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# Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

**Re-Examination, June 2017**

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

MASTER FILE.

Course: **Thermodynamics (BTM 305)**

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

**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,
- Figures on the extreme right show **CO** and **Module Number** respectively as per syllabus of the course.

1. (A) Differentiate following **(any four)**. [08] 1, 1&2
   (i) Closed and open system; (ii) Enthalpy and Internal energy;
   (iii) Intensive and extensive property; (iv) Heat and work
   (v) Thermodynamic and thermal equilibrium; (vi) Flow and non-flow work

   (B) Represent ideal gas expansion from $P_1$ under following reversible processes: **[12]** 1, 2
   (i) Isothermal, (ii) adiabatic, (iii) polytropic (n=2) and (iv) constant volume.
   Stating the assumption prove that the work done during the polytropic expansion is, $$W_{1\text{-}2} = \frac{P_1V_1 - P_2V_2}{n-1}$$

2. (A) What is Zeroth law of thermodynamics? Does it have any association with the first law of thermodynamics? Explain. Write statement of First law applied to closed and open system with appropriate examples. [08] 1, 1&2

   (B) Prove that Energy is a property? [12] 1, 3
   A fluid system undergoes a non-flow frictionless process following the pressure-volume relation as $p = \frac{5}{V^2} + 15$ where p is in bar and V is in $m^3$. During the process the volume changes from 0.15 $m^3$ to 0.05 $m^3$ and the system rejects 45 kJ of heat. Determine change in internal energy and enthalpy.

3. (A) For isothermal flow and non-flow steady processes, prove that [08] 4, 2
   $$\int_1^2 pdv = -\int_1^2 vdp$$
   Also state the assumptions made.

   (B) Write down the general energy equation for steady flow system and simplify when applied for the following systems : **[12]** 4, 2
   (*i*) Pump (*ii*) Boiler, (*iii*) Steam nozzle (*iv*) Steam turbine, (*v*) Heat exchanger and (vi) Throttling valve.

4. (A) Give the following statements of second law of thermodynamics and prove their equivalence. **[08]** 2, 1

(i) Clausius statement, (ii) Kelvin-Planck statement.

(B) One kg of water at 0°C is brought into contact with a heat reservoir at 90°C. When the water has reached 90°C, find **[12]** 4, 3

(i) Entropy change of water ; (ii) Entropy change of the heat reservoir ;

(iii) Entropy change of the universe.

If water is heated from 0°C to 90°C by first bringing it in contact with a reservoir at 40°C and then with a reservoir at 90°C, what will the entropy change of the universe be?

Explain how water might be heated from 0°C to 90°C with almost no change in the entropy of the universe.

5. (A) Define availability? Derive an expression for availability analysis of an open system. **[08]** 3, 1&4

(B) A piston-cylinder contains 3 kg of wet steam at 1.4 bar. The initial volume is 2.25 $m^3$. The steam is heated until its temperature reaches 400°C. The piston is free to move up or down unless it reaches the stops at the top. When the piston is up against the stops the cylinder volume is 4.65 $m^3$. Determine the amount of work and heat transfer to or from steam. **[12]** 4, 2&3

6. (A) What is a cycle? Differentiate between an air standard cycle and actual cycle? What is an air-standard efficiency? Explain briefly Brayton cycle. Derive expression for optimum pressure ratio. **[08]** 5&6, 1

(B) An air-standard Diesel cycle has a compression ratio of 18, and the heat transferred to the working fluid per cycle is 1800 kJ/kg. At the beginning of the compression stroke, the pressure is 1 bar and the temperature is 300 K. Calculate : [12] 6. 2&3

(i) Thermal efficiency,

(ii) The mean effective pressure

7. (A) Define and explain following terms – **[08]** 7, 1&2

(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) What is air-fuel ratio? What do you mean by lean mixture and reach mixture? **[12]** 7, 3&4

One mole of $CH_4$ and 3 mole of $O_2$ reacts in a closed chamber at 300K and 1 atm. and complete combustion takes place. If final temperature is 1800K, determine-

- Final pressure of the tank
- Heat transfer during this process

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

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

**Re-Examination**

**June-2017**

Maximum Marks: **100**

Duration: **3 hours**

Class: **S.Y.B.Tech** Semester: **III**

Program: **Mechanical Engineering**

Name of the Course: **Applied Mathematics III**

Course Code : BTM301

MASTER FILE

**Instructions:**

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.

| Q | | Marks | CO | Module |
|---|---|---|---|---|
| 1(a) | Determine constants $\alpha, \beta, \gamma$ if $A = \begin{bmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{bmatrix}$ is orthogonal. | 6 | 3 | 5 |
| (b) | Evaluate $L^{-1}\left\{\frac{s+1}{s^2(s-2)}\right\}$ | 6 | 1 | 2 |
| (c) | Obtain all Taylor's and Laurent's series expansions of $f(z) = \frac{2z+1}{z^2-5z+6}$ about $z = 0$ indicating the region of convergence. | 8 | 2 | 4 |
| | | | | |
| 2 (a) | Using complex variables evaluate $\int_0^{2\pi} \frac{1}{5-3\cos\theta} d\theta$ | 6 | 2 | 4 |
| (b) | If $\int_0^{\infty} e^{-2t} \sin(t+\alpha) \cdot \cos(t-\alpha)\, dt = \frac{3}{8}$, find the value of $\alpha$ (Use Laplace Transforms) | 6 | 1 | 1 |
| (c) | Verify Gauss Divergence Theorem for $\overline{F} = (x^2 - yz)\hat{i} + (y^2 - xz)\hat{j} + (z^2 - xy)\hat{k}$ over the surface of the cuboid $0 \le x \le a,\ 0 \le y \le b,\ 0 \le z \le c$ . | 8 | 3 | 3 |
| | | | | |

| | | | | |
|---|---|---|---|---|
| 3 (a) | Find unit normal vector to the surface $\phi(x,y,z)=x^2y-2z^2=1$ at $P(1,3,1)$ | 6 | 3 | 3 |
| (b) | Use Cauchy's Integral formula to evaluate $\int_C \frac{\sin(\pi z^2)+\cos(\pi z^2)}{(z-1)(z+2)}dz$, where $C:\lvert z\rvert=3$ | 6 | 2 | 4 |
| (c) | Using Convolution Theorem, evaluate $L^{-1}\left\{\frac{s}{(s^2+4)^2}\right\}$ | 8 | 1 | 2 |
| | | | | |
| 4 (a) | Evaluate $\int_C (3x+7y)dx+(2x+9y)dy$ where C is the circle $x^2+y^2=4$ | 6 | 3 | 3 |
| (b) | If A and B are non-singular matrices of same order, then prove that $[AB]^{-1}=B^{-1}A^{-1}$ | 6 | 3 | 5 |
| (c) | Evaluate $\iint_S (\nabla\times\overline{F})\cdot\hat{n}ds$, where $\overline{F}=(x^2+y-4)\hat{i}+3xy\hat{j}+(3xz+yz^2)k$ and S is the surface of the paraboloid $z=9-(x^2+y^2)$ above XY plane. | 8 | 3 | 3 |
| | | | | |
| 5 (a) | Evaluate $L^{-1}\left\{\frac{s}{(s-1)(s-2)(s-3)}\right\}$ | 6 | 1 | 2 |
| (b) | Evaluate $\int_C \overline{F}\cdot d\overline{r}$ where $\overline{F}=2x\hat{i}+(xz-y)\hat{j}+2z\hat{k}$ and C is the straight line joining the points $A(1,2,-3)$ to $B(2,1,4)$. | 6 | 3 | 3 |
| (c) | Find Eigen Values and corresponding Eigen Vectors of $A$, where $A=\begin{bmatrix}3&-1&1\\-1&5&-1\\1&-1&3\end{bmatrix}$ | 8 | 3 | 7 |
| | | | | |
| 6(a) | Evaluate $L\left\{\frac{\sin 2t}{t}\right\}$ | 6 | 1 | 1 |
| (b) | For the following matrix A, find two non-singular matrices P and Q such that PAQ is in the normal form, where $A=\begin{bmatrix}1&-1&3&-4\\2&-3&0&1\\1&-1&3&3\end{bmatrix}$ | 6 | 3 | 6 |

| | | | | |
|---|---|---|---|---|
| (c) | Evaluate $\int_C \frac{1}{z(z-1)(z+2)}dz$ where $C:\|z\|=3$ | **8** | **2** | **4** |
| | | | | |
| 7(a) | Evaluate $\int_0^{1+i}(x^2+iy)dz$, along the parabola $y=x^2$ | **6** | **2** | **4** |
| (b) | Verify Cayley Hamilton Theorem for $A=\begin{bmatrix} 2 & 3 & -4 \\ -1 & -2 & -1 \\ 1 & 0 & 1 \end{bmatrix}$ | **6** | **3** | **7** |
| (c) | Using Laplace Transforms, Solve the differential equation $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = 1$ where $y(0)=0,\ y'(0)=1$ | **8** | **1** | **2** |
| | | | | |

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**Re-Examination**
**June 2017**

Program: **B.Tech. in Mechanical Engineering**
Class: **S.Y. B.Tech. (Mechanical)**
Course code: **BTM302**
Name of the Course: **Strength of Materials**

Date: **Jun 2017**
Duration: **3 Hr.**
Max. Marks: **100**
Semester: **III**

MASTER FILE.

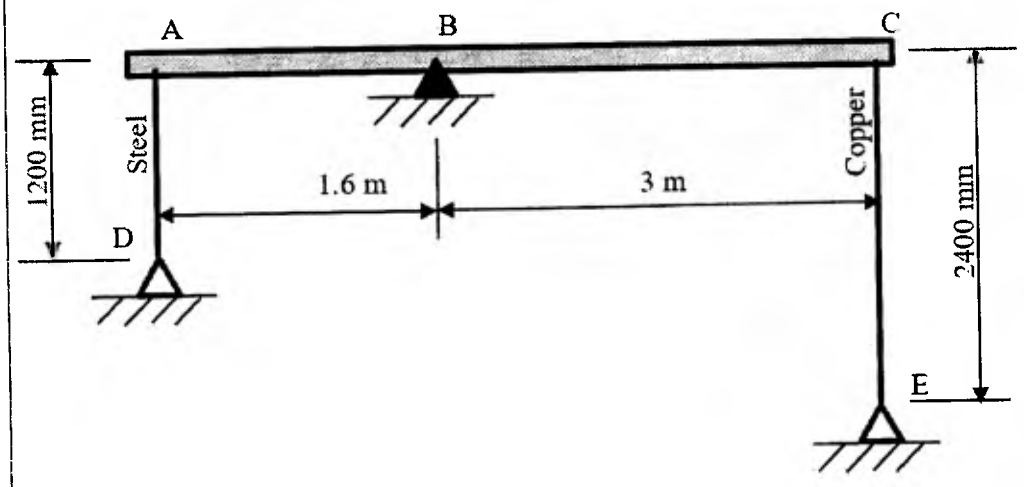
**Instructions:**

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

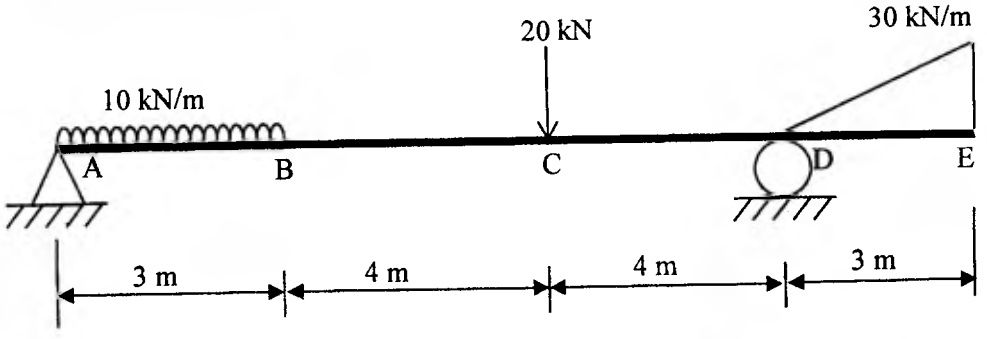
| | | Max. Marks | CO No. | Module No. |
|---|---|---|---|---|
| Q1 | A) The stress-strain data of a tensile test carried on structural steel is tabulated below. Plot the stress-strain data on graph paper and obtain the value of 0.2% proof stress by offset line method and 0.5% proof stress by total extension method. | **(8)** | *3* | *1* |

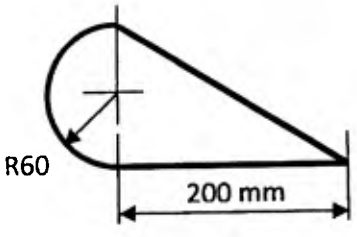
| σ (MPa) | 200 | 400 | 500 | 550 | 620 | 650 | 660 | 670 |
|---|---|---|---|---|---|---|---|---|
| ε (mm/mm) | 0.001 | 0.002 | 0.0025 | 0.0030 | 0.0045 | 0.006 | 0.008 | 0.010 |

| | | | | |
|---|---|---|---|---|
| | B) Define following terms: (i) Poisson's ratio, (ii) Hoop stress, (iii) Shear stress, (iv) Modulus of elasticity. | **(4)** | *1* | *2* |
| | C) A hollow engine shaft transmits 1.2 MW at 2000 rpm. If the internal diameter of the shaft is 50 mm, determine the minimum required external diameter for the shaft if allowable shear stress is 140 MPa. | **(5)** | *2* | *5* |
| | D) State assumptions made during development of classical bending equation. Also explain procedure for obtaining size of circular shafts subjected to combined bending and torsion. | **(5)** | *4* | *5* |
| Q2 | 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 direct integration method. If cross section of the beam varies arbitrarily from the fixed end to the free end, how would you compute deflection and slope at free end? | **(8)** | *4* | *6* |
| | B) A light rigid bar ABC is supported at B by hinge. Two wires one of steel 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 6 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 = 100 mm$^2$ and E = 200 GPa. For copper wire: A = 300 mm$^2$ and E = 120 GPa. | **(12)** | *2* | *2* |

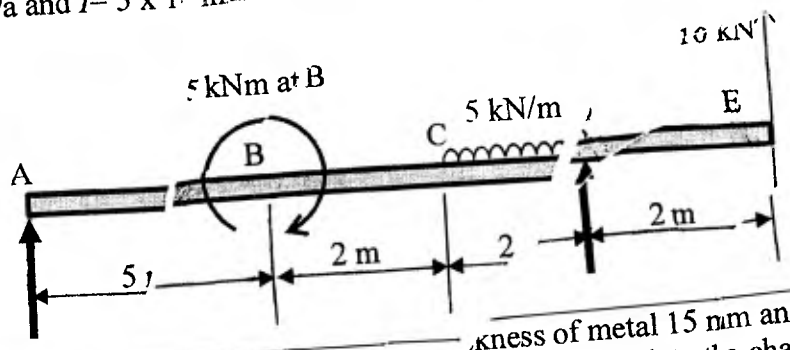



| | | | | |
|---|---|---|---|---|
| Q3 | A) Draw the shear force and bending moment diagram for the beam ABCDE shown in the figure. | (15) | *1* | *3* |
| | B) A 5 mm thick plate is to be punched of a shape shown in figure. Determine the minimum punching force to be applied on a punch. The ultimate shear strength of plate is 200 MPa. What is the corresponding compressive stress in the punch? | (5) | *2* | *2* |
| Q4 | A) An I-section 500 mm x 250 mm having flange thickness of 20 mm and web thickness of 10 mm is subjected to shear force of 1000 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) | *2* | *4* |
| | B) Derive Lame's equations to calculate stresses in thick cylindrical shells subjected to internal and external pressure. Apply these equations to describe nature of stresses generated within thick cylinders due to internal pressure. Describe any two thick walled and two thin walled pressurized components employed in industry. | (8) | *4* | *7* |
| Q5 | A) A brittle steel rod is heated to 300°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, $\alpha = 12 \times 10^{-6}$ mm/mm/°C. 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. | (5) | *2* | *2* |

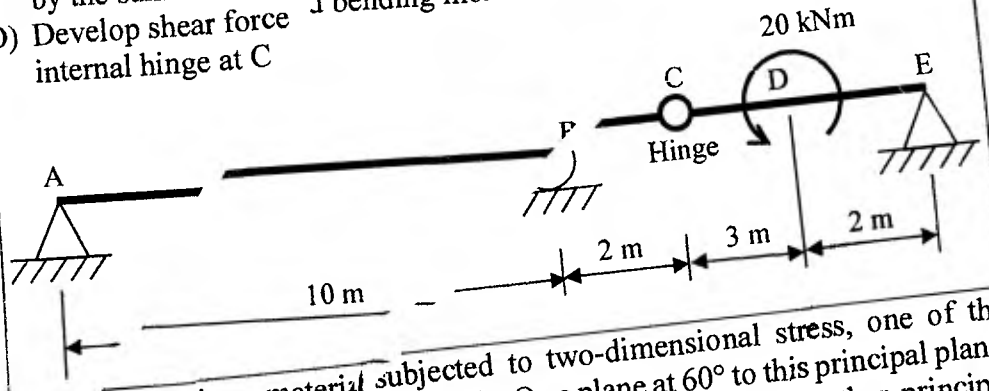


| | | | | |
|---|---|---|---|---|
| B) An overhanging beam ABCDE is loaded as shown in ure. Determine the deflection of beam at point E using Macaulay's me d. Take $E = 200$ GPa and $I = 5 \times 1^{6}$ mm$^4$. | (15) | 4 | 6 |




| | | | |
|---|---|---|---|
| Q6A) A cylindrical shell, 2000 mm in diameter. kness of metal 15 mm and 0.8 MPa. Calculate the chan e in m long, is subjected to internal pressur er pressure. Use thin cylinder theory. diameter, length and volume of shell F= 200 G a, Poisson's ratio = 0.3. | (5) | 2 | 7 |
| B) A rectangular beam section 50 m wide and 200 mm depth is subj ed to a moment of 10 kNm. Determi the maximum stress in the b m. Also calculate the radius of curvat of neutral axis at this section. C sider E = $2 \times 10^5$ N/mm$^2$. | (5) | 2 | |
| What is volumetric strain Which type of engineering ap ation would require computation of v metric strain. Prove that volum strain is given by the sum of linear st ns measured along three orthog m dir ions. | (5) | 1 | 1 |
| D) Develop shear force d bending moment diagram for internal hinge at C | (5) | 1 | 3 |




| | | | |
|---|---|---|---|
| Q7 A) At a point in a material subjected to two-dimensional stress, one of the principal stresses is 200 MPa, tensile. On a plane at 60° to this principal plane, the normal stress is -10 MPa, compressive. Determine the other principal stress, the shear stress on the plane of zero normal stress and planes on which the normal and shear stresses are equal in magnitude. | (10) | 4 | 5 |
| B) Explain importance of measuring impact strength of materials highlighting few applications which demand materials with superior impact strength. Describe any one experimental method to determine impact strength of material. Support your answer with neat sketch. | (5) | 3 | 1 |
| C) A steel rod 100 mm in diameter is subjected to axial compressive force of 1000 kN. If E = 200 GPa and $\nu = 0.3$, calculate change in diameter of the rod. Also calculate axial stress and strain in the rod. | (5) | 2 | 2 |

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Re-Exam Odd Semester
June 2017

Max. Marks: 100 Duration: 4 Hrs

Class: S.Y. B.Tech Mechanical Semester: III Program: B.Tech Mechanical

Name of the Course: Machine Drawing Course Code : BTM303

MASTER FILE

**Instructions:**
1. Question No.1 is compulsory.
2. Attempt any four out of remaining six questions.
3. Assume suitable data if necessary.
4. Use Only Drawing Sheets for answering.

| Q. No. | | | Module No./CO. No. | Max. Marks |
|---|---|---|---|---|
| Q.1 | (A) | A vertical cone, diameter of base 80 mm and axis 100 mm long, is completely penetrated by a horizontal cylinder of 35 mm diameter. The axis of the cylinder is parallel to the V.P. and intersects the axis of the cone at a point 25 mm above the base. Draw projections of solids, showing curves of intersection by cutting plane method. | 01/03 | 12 |
| | (B) | Draw Free Hand Sketches of the following:<br>i) Hexagonal Nut ii) Cap Nut<br>iii) T- Bolt iv) Hook Bolt | 02/02 | 08 |
| Q.2 | (A) | Given in **Figure 1** is Front View, Partial Side View and Partial Auxiliary View.<br>Draw the Following by First Angle Method<br>a) Front View b) Full Auxiliary View c) Full Side View | 01/03 | 10 |
| | (B) | Draw Free Hand Sketches of the following:<br>i) Buttress Thread ii) Acme Thread | 02/02 | 06 |
| | (C) | Calculate the tolerance limits for Ø45 H7/g8 | 02/01 | 04 |
| Q.3 | (A) | Given in **Figure 2** is the details of Socket Joint in front view. Assemble the parts and draw the following views:<br>i) Sectional Front view ii) Side View | 03/03 | 08 |
| | (B) | Given in **Figure 3** is the Universal Coupling Assembly. Identify & draw sectional front view of the following parts:<br>i) Fork End ii) Centre Block | 03/04 | 08 |

| | | | | |
|---|---|---|---|---|
| | (C) | Draw the free hand sketches of following:<br>i) Hollow saddle key ii) Round key | | 04 |
| Q.4 | (A) | Given in **Figure 4** is the details of plummer block. Imagine the parts assembled and draw the following views:<br>i) Right Half Sectional Front View ii) Top View | 04/01 | 16 |
| | (B) | Prepare Bill of Material | | 02 |
| | (C) | Give the tolerance limits for Bush & Body Assembly | | 02 |
| Q.5 | (A) | **Figure 5** shows details of expansion joint. Imagine the parts assembled together and draw the following views:<br>(a) Front view full in section<br>(b) Side view | 05/01 | 18 |
| | (B) | Prepare Bill of Material | | 02 |
| Q.6 | | Given in **Figure 6** is the Assembly of Gun Metal Stop Valve. Identify and draw the following views of:<br>(a) Body – (i) Sectional Front View (ii) Side View<br>(b) Cover – (i) Sectional Front View (ii) Side View | 06/04 | 20 |
| Q.7 | | **Figure 7** shows assembly of Drill Jig. Draw the Following views for:<br>(a) Jig Plate - (i) Sectional Front View<br>(ii) Top View<br>(b) Base Plate – (i) Sectional Front View<br>(ii) Top View | 07/04 | <br>06<br>04<br>06<br>04 |

**Table 10.4** Recommended diameter steps upto 500 mm (13 steps)

| Over | - | 3 | 6 | 10 | 18 | 30 | 50 | 80 | 120 | 180 | 250 | 315 | 400 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upto | 3 | 6 | 10 | 18 | 30 | 50 | 80 | 120 | 180 | 250 | 315 | 400 | 500 |

**Table 10.7** Equations to calculate fundamental deviation of shaft size up to 500 mm (D = Geometrical mean dia. in mm)

| Symbol | Fundamental deviation in microns | Symbol | Fundamental deviation in microns |
|---|---|---|---|
| d | $-16D^{0.44}$ | js | $\pm (IT/2)$ |
| e | $-11D^{0.41}$ | k4 to k7 | $+0.63D^{1/2}$ |
| f | $-5.5D^{0.41}$ | m | + (IT7 – IT6) |
| g | $-2.5D^{0.34}$ | n | $+5D^{0.34}$ |
| h | 0 | p | + (IT7 + 0 to 5) |

**Table 10.8** Fundamental Tolerance for IT grades in terms of i.

| IT Grade | IT5 | IT6 | IT7 | IT8 | IT9 | IT10 | IT11 | IT12 | IT13 | IT14 | IT15 | IT16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tolerance in Microns | 7i | 10i | 16i | 25i | 40i | 64i | 100i | 160i | 250i | 400i | 640i | 1000i |

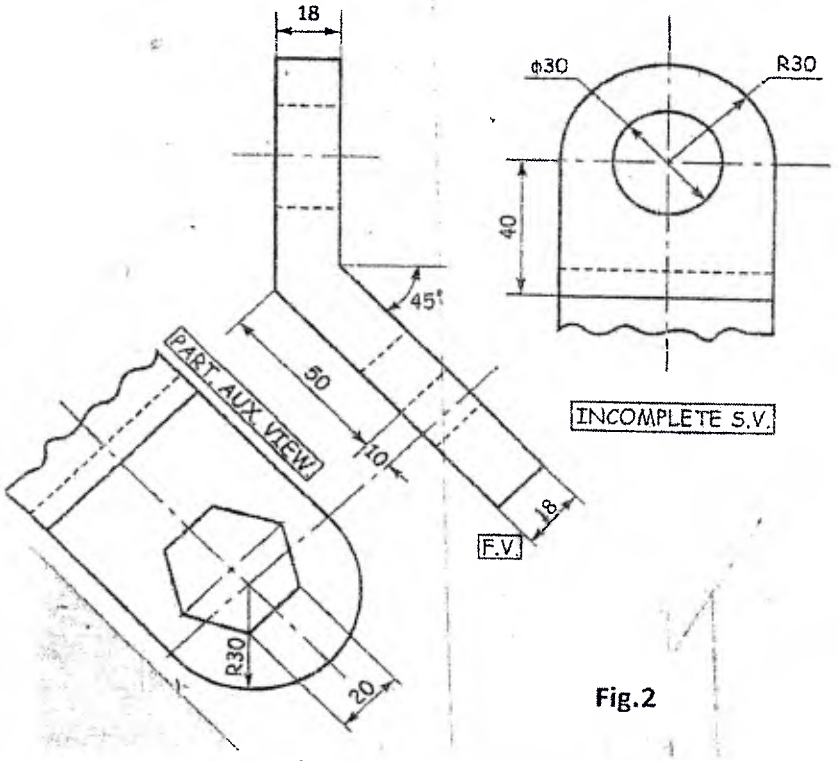


Figure1: Auxiliary View

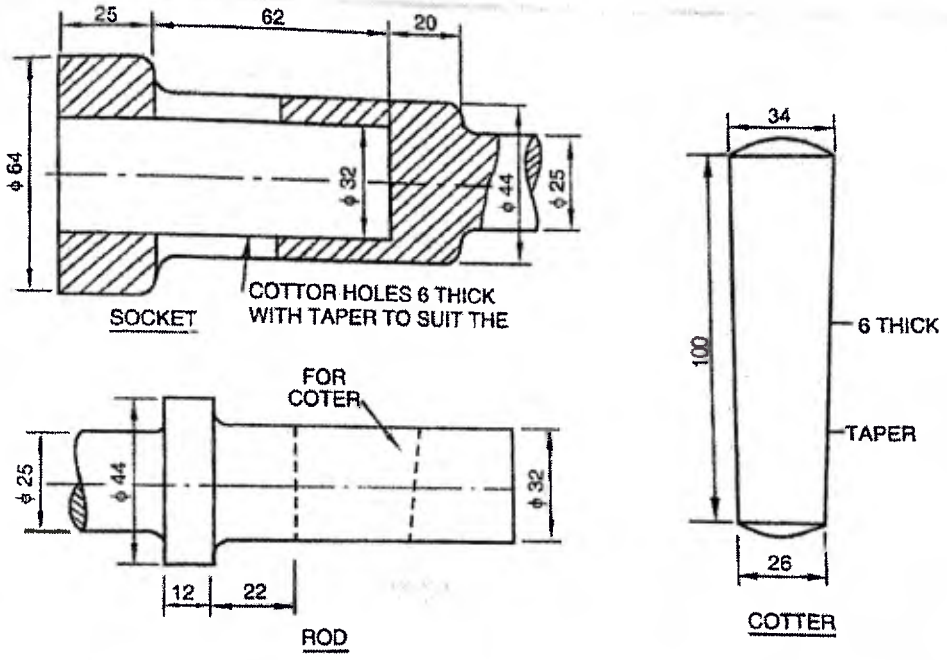


Figure 2: Socket Joint

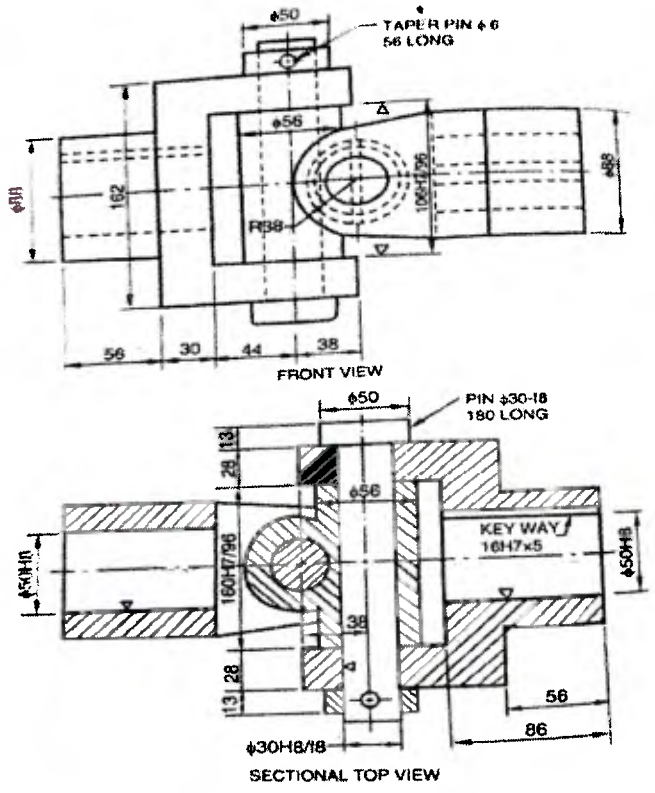


Figure 3: Universal Coupling Assembly

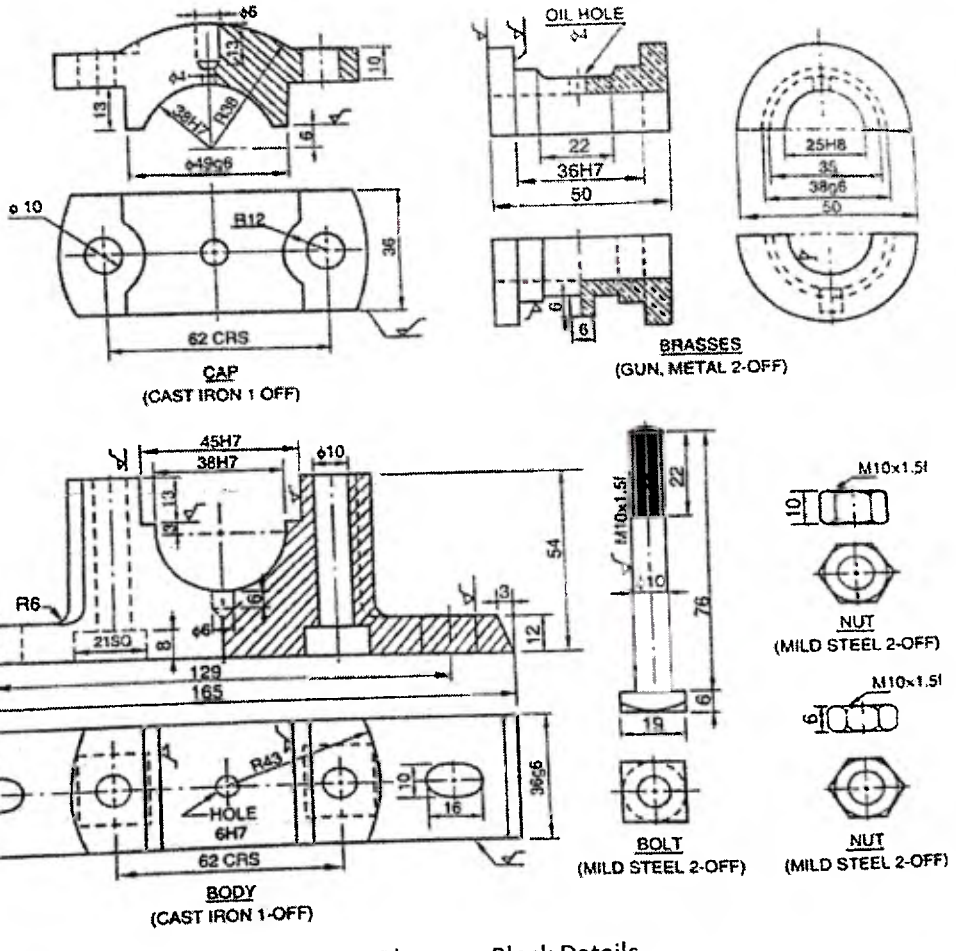


Figure 4: Plummer Block Details

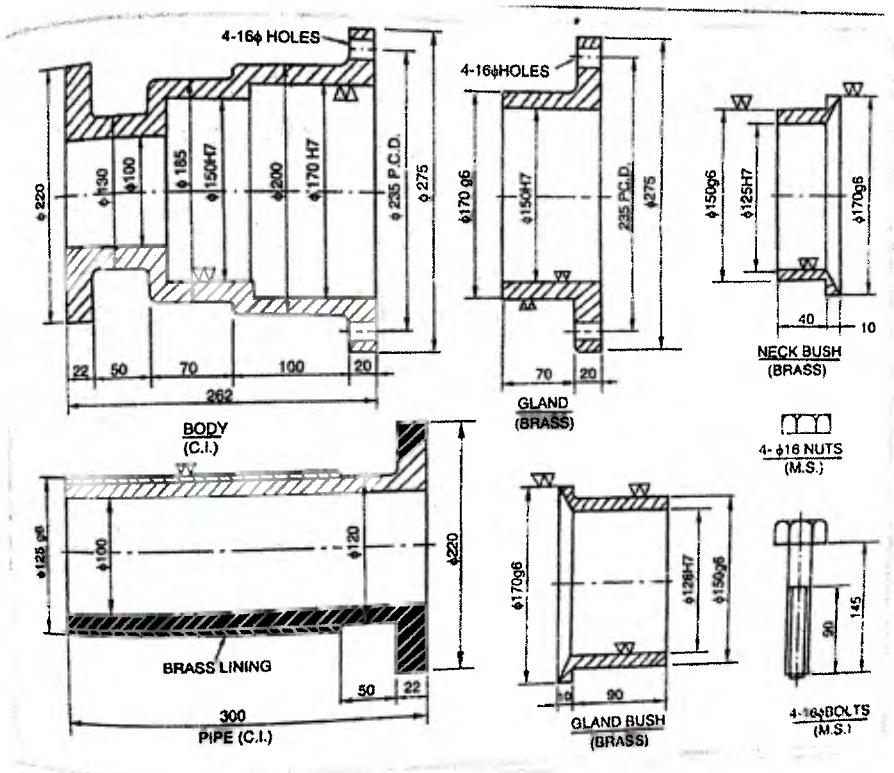


Figure 5: Details of Expansion Joint

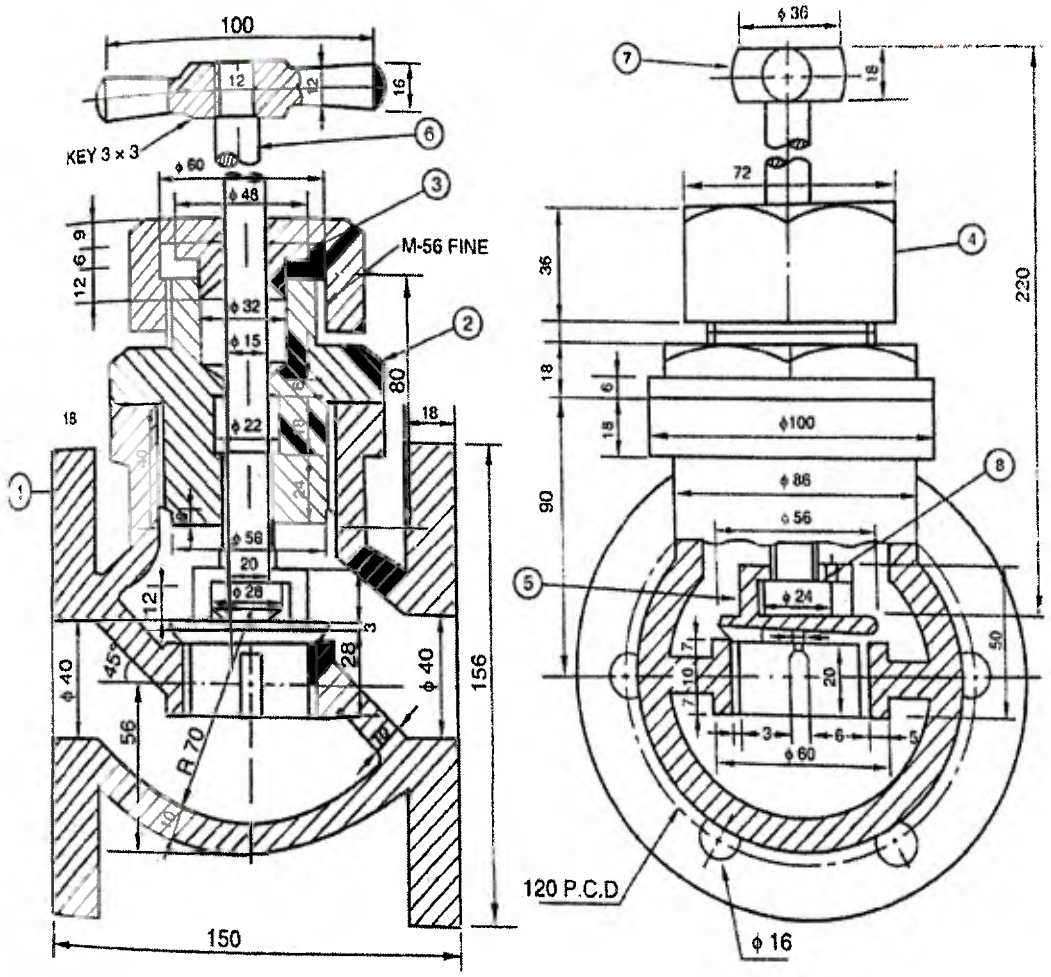


Figure 6: Assembly of Gun Metal Stop Valve

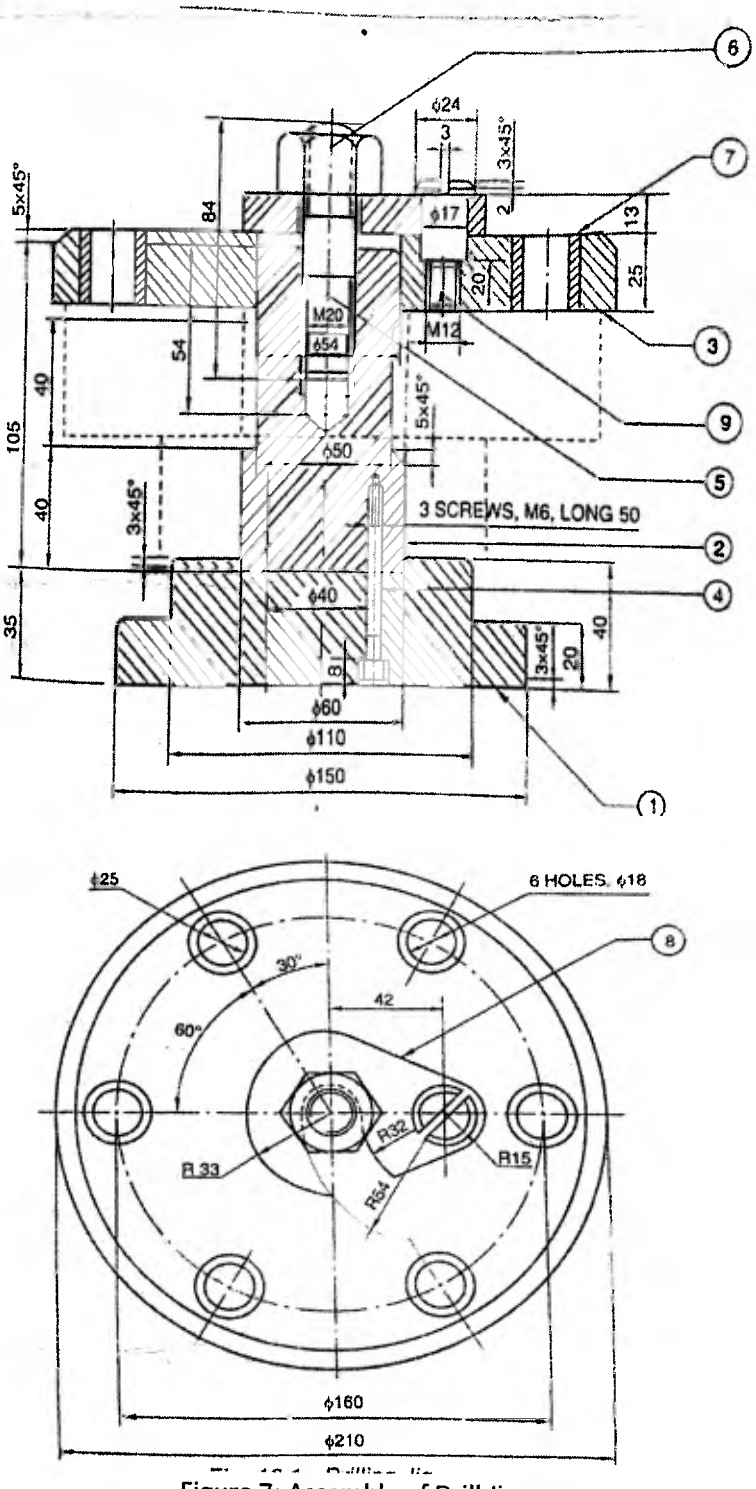


Figure 7: Assembly of Drill Jig

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Munshi Nagar, Andheri (West), Mumbai – 400058

RE-EXAM

JUNE 2017

Date:

Program: B.Tech Second Year Mechanical

Duration: 3 hours

Course code: BTM304

Maximum Marks: 100

Name of the Course: Material Science

Semester: III

MASTER FILE

**Instructions:**

Attempt any FIVE questions out of seven.

Illustrate the answers with sketches wherever required.

Answers to all sub questions should be grouped together.

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| Question No. | | Max. Marks | Course Outcome Number |
|---|---|---|---|
| Q1 | | | |
| A | What is Critical resolved shear stress? Derive its formula. | 08 | 01 |
| B | What is a Burger Vector? Show it by drawing a burger's circuit. What is Frank -Read source? State its importance in plastic deformation. | 12 | 02 |
| Q2 | | | |
| A | Distinguish between slip and twinning with examples. | 08 | 02 |
| B | What is the difference between alpha iron and ferrite, ductile and brittle fracture? | 12 | 02 |
| Q3 | | | |
| A | Describe Economic, environmental and social issues of material usage. | 08 | 01 |
| B | Explain crystal structures in brief. | 06 | 01 |
| C | Briefly discuss the important properties of materials. | 06 | 01 |
| Q4 | | | |
| A | Explain the effects of alloying elements on metals. | 10 | 04 |
| B | What are the ceramic materials? State the properties and applications of ceramic materials. | 10 | 04 |
| Q5 | | | |

| | | | |
|---|---|---|---|
| A | Differentiate between edge and screw dislocation. | 05 | 02 |
| B | State the Hume Rothery rules for substitutional solid solution formation. | 05 | 03 |
| C | Draw and properly label the TTT diagram of an eutectoid plain carbon steel. State its utility and limitations. | 10 | 03 |
| | | | |
| Q6 | What is invariant reaction? Mention different invariant reactions present in the Fe- $Fe_3C$ Diagram. | 20 | 03 |
| | | | |
| Q7 | Write short notes on following: | | |
| A | Phase rule and Phase Diagram | 05 | 01 |
| B | Solvus line and Solidus line | 05 | 01 |
| C | Justify Zinc is not as ductile as copper | 05 | 01 |
| D | Lever rule | 05 | 01 |

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# Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

End Semester **RE-Exam**

**June 2017**

Max. Marks: 100 Duration: 3 hours

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

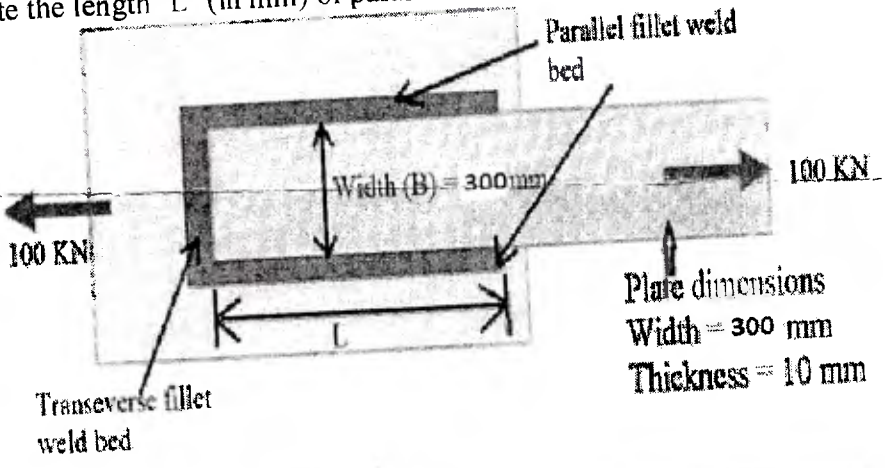
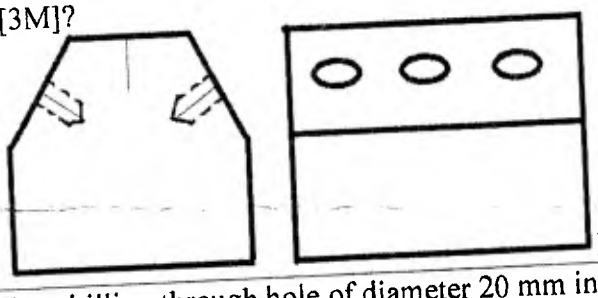
Name of the Course: **Manufacturing Science –I** Course Code : BTM 306

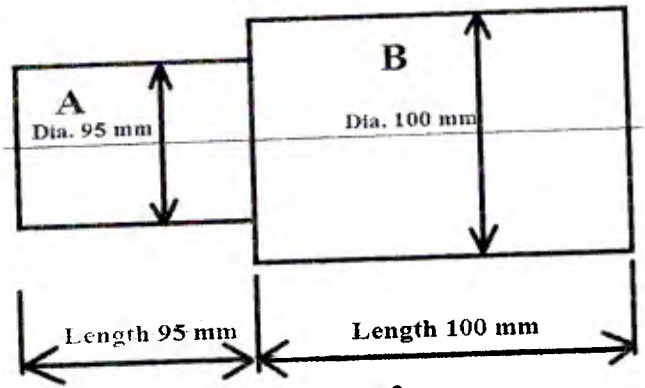
MASTER FILE

**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

| Q. No | | Max Mark | CO # | Mod # |
|---|---|---|---|---|
| **Q1(a)** | Describe in brief "Transfer molding process" and "vaccum forming process" with help of schematic sketch? | 10 | 3 | 1 |
| (b) | 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? | 10 | 2 | 5 |
| **Q2(a)** | Explain with neat schematic sketch working principle of Internal Centerless grinding machine? (5M)<br>Answer the following question with one or two points only;<br>i) For rough grinding operation of high speed steel material grinding wheel structure must be.....? Abrasive grits can be used are.....?<br>ii) To have fine finish on Brass & soft bronze suitable abrasive grit material is .....? Abrasive grit material on grinding wheel should have ..... grain size? | 10 | 1 | 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 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 & *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. | 10 | 2 | 3 |

| | | | | |
|---|---|---|---|---|
| Q3( a) | each alpha numeric terms in designation of different workpiece materials can be machined using such wheels? | 10 | 3 | 7 |
| 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=300 mm and thickness=10 mm). If 'allowable tensile stress' of filler metal (weld bed) is 80 MPa. Calculate the length 'L' (in mm) of parallel fillet weld?   Figure 1 | | | |
| Q4( a) | What are different modes of indexing? Explain the working of any one mode of indexing and draw its kinematic system? | 10 | 2 | 5 |
| b) | The finished part shown in figure no-1 needs to be manufactured in one setup, desired geometric tolerances have to be satisfied by each part. Which milling machine you will prefer to satisfy above mentioned points [2M]. Explain any four important features of that machine which differentiate it from other milling machine [3M]?  Figure No- 1 | 10 | 1 | 3 |
| Q5 (a) | For drilling through hole of diameter 20 mm in mild steel workpiece 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 workpiece indicating working principle of drilling operation? | 10 | 2 | 4 |
| (b) | 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? | 10 | 3 | 5 |

| | | | | |
|---|---|---|---|---|
| Q6( a) | Explain different advantages of CNC lathe machine?<br>Draw and explain parts/structure of carriage unit of conventional lathe machine? | 10 | 2 | 2 |
| (b) | Explain different pattern allowances, which are required to be provided on the pattern? Also sketch pattern allowances? | 10 | 1 | 1 |
| Q7( a) | Select the correct answer and justify.<br>Q.Significance of helix angle (α) of spiral multi fluted drill tool is; Justify?<br>a) Improves penetration in workpiece, if (α) is more. b) It gives more rigidity, if (α) is more, c) It smoothens the chip flow (faster evacuation), if (α) is more<br><br>Draw neat sketch of helical flute drill tool and show *lip length, helix angle, cutting lip angle* [3M] ? | 10 | 2 | 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 workpiece at that instant )<br>**Material - Steel**<br>  <br><br>Figure no. 2 | 10 | 1 | 2 |