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

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

END SEMESTER Examination

November 2017

Maximum Marks: **100** Duration: **3 hour**

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 FOUR questions out of remaining SIX questions.
- Question number.**1** is **compulsory**.
- Answers to all sub questions should be **grouped** together.

Q		Marks	CO	Module No.
1(a)	If $A=\begin{bmatrix}2 & 3\\ 0 & 1\end{bmatrix}$ find $A^{20}-2A^{19}+A$. using cayley Hamilton theorem.	5	4	7
(b)	Find Laplace transforms of $f(t)=\sin^7 t$	5	1	1
(c)	Obtain the Fourier series for $f(x)=\begin{cases}1+\frac{2x}{\pi} & -\pi<x<0\\ 1-\frac{2x}{\pi} & 0<x<\pi\end{cases}$	5	2	4
(d)	Find the image of the area between $x^2+y^2=4$ and $x^2+y^2=9$ in the $z-$plane into the $w-$plane under the transformation $w=\log z$	5	3	5
2 (a)	Find the eigen values and eigen vectors of the matrix.	6	4	7

	$A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$			
(b)	Prove that $\int_0^{\infty} \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$	6	1	2
(c)	If $f(x) = x \qquad 0 \le x \le 2$ Find half range cosine series using Parseval's identity deduce $\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + - - - - - - -$	8	2	5
3 (a)	Prove that the following function is analytic $f(z) = \cosh z$	6	3	5
(b)	Show that the matrix $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ satisfies Cayley-Hamilton's theorem	6	4	7
(c)	Find $L\left[\frac{d}{dt}\left(\frac{1-\cos 2t}{t}\right)\right]$	8	1	1
4 (a)	Find the Fourier series for $f(x) = \begin{cases} 0 & -\pi \le x \le 0 \\ x & 0 \le x \le \pi \end{cases}$	6	2	4
(b)	Find the Laplace transforms of f(t), where $f(t) = \begin{cases} t^2, 0 < t < 1 \\ 0, t > 1 \end{cases}$	6	1	1
(c)	If f (z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.	8	3	5
5 (a)	Evaluate: $L^{-1}\left\{\log\left\lvert\frac{s^2+b^2}{s^2+a^2}\right\rvert\right\}$	6	1	2

(b)	Find non – singular matrices P, Q so that PAQ is a normal form where $A=\begin{bmatrix}2 & 1 & -3 & -6\\ 3 & -3 & 1 & 2\\ 1 & 1 & 1 & 2\end{bmatrix}$	**6**	**4**	**6**
(c)	Find the Fourier sine series for the function $f(x)=e^{ax}$ for $0<x<\pi$ where a is constant	**8**	**2**	**4**
6(a)	Evaluate: $L^{-1}\left\{\frac{s^2+2s+3}{(s^2+2s+2)(s^2+2s+5)}\right\}$	**6**	**1**	**2**
(b)	For what values of λ and μ the linear equations. $x+2y+z=8$ $2x+2y+2z=13$ $3x+4y+\lambda z=\mu$ have i)No solution i) A unique solution iii)infinite number of solutions	**6**	**4**	**6**
(c)	Find the analytic function $f(z)=u+iv$ such that $u+v=\frac{x}{x^2+y^2}$	**8**	**3**	**5**
7 (a)	Obtain complex form of the Fourier series of the function the $f(x)=\begin{cases}0 & -\pi\le x\le 0\\ 1 & 0\le x\le\pi\end{cases}$	**6**	**2**	**4**
(b)	Evaluate: $L^{-1}\left\{\log\left(1+\frac{1}{s^2}\right)\right\}$	**6**	**1**	**2**
(c)	Solve $y''-3y'+2y=4e^{2t}$ Given $y(0)=-3$ $y'(0)=5$	**8**	**1**	**2**

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END SEMESTER

NOVEMBER 2017 **Date:** 20/11/2017

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:

- Q. No. 1 is compulsory.
- Attempt any **FOUR** questions out of six.
- Illustrate the answers with sketches wherever required.
- Answers to all sub questions should be grouped together.

Question No.		Maximum Marks	Course Outcome Number	Module No.
Q1 A	What are refractory materials? state the basic properties and uses also write what do you understand by (a) Glass (b) Abrasives	10	04	06
B	Explain the effects of carbon and various alloying elements added to (a) Carbon steels & (b) Alloy steels	10	01	05
Q2 A	Draw neat labeled diagram of Fe-Fe_3C and explain various reactions observed in details.	12	03	02
B	What is heat treatment? Why are the steels heat treated? How would you classify the types of heat treatment processes?	08	04	04
Q3A	Differentiate between edge dislocation and screw dislocation. Illustrate with sketches.	08	02	03
B	Determine the ASTM grain size number if 30 grains per square inch are measured at a magnification of 250.	06	02	03

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Q4 A	Draw an Eutectic phase diagram and explain it.	08	03	02
B	Explain advance materials and their applications.	06	01	01
C	Draw and properly label the T-T-T diagram of plain carbon steel.	06	03	02
Q5 A	Why are ceramics brittle, while metals are ductile? Discuss under what condition a ductile metal can become brittle?	06	04	06
B	Discuss environmental considerations of material usage and social issue of material usage.	08	01	07
C	Cite four reasons why martensite is so hard and brittle.	06	03	02
Q6 A	Write short notes on any <u>two</u> of the following: 1. Composite materials and its applications. 2. Nano Materials and their two unique properties. 3. Plasting processing techniques.	05 05 05	04 04 04	06 06 06
B	Define Phase, Phase rule, Isomorphous system, Burger vector and Creep Curve.	10	02	04
Q7	Two metals A (melting point 900 C) and B (melting point 600 C) form a eutectic at 400 C with a composition 40 wt.% A. The metal A is soluble to B to the extent of 5 wt.% A at room temperature which increases to 20 wt.% A at the eutectic temperature. Metal B is not soluble to A in the solid state.			
A	Construct the phase diagram for metals A and B and label all points, lines and areas.	10	03	02
B	(a) Indicate the start and end of solidification temperatures. 2 (b) Determine the compositions and relative amounts of the phases present at 300 C.	10	03	02

_____*All The Best *_____

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ENDSEM

November 2017

Class: S. Y. B. Tech (Mechanical). **Total Marks: 100**

Course: Machine Drawing **Time: 3 hrs**

Course Code: BTM303

Master file.

Note:

- Question no. 1 is compulsory.
- Attempt any four out of remaining six questions.
- Use only drawing sheet to answer.
- Assume suitable data if necessary.

Q. No.			Module /CO.No.	Marks
Q.1	(a)	A vertical cylinder, base 100 mm diameter, is penetrated by a horizontal cylinder of 50 mm diameter, the axis of the horizontal cylinder is parallel to the H.P. and V.P. and 8 mm away from the axis of the vertical cylinder. Draw the projections showing curves of intersections.	01/03	14
	(b)	Draw Free Hand Sketches of: i) Wing Nut ii) Hook Bolt	02/02	06
Q.2	(a)	Given in **Figure 1** is Front View, Partial Side View and Partial Auxiliary View. Draw the Following by First Angle Method i) Front View ii) Partial Top View iii) Full Auxiliary View	01/03	 2 3 7
	(b)	Show different types of fits via hole basis system and Define each of them?	02/02	02 06
Q.3	(a)	Given in **Figure 2** is the assembly drawing of Knuckle Joint. Draw detail drawing of the following parts. i) Fork End – Sectional Front View and Top View ii) Single Eye End -- Sectional Front View and Top View	03/01	 08 08
	(b)	Draw free hand sketches of following types of threads: (i) Witworth Thread ii) Buttress Thread		04
Q.4	(a)	Given in the **Figure 3** is the detail drawing of Protective Flange Coupling. Draw the following views of assembly drawing: (i) Sectional Front View (ii) Bill of Material	04/01	 10 04
	(b)	Draw the free hand sketches of the following: i) Feather Key ii) Hollow saddle key	03/02	06

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Q.5	(a)	Given in the **Figure 4** is the partial sectional front view of V-Belt Pulley. Draw the following views: i) Sectional Front View ii) Side View	05/03	06 08
	(b)	Draw the conventional representation of the following bearings: (i) Ball bearing (ii) Roller bearing (iii) Thrust bearing	04/02	02 02 02
Q.6		Given in the **Figure 5** is the detail drawing of non – return valve. Imagine the parts assembled and draw the following: a) Sectional Front View b) Bill of Material c) Calculate tolerance between valve and valve seat	06/01	12 04 04
Q.7		Given in **Figure 6** is the assembly of Drill Jig. Draw the detail views of following parts: a) Jig Plate - i) Sectional Front View ii) Top View b) Base – Sectional Front View c) Latch Washer – Top View	07/01	06 06 04 04

Limits, Tolerance Tables

Table 1 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 2 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 3 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

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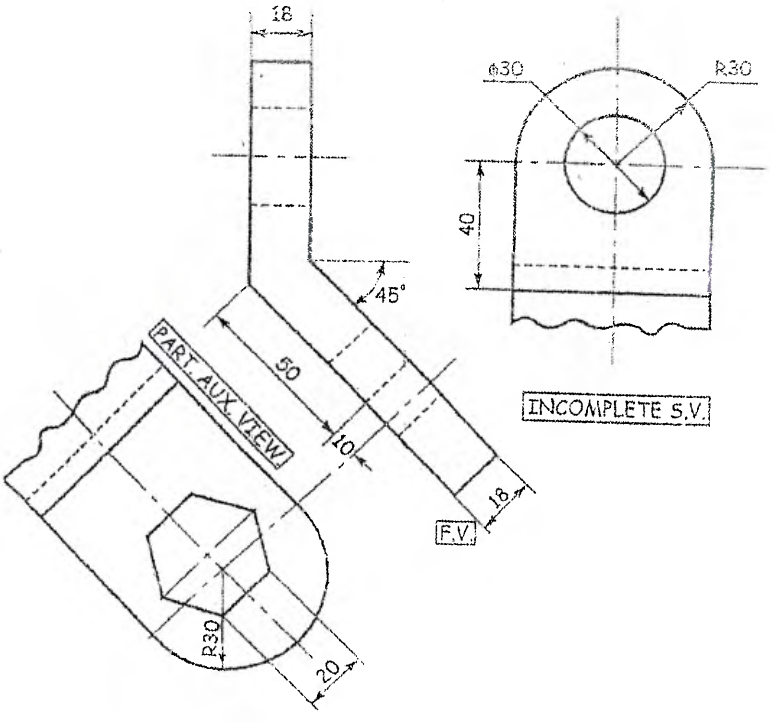
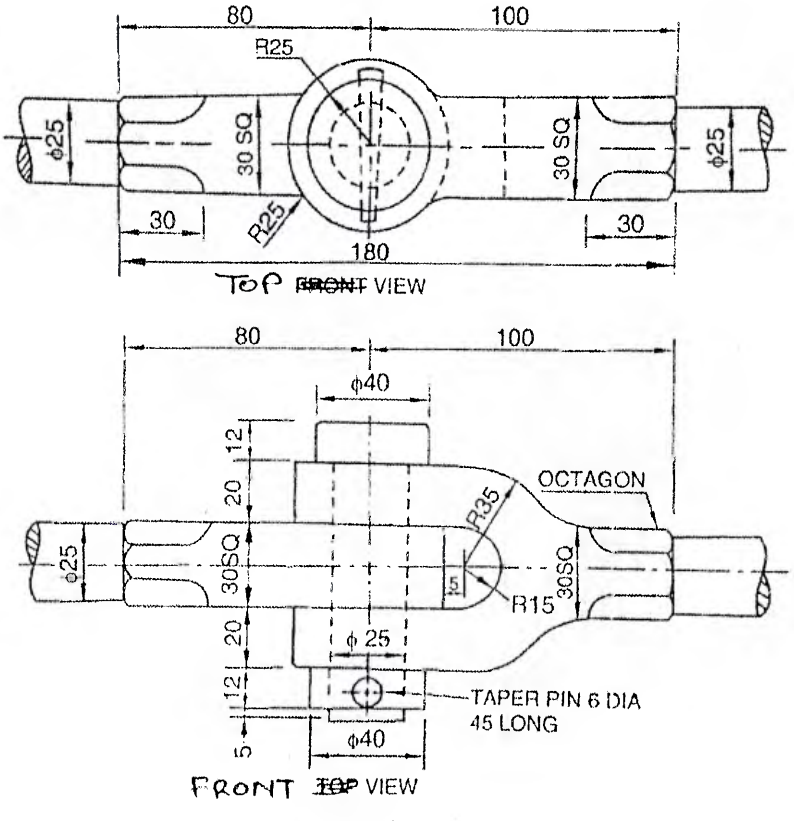
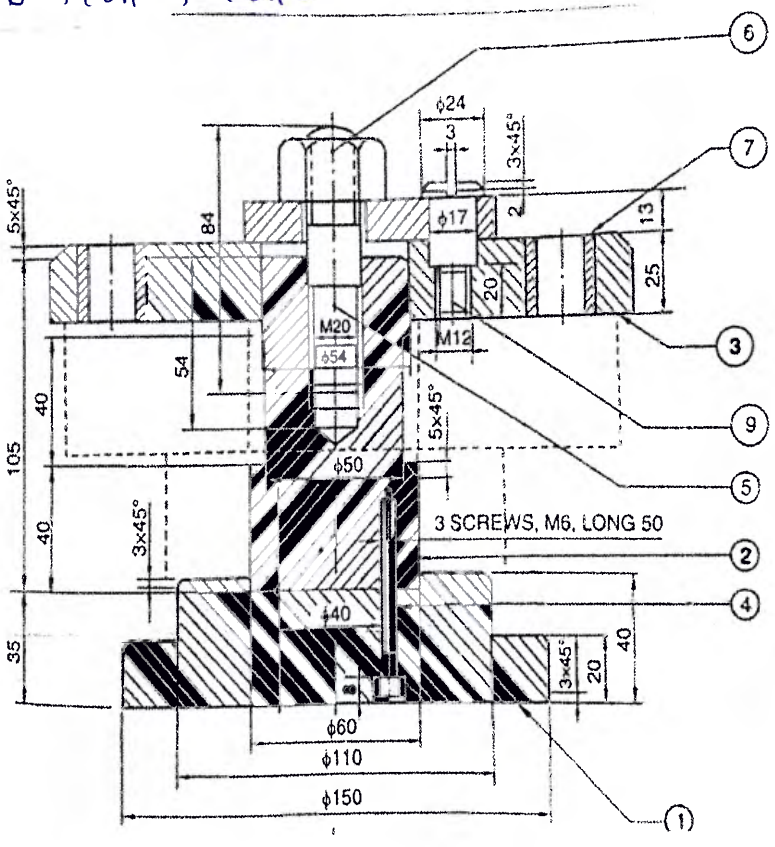


Figure 1: Auxiliary View

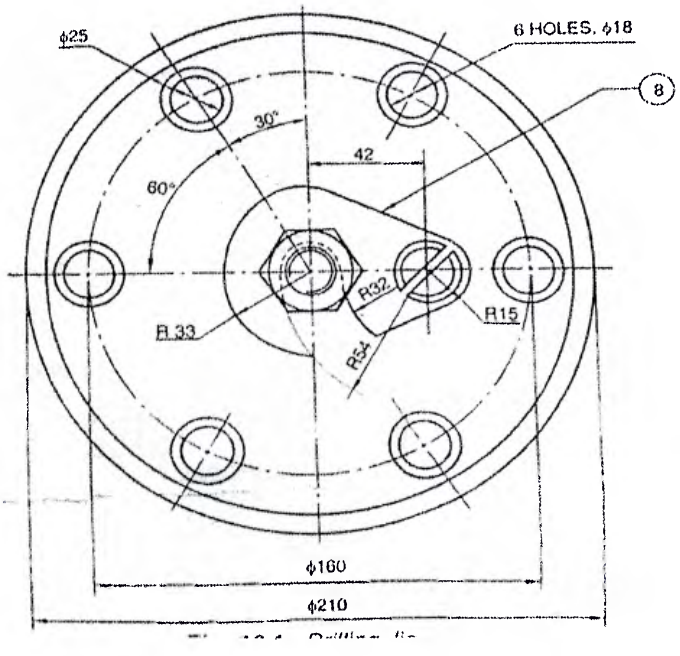


Assembly

Figure 2: ~~Details~~ of Knuckle Joint



FRONT VIEW



TOP VIEW

Figure 6: Assembly of Drill Jig

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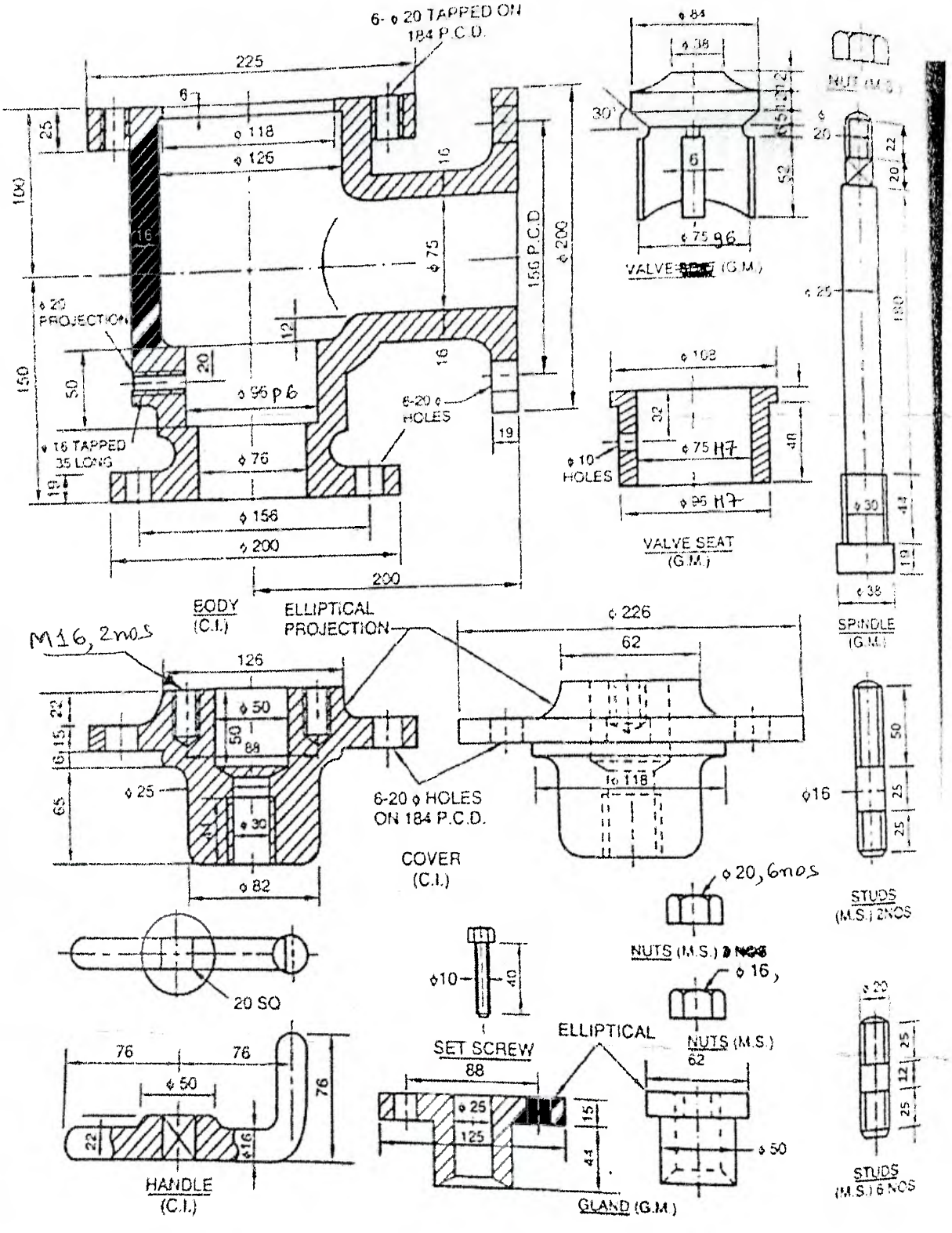
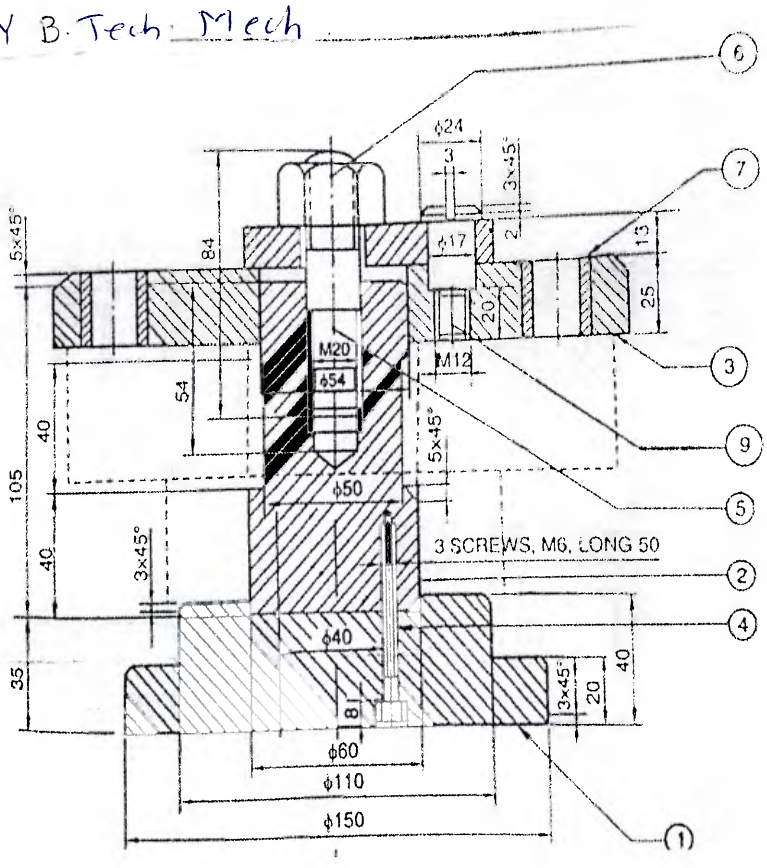
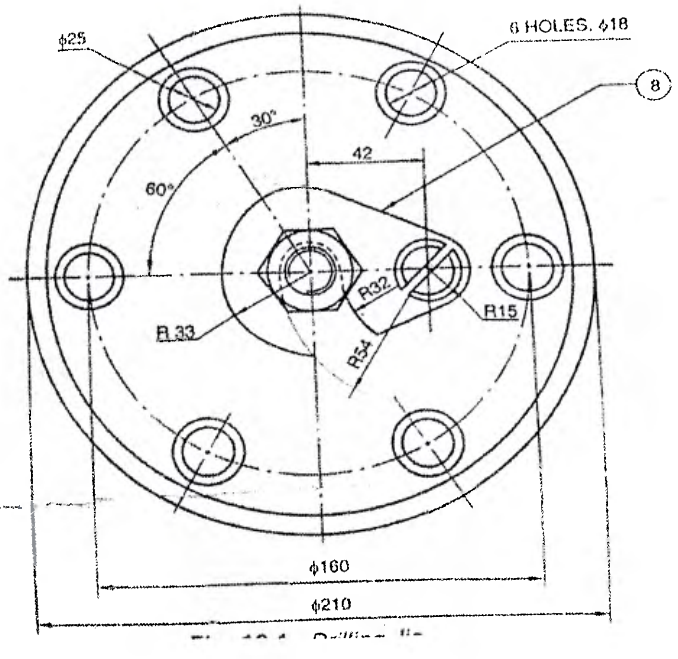


Figure 5: Details of Non – Return Valve



FRONT VIEW



TOP VIEW

Figure 6: Assembly of Drill Jig

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End Semester Examination
November 2017

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

Date: **Nov 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.

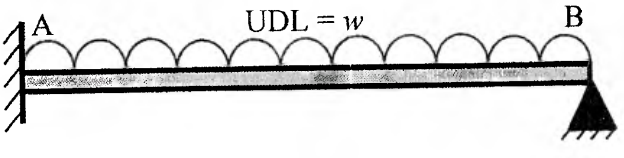
		Max. Marks	CO No.	Module No.
Q1 A)	A document containing stress vs strain test data for a critical machine component was partly damaged and only following data could be retrieved.	**(5)**	*3*	*1*

- Modulus of elasticity = 211 GPa, 0.5% Proof stress = 610 MPa
- Partial stress-strain data:

σ (MPa)	505	535	560	590
ε (mm/mm)	0.003	0.0033	0.0037	0.004

Develop the stress-strain curve for the material to the extent possible on a graph paper based on above data and determine the 0.2% proof stress.

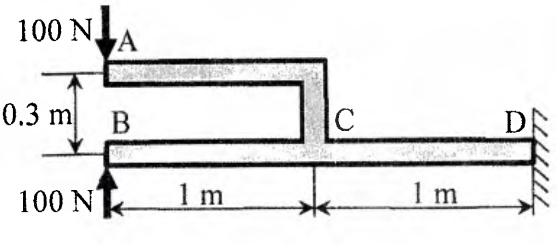
B) An indeterminate structure as shown in the figure consists of beam AB of length L subjected to UDL of w and supported at both ends A and B. Support at A is of fixed type and that at B is of simply supported type. The beam has area M.I. of I and modulus of elasticity for material is E. Calculate reactions at supports A and B and draw shear force diagram for the beam, given following information.



(5) *1* *2*

- Deflection at the free end of a cantilever beam of length L subjected to UDL w is given as $\frac{wL^4}{8EI}$
- Deflection at the free end of a cantilever beam of length L subjected to point load P acting at its free end is given as $\frac{PL^3}{3EI}$

C) A beam structure ABCD as shown in the figure has square cross section of 30 mm x 30 mm. It is fixed at D. Calculate maximum bending stress in the structure.



(5) *2* *4*

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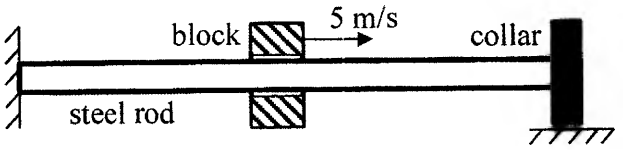
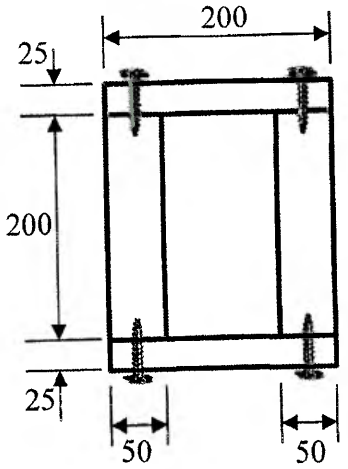
B) A sliding block weighing 200 N slides over a 50 mm diameter 2000 mm long horizontal steel rod at a velocity of 5 m/s as shown in the figure. The block is stopped by its impact with a rigid collar provided at the end of rod. Ignoring friction and bending of bar, find instantaneous stress and elongation induced in the rod. Consider E = 200 GPa. What would be effect, if any, on the stress induced if the rod is made of copper with same dimensions. **(5)** *4* *2*



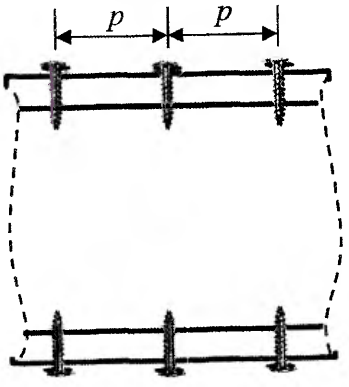
Q4 A) A square prism of wood 60 mm x 60 mm in cross-section and 400 mm long is subjected to tensile stress of 30 MPa along its longitudinal axis, lateral compressive stress of 15 MPa on one set of lateral faces and lateral tensile stress of 10 MPa on other set of lateral faces. Find the changed dimensions and change in volume of the prism. Take Poisson's ratio = 0.4 and modulus of elasticity = 15 GPa. **(5)** *2* *1*

B) A cylindrical shell, 2000 mm inside diameter, thickness of metal 20 mm and 3 m long, is subjected to internal pressure of 2.0 MPa. Calculate the change in diameter, length and volume of shell under the pressure. Use thin cylinder theory. E = 200 GPa, Poisson's ratio = 0.3. **(5)** *4* *7*

C) A simply supported beam of span 2 m and of a cross-section fabricated from flat sheets as shown in the figure carries a vertical load *W* at mid-span. The allowable working stress in bending is 10 MPa. Find the proper spacing *p* of joining screws, each of which can transmit a shear force of 3000 N. **(10)** *2* *4*



Cross-section



Part Elevation

(All Dimensions in mm)

Q5 A) Define following terms: (i) Young's Modulus, (ii) Modulus of rigidity, (iii) Bulk modulus, (iv) Poisson's ratio, (v) 0.2% offset proof stress, (vi) Ultimate tensile strength, (vii) Yield strength, (viii) Proof resilience, (ix) Hoop Stress, (x) Necking. **(5)** *3* *1*

B) A bar ABCD 1000 mm long is made up of three parts AB, BC and CD of lengths 300 mm, 500 mm and 200 mm respectively. AB and CD are cylindrical having diameters of 30 mm and 20 mm respectively. The rod BC is square section of 40 mm x 40 mm. The rod is subjected to an axial pull of 30 kN. Find the stresses in the three parts of the bar and the extension of bar. Take E = 200 GPa. **(5)** *2* *2*

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	C)	Derive the expression for relationship between rate of loading w, shear force V and bending moment M at any point on a transversely loaded beam.	**(5)**	*1*	*3*
	D)	A 3 mm x 3 mm high strength copper bar 2.5 m long is bent into a circle and held with its ends just in contact. Find the maximum bending stress in the bar. Also calculate the bending moment applied at the ends. Take E = 112 GPa.	**(5)**	*2*	*4*
Q6	A)	A cylindrical mild steel bar of 50 mm diameter, 500 mm long is enclosed by a brass sleeve by brazing. The assembly is subjected to an axial pull of 500 kN. Determine the cross-section area of the brass sleeve so that the sleeve carries 25% of the load. Also determine stresses in the material and the extension of the bar. E_b = 84 GPa and E_s = 210 GPa.	**(5)**	*2*	*1*
	B)	A steel shaft ABCD of total length of 2 meter is made up as follows: AB = 500 mm; BC = 1000 mm; CD = 500 mm. AB is hollow, its outside diameter being 100 mm and its inside diameter d mm. BC and CD are solid, having diameters of 90 and 75 mm respectively. If equal and opposite torques are applied to the ends of the shaft, find the maximum permissible value of d for the maximum shearing stress in AB not to exceed that in CD. If the torque applied to the shaft is 5000 Nm, what is the total angle of twist? G = 84 GPa.	**(5)**	*2*	*4*
	C)	In a two-dimensional stress system, two mutually perpendicular planes at a point carry tensile and compressive stresses σ_x, σ_y and shearing stress of 30 MPa. If principal stresses are 30 MPa, tensile and 70 MPa, compressive, determine stresses σ_x and σ_y. Also give location a plane with respect to the maximum principal stress plane on which the normal and shear stresses are equal in magnitude and both are positive in sign.	**(10)**	*4*	*5*
Q7	A)	A cantilever beam of length L is subjected to UDL of w acting from support till its half-length. Develop expression for the deflection curve of the beam. The beam has area moment of inertia I and modulus of elasticity E.	**(5)**	*2*	*6*
	B)	A thick-walled cylinder of 200 mm inside diameter is to contain fluid at a pressure of 50 MPa. Find the necessary thickness if the maximum hoop stress is not to exceed 200 MPa. If the inner surface becomes corroded and the cylinder has to be re-bored, by how much can the inside diameter be increased without raising by more than 5%, the maximum hoop stress induced by the same internal pressure?	**(5)**	*4*	*7*
	C)	A hollow shaft is subjected to a torque of 500 kNm and a bending moment of 250 kNm. The internal diameter of the shaft is one-half the external diameter. If the maximum shear stress is not to exceed 100 MPa, find the diameter of the shaft.	**(5)**	*4*	*6*
	D)	Describe the Mohr circle method to obtain combined stresses for a two-dimensional stress system. Discuss two theories of failure which are used for design of machine components. Which theory of failure you would recommend for design of component made of (i) copper and (ii) cast iron?	**(5)**	*4*	*6*

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END SEM EXAMINATION

Program: **B. Tech. in Mechanical Engineering**
Class: **Second Year B. Tech. (Mechanical)**
Course code: **BTM 305**
Name of the Course: **Thermodynamics**

Date: **Nove mber-2017**
Duration: **3 Hr.**
Max. Points: **100**
Semester: **III**

Master file.

Instructions:

- Attempt **ANY 05** questions.
- Assume suitable data wherever necessary and state the same.
- Draw **neat** and lebelled system diagram **and/or** process diagram wherver necessary.
- **Legible hand writing**, proper figures and tidy work carry weightage.
- Refer **Steam Tables and Mollier Diagram** wherever necessary.
- Answers to theory questions should be **brief and prescise**.

		Max. Points	CO No.	Module No.
Q 1	A) **Explain:**-i) Thermodynamic Equilibrium ii) Quasi-static Process. Give suitable examples.	(08)	1	1
	B) 1 kg of water in the cylinder –piston arrangement is initially at the saturated liquid state at 8 bar. It absobs heat from a reservoir at 250 $°C$. During the process, the piston moves out in such a way that the pressure remains constatnt. At the end of the process, water is completely evaporated to form dry,saturated steam. **Evaluate:**- i) Heat and Work Transfer in the process iii) Change in Entropy of the system, reservoir and universe.	(12)	1,2,4	1,2,4,5
Q 2.	A) **Discuss:**- i) Joule's Experiment ii) PMM-1 and its Converse.	(08)	1,2	2
	B) **Obtain:**-Steady Flow Energy Equation for a rotary compressor. Air enters an air compressor at 8 m/s velocity, 100 kPa pressure and volume of 0.95 m^3/kg. It flows steadily at the rate of 0.6 kg/s and leaves the compressor at 6 m/s, 700 kPa pressure and volume of 0.19 m^3/kg. The internal energy of the air leaving the compressor is 90 kJ/kg more than that of the air entering the compressor. The cooling water in the compressor jacket absorbs heat from the air in the compressor at the rate of 60 kW. **Evaluate:**- i) The ratio of inlet pipe diameter to outlet pipe diameter ii) The rate of shaft work input to air in kW.	(12)	1,2,4	2

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Q.3	A) **Explain:-** Working of Ideal Rankine cycle with details of processes involved, using a neat schematic and p-V , T-s and h-s diagrams.	(08)	1,3	5
	B) **Explain:-** Necessity for reheating the steam in thermal power plants. Steam at a pressure of 15 bar *and* 250 $°C$ is expanded isentropically through a turbine at first to a pressure of 4 bar. It is then reheated at constsnt pressure to the initial temperature of 250 $°C$ and is finally expanded to 0.1 bar. **Evaluate:-** i) Thermal Efficiency of Cycle ii) Work output per kg of steam flowing through the turbine iii) Amount of heat supplied during reheat.	(12)	1,3,4	5
Q.4	A) **Explain:-**Working of an Ideal Otto cycle with p-v and T-s diagrams. **Prove**:-Eefficiency of an ideal Otto Engine is independent of operating temperatures and depends only on Compression ratio of the engine.	(08)	1,3	6
	B) An ideal Diesel engine operates within the temperature limits of 1700K *and* 300K with a compression ratio of 16. **Evaluate:-** i)Pressures and temperatures at cardinal points ii) Thermal efficiency of the cycle iii) Mean Effective Pressure	(12)	1,3,4	6
Q.5	A) **Prove**:- $v = v_f + x.v_{fg}$; where the terms involved have usual meaning.Steam initially at 1.5 MPa and 300$°C$ expands reversibly and adiabatically in a steam turbine to 40$°C$. **Evaluate:-**Ideal Turbine shaft work per kg of steam	(08)	1,3,4	5
	B) A Gas Turbine power plant working on an ideal Brayton Cycle receives air at the inlet to the compressor at 0.1 MPa and 30$°C$. The pressure ratio of the cycle is 6. Maximum temperature in the cycle is 900 $°C$. **Evaluate**:-Efficiency of the gas turbine power plant i) with polytropic efficiency of compressor and turbine as 100%. each. ii) with polytropic efficiency of compressor and turbine as 80%. each.	(12)	1,3,4	6
Q.6	A) **Explain:-**Working of Ideal Vapor Compression Refrigeration Cycle explaining the details of processes involved uisng a neat schematic and T-s and p-H diagrams.	(08)	1,2	7
	B) **Prove**:- $COP_{HP} = 1 + COP_R$; where the terms involved have usual meaning. A refrigerating machine working on Reversed Carnot Cycle consumes 6 kW and produces the refrigerating effect of 1000 kJ/min.The sink temperature is -40 $°C$.**Evaluate:**-i) Source Temperature ii) COP of refrigerator.	(12)	1,3,4	3,7
Q.7	**Explain** the following with neat sketches and illustrative examples:- i) Zeroth Law of Thermodynamics and International Practical Temperature Scale (IPTS) ii) Dead State and Availability iii) Statements of Second Law of Thermodynamics iv) Entropy:- Definition, Principle of increase and Clausius' inequality	(20)	1,2,3	3,4

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

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Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

End Semester **Re-Exam**

November 2017

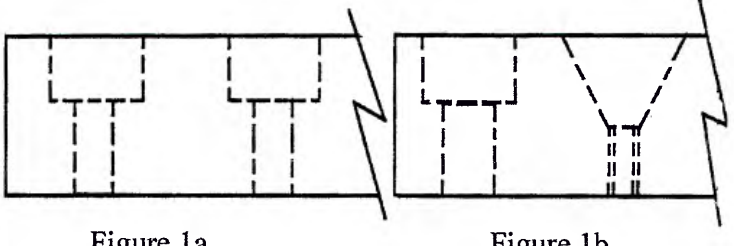
Max. Marks: 100Duration: 3 hours

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

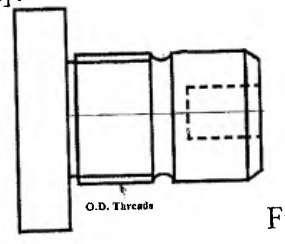
Name of the Course: **Manufacturing Science –I** Course Code : **BTM 306**

Instructions: Master file.

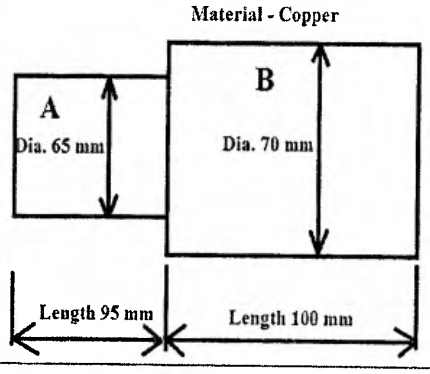
1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six (each question carries 20 marks)
3. Draw neat schematics diagrams wherever necessary.
4. Assume suitable data if necessary.

Q. No		Max Mark	CO #	Module no.
Q1 (a)	Give an example of super abrasive grinding wheel compositional *specification*? Give significance of each alpha numeric terms in details which describes grinding wheel?	10	CO1 ,4	M6
b)	Draw well labelled neat schematic sketch straight flute drill tool and twisted flute drill tool? Also state difference between them in terms of their geometry, machining capability and applications? For drilling the 50 holes of such pattern in long metal strip (refer figure 1a. and 1 b.), Suggest the suitable drilling machine can be used for such kind of batch production requirement. Suggest the sequence of drilling operation, cutting tool required for each operation?  Figure 1a. Figure 1b.	10	CO2 ,4	M4
Q2 (a)	Draw neat schematic sketch of slotting machine? Explain working principle of slotting machine with schematic sketch? Describe kinematic system of shaper machine? Also draw one geometry of product which can be manufacture by shaper and slotting machine?	10	CO4	M5
(b)	Draw well labelled block diagram of CNC control system? Explain each elements of NC machine tools briefly? The finished part shown in figure no. 1 needs to be manufactured in *one* setup, in *mass* production, with desired *geometric tolerances* has to be satisfied.	10	CO2 ,4	M2

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

	Which lathe machine you will prefer to satisfy above mentioned points [1M]? Explain any four important features of that machine which differentiate it from other lathe machine [4M]?  Figure 2			
Q3 (a)	Calculate power required to drill 10 mm diameter hole in AISI 1018 material at feed of 0.20 mm/rev, speed of 250 RPM. Determine volume of metal removed per unit energy and machining time? Note- Torque required for drilling the hole in AISI 1018 material is given by, $T=C \times f^{0.75} \times D^{1.8}$. where 'C=0.56' is constant for material. Approach and overrun distance equal to 5 mm and half drill point angle if 45°. Draw well labeled sketch of work piece and drill tool indicating working principle of drilling operation?	10	CO2 ,4	M4
(b)	Give the basic requirements for efficient grinding? Explain in brief Horizontal spindle rotary table grinder machine along with its neat schematic sketch and applications? Answer the following question with one or two points only; i) Why Silicon carbide abrasive particle grinding wheel cannot be used for grinding steel material? (2M) ii) Give significance of following terms related to grinding wheel a) Grade of hardness, b) Structure? (3M)	10	CO1 ,4	M6
Q4 (a)	With the help of neat sketch [3M] Explain material removal mechanism [2M] and characteristics [2M] of "ultrasonic machining" (USM) process? Specify what are different materials and geometries can be machined using this process [3M]?	10	CO3	M7
(b)	Draw neat setup sketch of centrifugal casting process and explain its characteristics? Give its classification and explain any of its subtype with schematic sketch?	10	CO3	M1
Q5 (a)	Find the best welding speed to be used for the welding of 8 mm steel plates with an ambient temperature of 25° C with welding transformer set at 25 V and current passing is 300 A. Arc efficiency is 0.9 and possible travel speeds are 6 to 9 mm/s. limiting cooling rate for satisfactory performance is 6° C/s at a temperature of 550° C. Data- k= 0.028 J/mm.s.°C, R= 6° C/s, T_o= 25° C, T_c= 550° C, V= 25 V, I = 300A, h= 8 mm, f_1 = 0.9, ρ^*c = 0.0044 J/mm^3. °C.	10	CO2 ,3	M7
(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. Calculate approach distance and over run distance?cutting velocity 15 m/min and feed is 0.35 mm/tooth.	10	CO1 ,4	M3

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

Q6 (a)	A steel manufacturing industry wants to manufacture long billets, blooms etc. long products of steel material. Suggest a manufacturing process and explain the basic steps involved with the help of well labelled schematic sketch? Also list down important critical points to be consider for manufacturing of such products?	10	CO2 ,3	M1
(b)	A cast steel block having length of 850 mm and with 750 mm have thickness of 150 mm. Finish size of block required to have to be of 850X750X130 mm^3. For each pass allowable depth of cut for single point tool is 4 mm. Cutting speed maintained is 250 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 it? Why it is necessary to select correct ram stroke available on shaper machine [2M]?	10	CO1 ,4	M5
Q7 (a)	Explain construction working of Universal type of knee and column type conventional milling machine with help of neat schematic sketch? Also state its special capability (which differ it from other one) in terms of kind of milling operations it can perform?	10	CO4	M3
(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)  Figure 3	10	CO4	M2

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

Sardar Patel College of Engineering

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(A Government Aided Autonomous Institute)

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

END SEMESTER Examination

November 2017

Maximum Marks: **100** Duration: **3 hour**

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 FOUR questions out of remaining SIX questions.
- Question number.**1** is **compulsory**.
- Answers to all sub questions should be **grouped** together.

Q		Marks	CO	Module No.
1(a)	If $A=\begin{bmatrix}2 & 3\\ 0 & 1\end{bmatrix}$ find $A^{20}-2A^{19}+A$. using cayley Hamilton theorem.	5	4	7
(b)	Find Laplace transforms of $f(t)=\sin^7 t$	5	1	1
(c)	Obtain the Fourier series for $f(x)=\begin{cases}1+\frac{2x}{\pi} & -\pi<x<0\\ 1-\frac{2x}{\pi} & 0<x<\pi\end{cases}$	5	2	4
(d)	Find the image of the area between $x^2+y^2=4$ and $x^2+y^2=9$ in the z – plane into the w – plane under the transformation $w=\log z$	5	3	5
2 (a)	Find the eigen values and eigen vectors of the matrix.	6	4	7

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	$A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$			
(b)	Prove that $\int_0^{\infty} \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$	**6**	**1**	**2**
(c)	If $f(x)=x \qquad 0 \le x \le 2$ Find half range cosine series using Parseval's identity deduce $\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \text{------}$	**8**	**2**	**5**
3 (a)	Prove that the following function is analytic $f(z)=\cosh z$	**6**	**3**	**5**
(b)	Show that the matrix $A=\begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ satisfies Cayley-Hamilton's theorem	**6**	**4**	**7**
(c)	Find $L\left[\frac{d}{dt}\left(\frac{1-\cos 2t}{t}\right)\right]$	**8**	**1**	**1**
4 (a)	Find the Fourier series for $f(x)=\begin{cases} 0 & -\pi \le x \le 0 \\ x & 0 \le x \le \pi \end{cases}$	**6**	**2**	**4**
(b)	Find the Laplace transforms of f(t), where $f(t)=\begin{cases} t^2, 0<t<1 \\ 0, t>1 \end{cases}$	**6**	**1**	**1**
(c)	If f (z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.	**8**	**3**	**5**
5 (a)	Evaluate: $L^{-1}\left\{\log\left\lvert\frac{s^2+b^2}{s^2+a^2}\right\rvert\right\}$	**6**	**1**	**2**

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(b)	Find non – singular matrices P, Q so that PAQ is a normal form where $A=\begin{bmatrix}2 & 1 & -3 & -6\\ 3 & -3 & 1 & 2\\ 1 & 1 & 1 & 2\end{bmatrix}$	**6**	**4**	**6**
(c)	Find the Fourier sine series for the function $f(x)=e^{ax}$ for $0<x<\pi$ where a is constant	**8**	**2**	**4**
6(a)	Evaluate: $L^{-1}\left\{\frac{s^2+2s+3}{(s^2+2s+2)(s^2+2s+5)}\right\}$	**6**	**1**	**2**
(b)	For what values of λ and μ the linear equations. $x+2y+z=8$ $2x+2y+2z=13$ $3x+4y+\lambda z=\mu$ have i)No solution i) A unique solution iii)infinite number of solutions	**6**	**4**	**6**
(c)	Find the analytic function $f(z)=u+iv$ such that $u+v=\frac{x}{x^2+y^2}$	**8**	**3**	**5**
7 (a)	Obtain complex form of the Fourier series of the function the $f(x)=\begin{cases}0 & -\pi\le x\le 0\\ 1 & 0\le x\le\pi\end{cases}$	**6**	**2**	**4**
(b)	Evaluate: $L^{-1}\left\{\log\left(1+\frac{1}{s^2}\right)\right\}$	**6**	**1**	**2**
(c)	Solve $y''-3y'+2y=4e^{2t}$ Given $y(0)=-3$ $y'(0)=5$	**8**	**1**	**2**