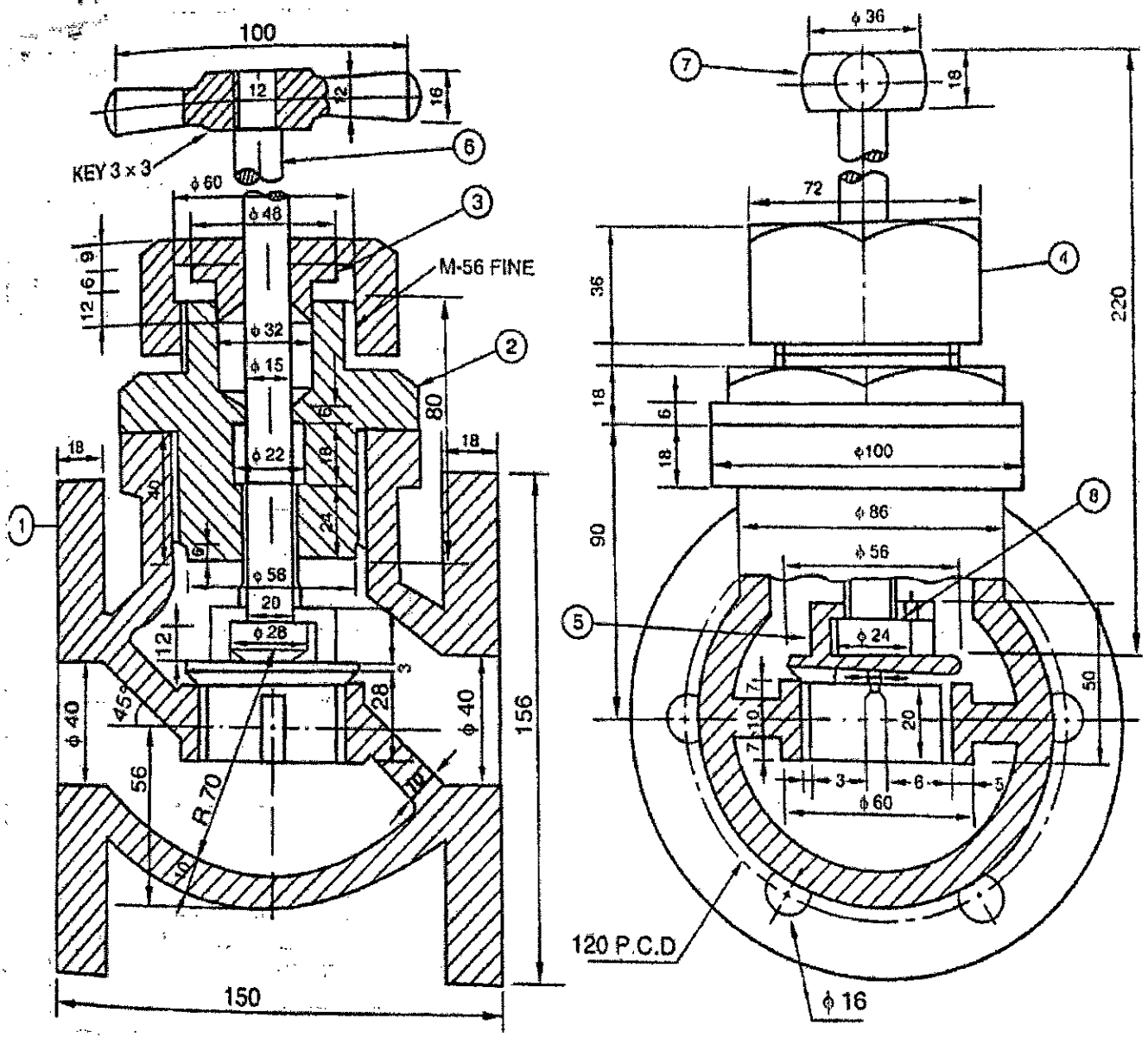


Figure 5: Gun Metal Stop Valve Assembly

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

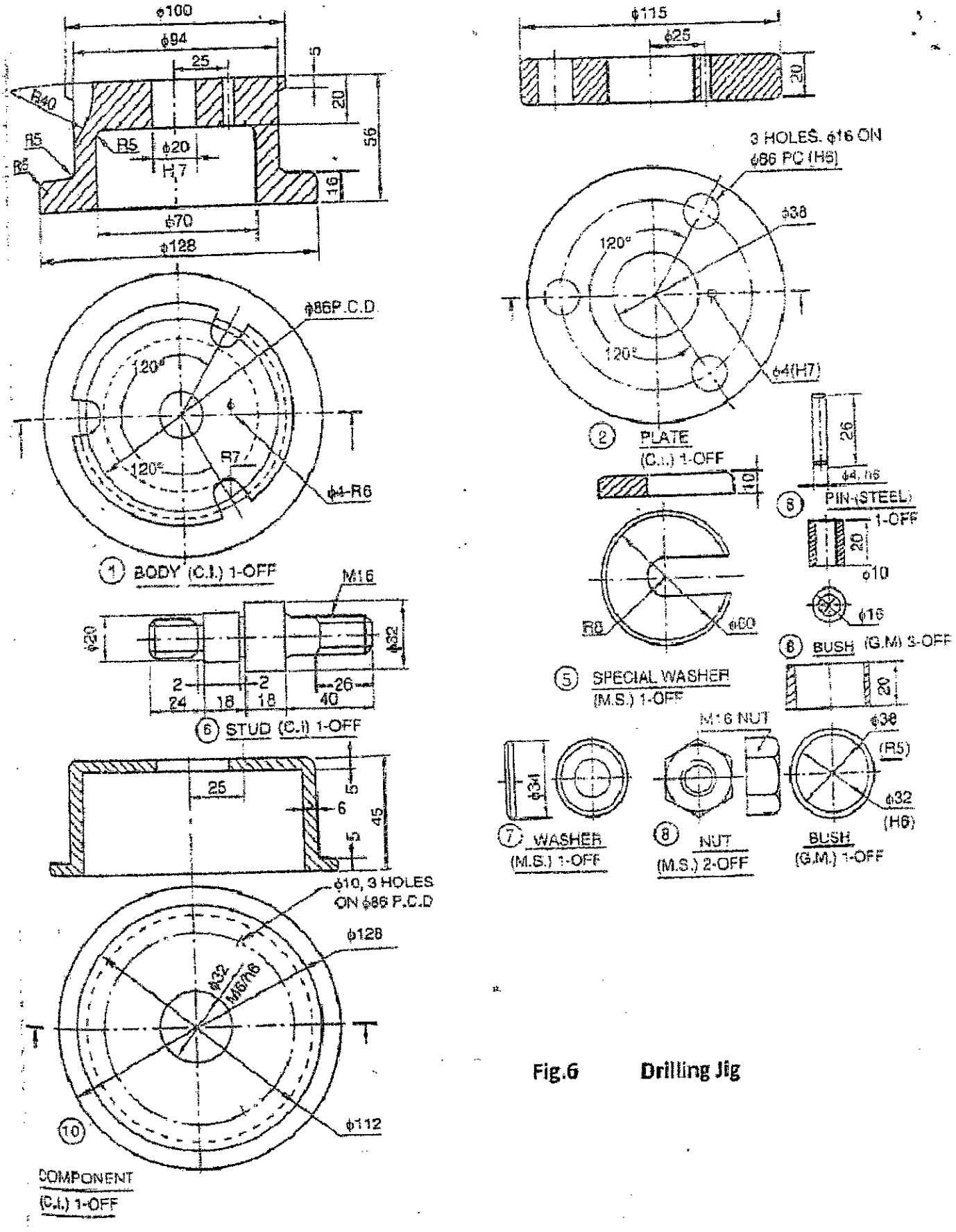


Fig.6 Drilling Jig