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06MAT31

Third Semester B.E. Degree Examination, December 2011
Engineering Mathematics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Find a Fourier series to represent $f(x)=\begin{cases}0 & -\pi\le x\le 0\\ x^2 & 0\le x\le \pi\end{cases}$. **(06 Marks)**

b. Find half range cosine series of $f(x)=1-\frac{x}{l}$ in (o, l). **(07 Marks)**

c. Compute the Fourier coefficients a_0, a_1, a_2, b_1 and b_2 for f(x) tabulated below: **(07 Marks)**

x	0	1	2	3	4	5
f(x)	9	18	24	28	26	30

2 a. Find Fourier transform of,

$f(x)=\frac{1}{2a}\quad |x|\le a$

$=0\quad |x|>a$ **(06 Marks)**

b. Find Fourier cosine transform of e^{-ax}, $a\ge 0$, hence find $\int_0^\infty \frac{\cos\alpha x}{a^2+\alpha^2}dx$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\frac{1}{s}e^{-as}$. **(07 Marks)**

3 a. Form the second order partial differential equation of $z=xf(ax+by)+g(ax+by)$. **(06 Marks)**

b. Solve : $(y+zx)z_x-(x+yz)z_y=x^2-y^2$. **(07 Marks)**

c. Solve : $3u_x+2u_y=0$, given $u(x,0)=4e^{-x}$ using method of separation of variables. **(07 Marks)**

4 a. With suitable assumptions, derive one dimensional equation for heat flow. **(06 Marks)**

b. Solve : $\frac{\partial^2 u}{\partial t^2}=c^2u_{xx}$ by the method of separation of variables. **(07 Marks)**

c. Solve $u_{xx}+u_{yy}=0$, for $0<x<a$, $0<y<b$ and $u(x,0)=0$; $u(x,b)=0$; $u(0,y)=0$; $u(a,y)=f(y)$. **(07 Marks)**

PART – B

5 a. Find the third approximate root of $xe^x-2=0$, by Regula Falsi method. **(06 Marks)**

b. Using Gauss Seidel method of iteration, find a, b, c (4^{th} iteration values), given $5a-b=9$, $a-5b+c=-4$, $b-5c=6$ taking $\left(\frac{9}{5},\frac{4}{5},\frac{6}{5}\right)$ as first approximation. **(07 Marks)**

c. Find all the eigen values and the eigen vector corresponding to smallest eigen value of :

$$\begin{bmatrix}1 & 0 & -1\\ 1 & 2 & 1\\ 2 & 2 & 3\end{bmatrix}$$ **(07 Marks)**

6 a. Given the following table of x and f(x), fit a Lagrangian polynomial and hence find f(1) and f(4). **(06 Marks)**

x	-1	0	2	3
f(x)	-8	3	1	2

b. Using Newton's dividend different formula, find f(2, 5) given:

x	-3	-1	0	3	5
f(x)	-30	-22	-12	330	3458

(07 Marks)

c. Tabulate the values $y = \log_e x$, $4 \le x \le 5.2$, in steps of 0.2 and find $\int_4^{5.2} \log_e x \, dx$ using Simpons' $\frac{3}{8}$ rule. **(07 Marks)**

7 a. Derive eulers' equation for extremal value in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(06 Marks)**

b. Determine the plane curve down which a particle will slide down without friction from $A(x_1, y_1)$ to $B(x_2, y_2)$ in shortest time. **(07 Marks)**

c. The curve 'C' joining the two points $A(x_1, y_1)$ to $B(x_2, y_2)$ is rotated about x-axis, find equation of 'C' such that the solid of resolution has minimum surface area. **(07 Marks)**

8 a. Find $z(e^{-an} \sin n\theta)$ and $z(n \cos n\theta)$. **(06 Marks)**

b. Find z^{-1} of $\left\{\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}\right\}$. **(07 Marks)**

c. Solve : $u_{n+2} + 2u_{n+1} + u_n = n$ given $u_0 = u_1 = 0$. **(07 Marks)**

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06ME32A

Third Semester B.E. Degree Examination, December 2011
Materials Science and Metallurgy

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define unit cell, coordination number, vacancy and grain boundary. **(04 Marks)**

b. Draw a neat sketch of a BCC unit cell. Derive the relation between lattice parameters and atomic radius for the BCC unit cell. Calculate its atomic packing factor. **(08 Marks)**

c. Explain edge dislocation, with the help of a neat sketch. **(04 Marks)**

d. Explain briefly the vacancy mechanism of diffusion. **(04 Marks)**

2 a. Define engineering stress and true stress. Derive the relation between the two. **(06 Marks)**

b. A tensile specimen of 10mm diameter and 100mm gauge length is subjected to a tensile test. If its diameter is reduced to 8mm by applying a load of 1500N, what is its final length? Also determine engineering stress, engineering strain, true stress and true strain. **(06 Marks)**

c. Explain Vickers hardness testing, in brief. **(04 Marks)**

d. When a 3000 kg load is applied through a 10mm diameter ball in a Brinell test on steel, an indentation of 3.1mm is produced. Determine the BHN of the metal. **(04 Marks)**

3 a. Sketch the basic modes of fracture. List the differences between them. **(06 Marks)**

b. Explain with the help of a sketch, the fatigue behaviour of metals. State any three methods to improve fatigue resistance. **(07 Marks)**

c. With the help of a neat sketch, explain the different stages in a creep curve. Give two examples for creep resistant materials. **(07 Marks)**

4 a. State Hume – Rothery rules that govern the formation of solid solutions. **(04 Marks)**

b. Draw neatly labeled sketches of eutectic phase diagrams for a binary system with i) no solid solubility and ii) partial solid solubility. **(06 Marks)**

c. Describe the phase rule and lever rule in brief. **(04 Marks)**

d. A binary alloy system contains two solid phases α and β at a particular temperature. The compositions of α and β are A – 5% B and A – 95% B respectively. Calculate the amount of α and β in i) A – 40% B alloy and ii) A – 70% B alloy at that temperature. **(06 Marks)**

PART – B

5 a. Draw a neat labeled iron – carbon phase diagram. Write the three invariant reactions taking place in the system. **(10 Marks)**

b. Draw the schematic microstructures of slowly cooled eutectoid steel and hypo – eutectoid steel. **(04 Marks)**

c. Briefly explain the TTT diagram for eutectoid steel. **(06 Marks)**

6 a. Compare annealing and normalizing heat treatments adopted for steels. **(06 Marks)**

b. Explain carburizing and flame hardening, in brief. **(06 Marks)**

c. Define hardenability. Explain with a neat sketch, the Jominy end quench test of determining the hardenability of steels. **(08 Marks)**

7 a. Briefly describe the composition, properties and applications of medium and high carbon steels. **(10 Marks)**

b. State the properties and applications of gray cast iron. **(04 Marks)**

c. Write a note on brasses. **(06 Marks)**

8 a. Define corrosion. State its effects. **(03 Marks)**

b. Briefly explain the mechanism of corrosion. **(05 Marks)**

c. Write a note on passivity. **(04 Marks)**

d. List various methods of corrosion prevention. Explain cathodic protection with examples. **(08 Marks)**

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06ME32B

Third Semester B.E. Degree Examination, December 2011
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Distinguish between the line standards and end standards .Give examples for each. **(03 Marks)**

b. Define meter in terms of wavelength standards. Discuss the important features of wavelength standards. **(04 Marks)**

c. Four length bars of basic length 100mm are to be calibrated using a calibrated bar of 400mm length, whose actual length is 399.9992mm. It was also found that lengths of bars B, C and D in comparison to A are +0.0002mm, +0.0004mm and -0.0001mm respectively. The lengths of all the four bars put together in comparison to standard calibrated bar is +0.0003mm longer. Determine the actual dimensions of all the four bars. **(06 Marks)**

d. Explain the procedure for wringing of slip gauges. Using a slip gauge set M-87, build up the dimension 29.758mm. **(07 Marks)**

2 a. Define the following terms:
i) Tolerance ii) Fundamental deviation iii) Basic hole
iv) Basic shaft v) Unilateral tolerance vi) Bilateral tolerance. **(06 Marks)**

b. Differentiate between interchangeability and selective assembly. **(03 Marks)**

c. Sketch and explain any two types of plug and ring gauges. **(06 Marks)**

d. Determine the dimensions of shaft and hole for a fit 30 H_8/d_{10}. Sketch the fit using the following data:
i) Diameter 30 falls in the diameter range 18-30, upper deviation for 'd' shaft is $-16D^{0.44}$.
ii) $i = 0.45D^{1/3} + 0.001D$. Tolerance for IT8 = 25i, tolerance for IT10 = 64i. **(05 Marks)**

3 a. State the purpose for which each of the following devices are used:
i) Pneumatic comparator ii) Brooke's level comparator iii) LVDT iv) Bevel protector
v) Sin bar vi) Sin centre. **(03 Marks)**

b. Illustrate a systematic way of building the angle gauges to get the angle 37°16′45″. **(03 Marks)**

c. Sketch and explain the working of the solex pneumatic comparator. **(07 Marks)**

d. Describe with a neat sketch, the working of a LVDT. **(07 Marks)**

4 a. What are the optical flats? Illustrate with neat sketches, the typical interference fringe pattern for i) flat surface ii) convex surface and iii) concave surface. **(05 Marks)**

b. Derive an expression for the best wire size for three wire method of screw thread measurement. **(05 Marks)**

c. With a neat sketch, explain the construction and working of a toolmaker's microscope. **(10 Marks)**

Important Note : 1. On completing your answers, compulsoriiy draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. Describe the three stages of measurements, with a suitable example. (05 Marks)

b. Differentiate between:
   i) Accuracy and precision
   ii) Repeatability and reproducibility
   iii) Assembly errors and random errors. (09 Marks)

c. Distinguish between:
   i) Primary and secondary transducers
   ii) Active and passive transducers
   iii) Mechanical and electrical transducers. (06 Marks)

6 a. Explain with a neat sketch, the chopper amplifiers. (06 Marks)

b. Explain the working principle of CRO, with a neat sketch. (09 Marks)

c. Explain the working of light beam or mirror type oscillograph, with a neat sketch. (05 Marks)

7 a. With a neat sketch, explain the working of a proving ring. (08 Marks)

b. With a neat sketch, explain the working of a McLeod gauge. (08 Marks)

c. Write a note on hydraulic dynamometers. (04 Marks)

8 a. Explain the following:
   i) Seebeck effect,
   ii) Thomson effect
   iii) Peltier effect. (06 Marks)

b. State and explain the laws of thermocouples. (06 Marks)

c. Explain with a neat sketch, the working of Tuckerman optical extensometer. (08 Marks)

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06ME33

Third Semester B.E. Degree Examination, December 2011
Basic Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use of thermodynamic data handbook is permitted.

PART – A

1 a. With the suitable sketches/examples, distinguish between:
i) Closed system and open system ii) Point function and path function
iii) Intensive and extensive properties iv) Thermal and mechanical equilibrium. **(08 Marks)**

b. State the zeroth law of thermodynamics. How does this forms the basis of temperature measurement? **(06 Marks)**

c. The emf in a thermocouple, with the test junction at t°C on gas thermometer scale and reference junction at ice point is given by $e = 0.20t - 5\times10^{4}t^{2}$ mV.
The millivoltmeter is calibrated at ice and steam points. What will this thermometer read in a place, where, the gas thermometer reads 50°C? **(06 Marks)**

2 a. Define work, from the thermodynamic point of view. Mention suitable examples. **(04 Marks)**

b. Compare heat and work. **(06 Marks)**

c. Show that work is a path function. **(03 Marks)**

d. A cylinder fitted with a piston on which a number of weights are placed. The initial pressure is 200 kPa and the initial volume is 0.04 m^3. Heat is transferred to the system and weights are removed from the piston in such a way that $PV^{1.3}$ = Constant describes the relation between the pressure and volume, during the process. Final volume is 0.1 m^3. Calculate the work done during the process. **(07 Marks)**

3 a. What is perpetual motion of I kind? Explain. **(03 Marks)**

b. Derive the steady flow energy equation for a single stream of fluid entering and a single stream of fluid leaving the control volume. **(08 Marks)**

c. A fluid system undergoes a non flow frictionless process following the pressure-volume relation $P = \left[\frac{5}{V} + 1.5\right]$, 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: i) the change in internal energy and ii) the change in enthalpy. **(09 Marks)**

4 a. State the limitations of first law of thermodynamics. **(04 Marks)**

b. Define i) heat pump and ii) heat engine. Prove that, of all the heat engines operating between the two temperature limits, none has a higher efficiency than a reversible engine working between same temperature limits. **(08 Marks)**

c. A reversible heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. What is the least rate of heat rejection per kW net output of the engine? **(08 Marks)**

PART – B

5 a. State and prove the Clausius inequality. **(07 Marks)**

b. Explain the principle of measure of entropy. **(05 Marks)**

c. A fluid undergoes a reversible adiabatic compression from 0.5 MPa,0.2 m^3 to 0.5 m^3 according to the law $PV^{1.3}$ = Constant. Determine the change in enthalpy, internal energy and entropy and the heat transfer and work transfer during the process. **(08 Marks)**

6 a. Explain the concept of available and unavailable energy. When does the system become dead? **(06 Marks)**

b. Write a brief note on law of degradation of energy. **(04 Marks)**

c. Calculate the decrease in available energy when 25 kg of water at 95°C mixes with 35 kg of water at 35°C, the pressure being taken as constant and the temperature of the surroundings being 15°C. C_p of water = 4.2 kJ/kg.K. **(10 Marks)**

7 a. Define i) Isothermal compressibility, ii) Isentropic compressibility and iii) Coefficient of volume expansion. **(06 Marks)**

b. Explain the terms:
i) Pure substance ii) Degree of superheat iii) Sensible heat iv) Dryness fraction. **(04 Marks)**

c. With a neat sketch, explain the method of measurement of dryness fraction of steam, using a throttling calorimeter. **(06 Marks)**

d. Determine the amount of heat which should be supplied to 2 kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry. **(04 Marks)**

8 a. Derive the expressions for gas constant and molecular weight of a mixture of the ideal gases A, B and C. **(06 Marks)**

b. Explain the following:
i) Compressibility factor
ii) Reduced properties
iii) Law of corresponding states
iv) Generalized compressibility chart **(08 Marks)**

c. The specific heats of a gas are given by $C_p = a + kT$ and $C_v = b + kT$, where a, b & k are constants and T is in K. 1.5 kg of this gas occupying a volume of 0.06 m^3 at 5.6 MPa, expands isentropically until the temperature is 240°C. If a = 0.946, b = 0.662 and $k = 10^{-4}$, calculate the work done in the expansion. **(06 Marks)**

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06ME34

Third Semester B.E. Degree Examination, December 2011
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define: i) Hooke's law ii) Poisson's ratio iii) Elastic limit iv) Modulus of rigidity **(04 Marks)**

b. Derive an expression for the extension of a member subjected to a tensile load P. The length of the member being L and its Young's modulus is E. **(04 Marks)**

c. A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Fig.Q1(c). Calculate the force P_2 necessary for equilibrium, if $P_1 = 45$ kN, $P_3 = 450$ kN and $P_4 = 130$ kN Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1×10^5 N/mm^2. **(12 Marks)**

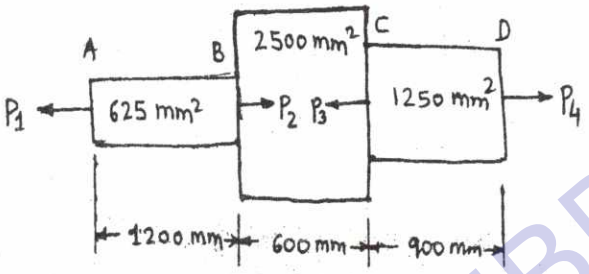

Fig.Q1(c)

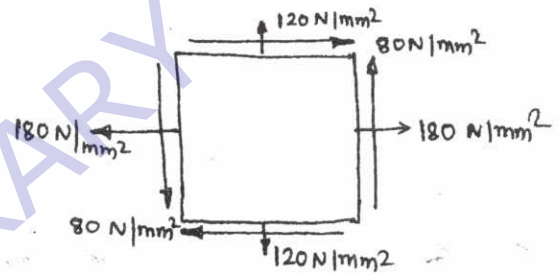

Fig.Q3(c)

2 a. Define: i) Volumetric strain ii) Bulk modulus. **(02 Marks)**

b. Establish the relationship between Young's modulus (E), modulus of rigidity (G) and Poisson's ratio (γ). **(08 Marks)**

c. A steel rail is 12.6m long and is laid at a temperature of 24°C. The maximum temperature expected is 44°C.

i) Estimate the minimum gap between two rails to be left so that temperature stresses do not develop.

ii) Calculate the thermal stresses developed in the rails if a gap of 2mm is provided for expansion.

iii) If the stress developed is 20 MN/m^2 , what is the gap left between the rails?

Take $E = 2\times10^5$ MN/m^2 and $\alpha = 12\times10^{-6}$/°C. **(10 Marks)**

3 a. Define: i) Principal stresses ii) Principal planes. **(04 Marks)**

b. In a general two dimensional stress system, show that sum of normal stresses in any two mutually perpendicular directions is constant. **(06 Marks)**

c. The state of stress at a point in a strained material is as shown in Fig.Q3(c). Determine i) The direction of principal planes ii) The magnitude of principal stresses iii) The magnitude of maximum shear stress & its direction. Indicate all the above planes by a sketch. **(10 Marks)**

4 a. A cylindrical shell is 3m long and is having 1m internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in dimensions of the shell, if it is subjected to an internal fluid pressure of 1.5 N/mm^2.

Take $E = 2\times10^5$ N/mm^2 and $\gamma = 0.3$. **(10 Marks)**

b. A pipe of 400mm internal diameter and 100mm thickness contains a fluid at a pressure of 80 N/mm^2. Find the maximum and minimum hoop stress across the section. Also sketch the radial and hoop stress distribution across the section. **(10 Marks)**

PART – B

5 a. Classify beams (based on type of supports) and loads and sketch them. **(06 Marks)**

b. Draw the shear force and bending moment diagrams for the beam shown in Fig.Q5(b).

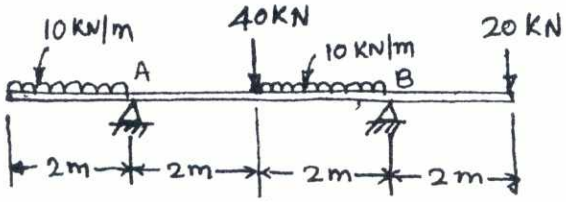

Fig.Q5(b) **(14 Marks)**

6 a. State the assumptions made in the simple theory of bending. **(04 Marks)**

b. Derive an expression for the relationship between bending stress and radius of curvature of a beam. **(06 Marks)**

c. A cast iron beam has an I section with a top flange 80mm×40mm, web 120mm×20mm and bottom flange 160mm×40mm. If the tensile stress is not to exceed 30N/mm^2 and compressive stress 90 N/mm^2, what is the maximum uniformly distributed load the beam carry over a simply supported span of 6m, if the large flange is in tension. **(10 Marks)**

7 a. Derive an expression for the maximum deflection of a cantilever beam carrying a point load at its free end. **(08 Marks)**

b. Find the maximum deflection and the maximum slope for the beam loaded as shown in Fig.Q7(b). Take flexural rigidity EI = 15×10^9 kN.mm^2. **(12 Marks)**

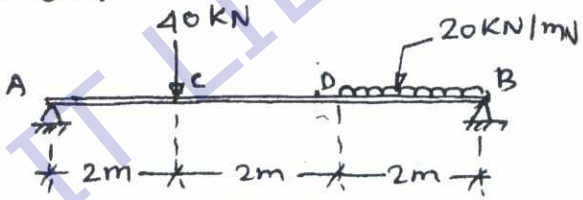

Fig.Q7(b)

8 a. State the assumptions made in the theory of pure torsion. **(04 Marks)**

b. Determine the diameter of a solid shaft which will transmit 440 kW at 280 rpm. The angle of twist must not exceed one degree per meter length and the maximum torsional stress is to be limited to 40 N/mm^2. Assume G = 84 kN/mm^2. **(08 Marks)**

c. A 2m long pin ended column of square cross section is to be made of wood. Assuming E = 12 GPa and the allowable stress being limited to 12 MPa, determine the size of the column to support a load of 95 kN. Use a factor of safety 3 and the Euler's crippling load for buckling. **(08 Marks)**

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06ME35

Third Semester B.E. Degree Examination, December 2011
Manufacturing Processes – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Classify manufacturing processes. Explain briefly the various factors to be considered while selecting a process for a given application. **(10 Marks)**

b. List the various types of patterns. Explain the different types of pattern allowances, with neat sketches. **(10 Marks)**

2 a. Sketch and explain the different types of gates. Bring out the requirements of a riser. **(10 Marks)**

b. Sketch and explain the working of a jolt – squeeze type of a moulding machine. **(10 Marks)**

3 a. With neat sketches, explain the investment casting process. **(10 Marks)**

b. With a neat sketch, explain the continuous casting process. Bring out its advantages. **(10 Marks)**

4 a. Sketch and explain the principle and working of a high frequency induction furnace. **(10 Marks)**

b. Sketch and explain the construction and operation of a cupola. **(10 Marks)**

PART – B

5 a. Sketch and explain the metal inert gas welding (MIG). Bring out its advantages and limitations. **(10 Marks)**

b. Classify welding processes and bring out the advantages and limitations of welding. **(10 Marks)**

6 a. With neat sketches, bring out the differences between spot and seam welding. **(10 Marks)**

b. Explain electron beam welding, with a neat sketch and bring out its advantages and limitations. **(10 Marks)**

7 a. What is meant by HAZ? Explain the various regions of HAZ in low carbon steel during welding, with a neat sketch. **(10 Marks)**

b. Discuss the various types of weld defects, their causes and remedies. **(10 Marks)**

8 a. Differentiate between brazing and soldering. Bring out the advantages, limitations and applications of these two processes. **(10 Marks)**

b. What is meant by NDT? With a neat sketch, explain the X – ray radiography and bring out its advantages and limitations. **(10 Marks)**

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06ME36A/46A

Third/Fourth Semester B.E. Degree Examination, December 2011
(ME/IP/AU/IM/MA/AE/MI)
COMPUTER AIDED MACHINE DRAWING

Time: 3 Hours Max. Marks: 100

Note: 1. Answer any **ONE** question from each of the parts **A, B** and **C**.
2. Use **FIRST ANGLE** projection only.
3. Missing data if any may suitably be assumed.
4. All the calculations should be on answer sheet supplied.
5. All the dimensions are in mm.
6. Drawing instruments may or may not be used for sketching
7. **Part C Assembled View should be in 3D and other 2 views in 2D.**

PART – A

1. A cube of 40mm side is cut by a VT, so that the true shape of section is an equilateral triangle of sides of maximum length. Draw the sectional top view and true shape of section. Determine the inclination plane to HP and measure the length of the sides of the equilateral triangle. **(20 marks)**

2. Draw two views of Square headed bolt with nut for a 30mm diameter bolt. Take length of bolt equal to 125mm. **(20 marks)**

PART – B

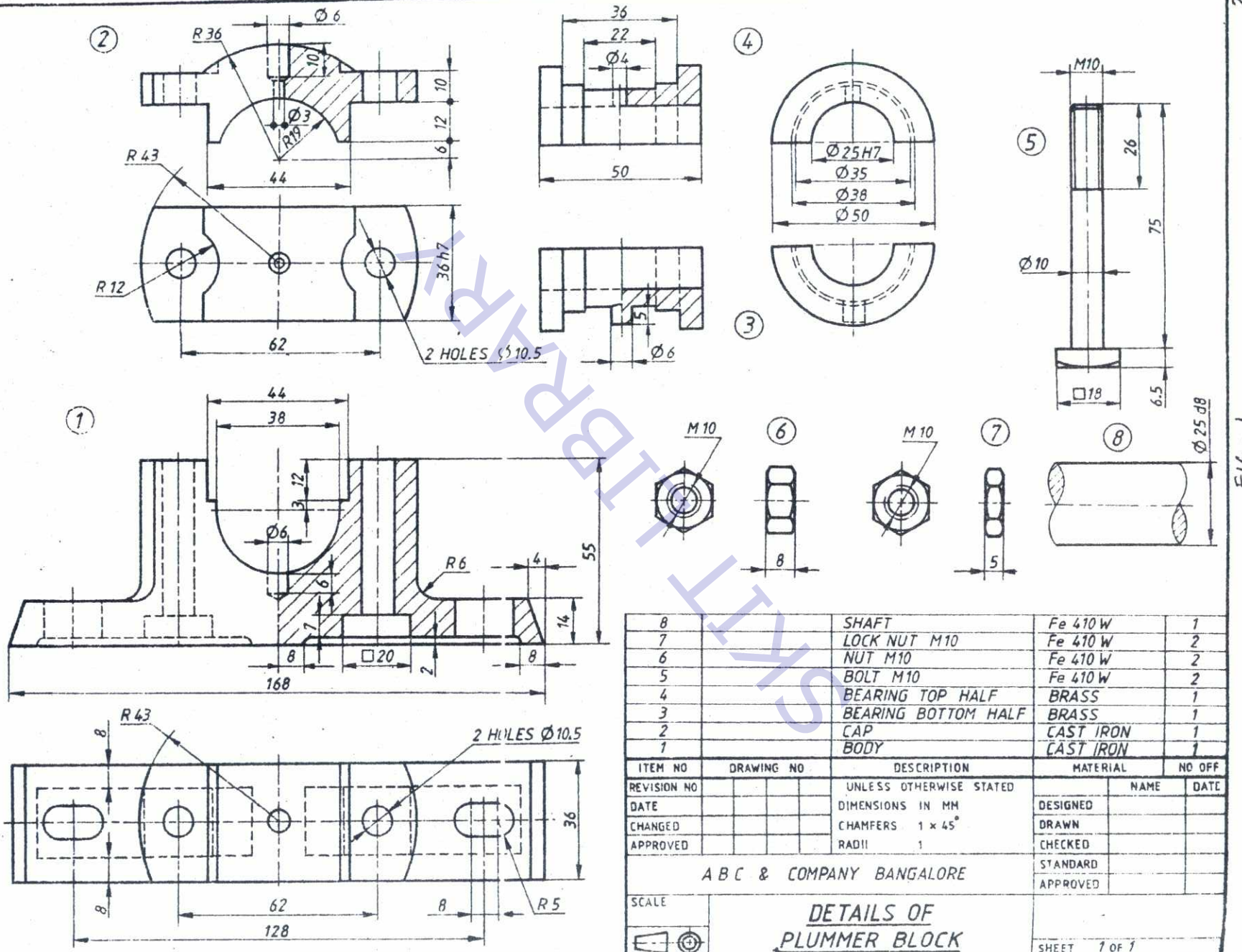
3. Draw the following views of a SOCKET and SPIGOT COTTER JOINT used for joining two rods of diameter 20mm:
   a) Sectional front view
   b) A view looking from Socket end **(20 marks)**

4. Draw sectional front view and side view of an Oldham's coupling to connect two shafts of diameter 20 mm. Indicate all dimensions. **(20 marks)**

PART – C

5. Details of a " PLUMMER BLOCK" are shown in figure 1. Assemble the parts and draw the following views of the assembly:
   (i) Front View showing right half in section.
   (ii) Top View. **(60 marks)**

6. Figure 2. shows the details of Screw Jack. Assemble the parts and draw the following views: (i) Front View showing right half in section and (ii) Top View **(60 marks)**



8		SHAFT	Fe 410 W	1
7		LOCK NUT M10	Fe 410 W	2
6		NUT M10	Fe 410 W	2
5		BOLT M10	Fe 410 W	2
4		BEARING TOP HALF	BRASS	1
3		BEARING BOTTOM HALF	BRASS	1
2		CAP	CAST IRON	1
1		BODY	CAST IRON	1
ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF

REVISION NO		UNLESS OTHERWISE STATED	
DATE		DIMENSIONS IN MM	
CHANGED		CHAMFERS 1 × 45°	
APPROVED		RADII 1	

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
STANDARD		
APPROVED		

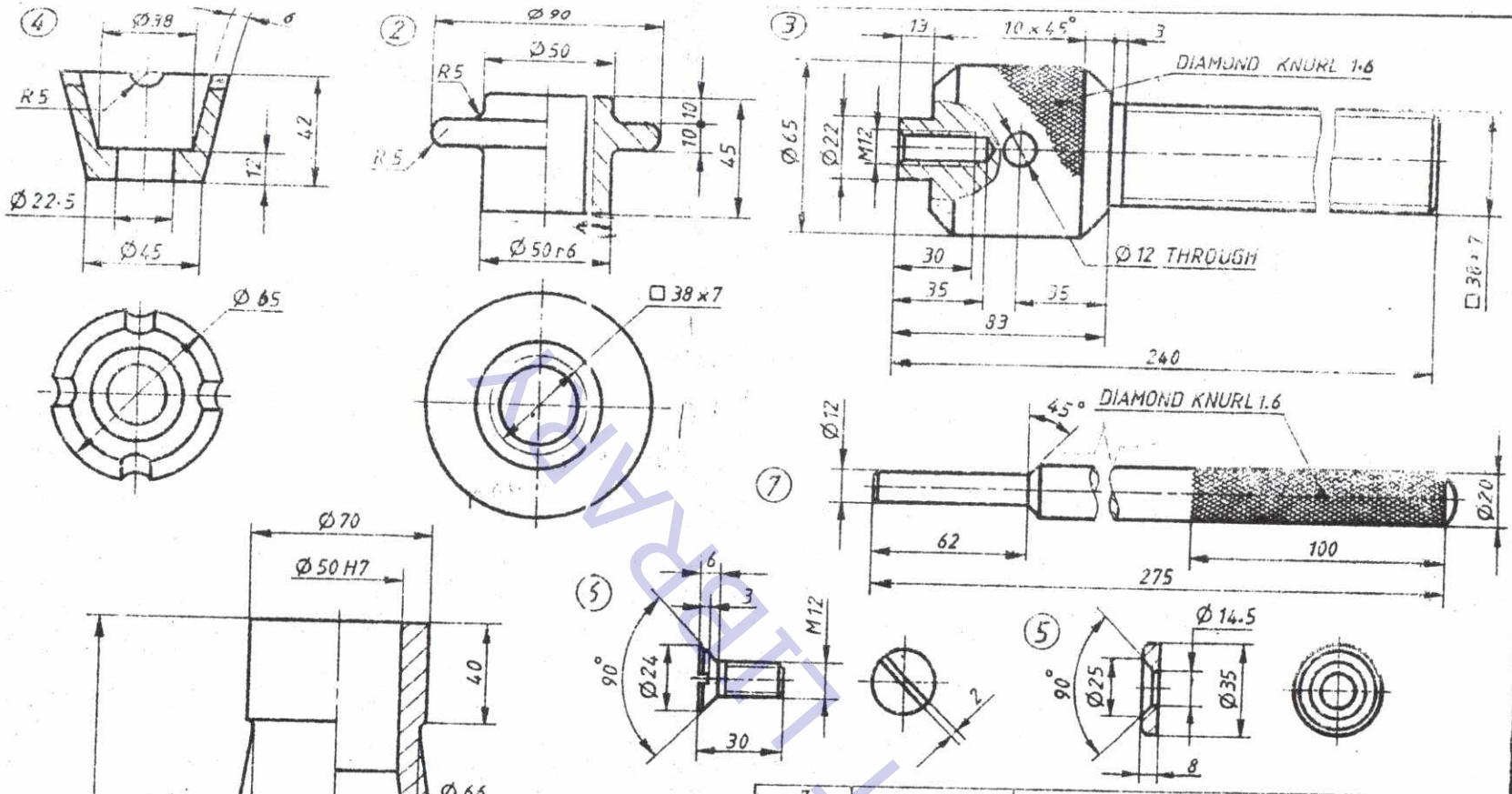
ABC & COMPANY BANGALORE

SCALE

DETAILS OF PLUMMER BLOCK

SHEET 1 OF 1

FIG - 1



7		TOMMY BAR	Fe-410 W	1
6		CSK SCREW	Fe-410 W	1
5		WASHER SPECIAL	Fe-410 W	1
4		CUP	CAST STEEL	1
3		SCREW-SPINDLE	Fe-410 W	1
2		NUT	GUN METAL	1
1		BODY	CAST IRON	1

ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF
REVISION NO		UNLESS OTHERWISE STATED		
DATE		DIMENSIONS IN MM		
CHANGED		CHAMFERS 1 × 45°		
APPROVED		RADII 1		

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
STANDARD		
APPROVED		

A B C & COMPANY BANGALORE

SCALE

DETAILS OF SCREW JACK

SHEET 1 OF 1

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06ME36B

Third Semester B.E. Degree Examination, December 2011
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the terms: density, specific weight, specific gravity and viscosity. **(08 Marks)**

b. Derive a relation for capillary rise. **(04 Marks)**

c. Calculate the capillary effect in mm in a glass tube of 4mm diameter, when immersed in i) water and ii) mercury. The temperature of the liquid is 20°C and the values of surface tension of water and mercury are 0.0735 N/m and 0.48 N/m, respectively. The contact angle for water is 0° and that for mercury is 130°. **(08 Marks)**

2 a. Explain the three types of equilibrium of an immersed or floating body. **(06 Marks)**

b. A hydraulic press has a ram of 30 cm diameter and a plunger of 4.5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 500N. **(06 Marks)**

c. A circular plate 3m in diameter is submerged in water. The greatest and least depths are 2m and 1m, below the free surface. Find the total pressure force on the front face of the plate and the position of centre of pressure. **(08 Marks)**

3 a. Derive the continuity equation in 3-dimensions, using the Cartesian coordinate system. **(10 Marks)**

b. The one-dimensional steady flow through a converging nozzle is stated to have linear velocity distribution $u = u(x)$ with velocities $u = V_0$ at the nozzle base and $u = 3V_0$ at the nozzle tip. Set up an expression as a general function of distance x from the nozzle base. **(10 Marks)**

4 a. State the Buckingham π theorem. **(04 Marks)**

b. State and derive an expression for any two dimensionless numbers. **(08 Marks)**

c. The resulting force F of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity μ, air density ρ and the bulk modulus of air K. Show that

$$F = l^2 V^2 \rho \, f\left[\frac{\mu}{lV\rho}, \frac{K}{V^2\rho}\right]$$ **(08 Marks)**

PART – B

5 a. Derive the Euler's equation of motion for steady flow of an incompressible fluid and subsequently derive the Bernoulli's equation. **(12 Marks)**

b. Water is flowing upwards through a pipeline having diameters 15cm and 30cm at the bottom and upper ends, respectively. When a discharge of 50 litres/s is passed through the pipeline, the pressure gauges at the bottom and upper end read 30 kPa and -54 kPa, respectively. If the friction loss in the pipe is 2m, determine the difference in elevation head. Take the specific weight of water as 10 kN/m^3. **(08 Marks)**

6 a. Derive an expression for the rate of flow in a venturimeter. **(08 Marks)**

b. A pitot-static tube placed in the centre of a 300mm pipeline has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.8 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60mm of water. Take the coefficient of pitot tube as $C_V = 0.98$. **(06 Marks)**

c. Find the diameter of a pipe of length 2000m, when the rate of flow through the pipe is 200 litres/s and the head lost due to friction is 4m. Take the value of C = 50 in Chezy's formulae. **(06 Marks)**

7 a. Derive an expression for shear stress distribution and velocity distribution for laminar flow through a circular pipe (Hagen-Poiseuille). **(12 Marks)**

b. An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50mm apart. Find the rate of flow of oil between the plates if the drop in pressure in a length of 1.2m is 0.3 N/cm^2. The width of both the plates is 200mm. **(08 Marks)**

8 a. Derive an expression for drag and lift. **(06 Marks)**

b. Find the difference in drag force exerted on a flat plate of size 2m×2m, when the plate is moving at a speed of 4m/s normal to its plane in i) water and ii) air of density 1.24 kg/m^3. The coefficient of drag is given as 1.15. **(06 Marks)**

c. An aeroplane is flying at an height of 15 kms, where the temperature is -30°C. The speed of the plane is corresponding to M = 2. Assuming K = 1.4 and R = 287 J/kgK, find the speed of the plane. **(08 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, December 2011

Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Express $\frac{1}{(2+i)^2}-\frac{1}{(2-i)^2}$ in the form $a+ib$. **(06 Marks)**

b. Find the modulus and amplitude of $\frac{(3-\sqrt{2}i)^2}{1+2i}$. **(07 Marks)**

c. Find the real part of $\frac{1}{1+\cos\theta+i\sin\theta}$. **(07 Marks)**

2 a. Find the n^{th} derivative of $\cos x\cos 2x\cos 3x$. **(06 Marks)**

b. If $y=(\sin^{-1}x)^2$, show that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0$. **(07 Marks)**

c. Find the nth derivative of $\frac{x+2}{x+1}+\log\left(\frac{x+2}{x+1}\right)$. **(07 Marks)**

3 a. State and prove Euler's theorem. **(06 Marks)**

b. Given $u=\sin\left(\frac{x}{y}\right)$, $x=e^t$, $y=t^2$, find $\frac{du}{dt}$ as a function of t. **(07 Marks)**

c. If $x=r\cos\theta$, $y=r\sin\theta$, find $\frac{\partial(x,y)}{\partial(r,\theta)}$ and $\frac{\partial(r,\theta)}{\partial(x,y)}$. **(07 Marks)**

4 a. Find the angle of intersection of the curves $r=a(1+\cos\theta)$ and $r=b(1-\cos\theta)$. **(06 Marks)**

b. Find the pedal equation of the curve $\frac{2a}{r}=1-\cos\theta$. **(07 Marks)**

c. Expand $e^{\sin x}$ by Maclaurin's series upto the term containing x^4. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n=\int_0^{\pi/2}\sin^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate : $\int_1^5\int_1^{x^2}x(x^2+y^2)dx\,dy$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^2\int_1^2 x^2yz\,dx\,dy\,dz$. **(07 Marks)**

6 a. Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

b. Show that $\Gamma(n) = \int_0^1 \left(\log\frac{1}{x}\right)^{n-1} dx$. **(07 Marks)**

c. Express $\int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta$ in terms of Gamma function. **(07 Marks)**

7 a. Solve : $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y\cos y}$. **(06 Marks)**

b. Solve : $(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$. **(07 Marks)**

c. Solve : $(x^2 - ay)dx = (ax - y^2)dy$. **(07 Marks)**

8 a. Solve : $\frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0$. **(06 Marks)**

b. Solve : $(D-2)^2 y = 8(e^{2x} + \sin 2x)$. **(07 Marks)**

c. Solve : $(D^3 + 4D)y = \sin 2x$. **(07 Marks)**

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