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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2013
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Use of Statistical tables permitted.

PART – A

1 a. Use modified Euler's method to solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ at $x = 0.1$ for three iterations taking h = 0.1. **(06 Marks)**

b. Solve $\frac{dy}{dx} = x + y$, $x = 0$, $y = 1$ at $x = 0.2$ using Runge-Kutta method. Take h = 0.2. **(07 Marks)**

c. Using Milne's predictor-corrector method find y(0.3) correct to three decimals given, **(07 Marks)**

x	-0.1	0	0.1	0.2
y	0.908783	1.0000	1.11145	1.25253

2 a. Approximate y and z at x = 0.2 using Picard's method for the solution of $\frac{dy}{dx} = z$, $\frac{dz}{dx} = x^3(y + z)$ with $y(0) = 1$, $z(0) = 1/2$. Perform two steps (y_1, y_2, z_1, z_2). **(10 Marks)**

b. Using Runge-Kutta method solve $y'' = x(y')^2 - y^2$ at $x = 0.2$ with $x_0 = 0$, $y_0 = 1$, $z_0 = 0$ take h = 0.2. **(10 Marks)**

3 a. If f(z) = u + iv is analytic prove that Cauchy-Reimann equations $u_x = v_y$, $u_y = -v_x$ are true. **(06 Marks)**

b. If $w = z^3$ find dw/dz. **(07 Marks)**

c. If the potential function is $\phi = \log\sqrt{x^2 + y^2}$. Find the stream function. **(07 Marks)**

4 a. Find the bilinear transformation which maps the points z = 1, i, -1 onto the points w = j, o, -i. **(06 Marks)**

b. Discuss the conformal transformation $w = e^z$. Any horizontal strip of height 2π in z-plane will map what portion of w-plane. **(07 Marks)**

c. State and prove Cauchy's integral formula. **(07 Marks)**

PART – B

5 a. Prove that $J_{1/2}^{(x)} = \sqrt{\frac{2}{\pi x}}\sin x$. **(06 Marks)**

b. State and prove Rodrigues formula for Legendre's polynomials. **(07 Marks)**

c. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomial. **(07 Marks)**

6 a. The probabilities of four persons A, B, C, D hitting targets are respectively 1/2, 1/3, 1/4, 1/5. What is the probability that target is hit by atleast one person if all hit simultaneously? **(06 Marks)**

b. i) State addition law of probability for any two events A and B.
ii) Two different digits from 1 to 9 are selected. What is the probability that the sum of the two selected digits is odd if '2' one of the digits selected. **(07 Marks)**

c. Three machine A, B, C produce 50%, 30%, 20% of the items. The percentage of defective items are 3, 4, 5 respectively. If the item selected is defective what is the probability that it is from machine A? Also find the total probability that an item is defective. **(07 Marks)**

7 a. The p.d.f of x is

x	0	1	2	3	4	5	6
p(x)	k	3k	5k	7k	9k	11k	13k

Find k. Also find $p(x \geq 5)$, $p(3 < x \leq 6)$. **(06 Marks)**

b. A die is thrown 8 times. Find the probability that '3' falls,
i) Exactly 2 times
ii) At least once
iii) At the most 7 times. **(07 Marks)**

c. In a certain town the duration of shower has mean 5 minutes. What is the probability that shower will last for i) 10 minutes or more; ii) less than 10minutes; iii) between 10 and 12 minutes. **(07 Marks)**

8 a. What is null hypothesis, alternative hypothesis significance level? **(06 Marks)**

b. The nine items of a sample have the following values: 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5. Apply student's t-distribution at 5% level of significance. ($t_{0.05}$ for 8df = 2.31). **(07 Marks)**

c. In experiments on a pea breading, the following frequencies of seeds were obtained:

Round-yellow	Wrinkled yellow	Round green	Wrinkled green	Total
315	101	108	32	556

Is the experiment is in the agreement of theory which predicts proportion of frequencies 9:3:3:1 $\left(x^2_{0.05}, 3df \equiv 7.815\right)$. **(07 Marks)**

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10ME42A/AU42A

Fourth Semester B.E. Degree Examination, June/July 2013
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat sketch, explain body centered cubic face centered cubic and closed packed hexagonal structures with examples. **(09 Marks)**

b. Derive expression for atomic packing factor of BCC, FCC and HCP structure. **(07 Marks)**

c. Briefly explain the different types of point defects. **(04 Marks)**

2 a. With the help of stress-strain diagram, explain the behaviour of ductile and brittle materials. **(08 Marks)**

b. The following data have been obtained in hardness test of specimens. Calculate the hardness number. Assume dia of ball indentor = 10mm. **(06 Marks)**

Material	Type	Load (kgf)	Impression (mm)
A	Brinell	500	4.6
B	Vicker's	5	0.28

c. Define the following terms Toughness, Resilience, Proof stress and ductility. **(06 Marks)**

3 a. With neat diagram, explain the fracture in the following: i) Ductile; ii) Brittle; iii) Fatigue. **(12 Marks)**

b. Explain the three stages of creep with a neat sketch and its characteristics. **(08 Marks)**

4 a. With neat diagram, explain the process of nucleation. **(05 Marks)**

b. Write a note on Gibb's phase rule with an example. **(04 Marks)**

c. With the help of cooling curve, explain how solidification process begins in pure metals. **(06 Marks)**

d. Briefly explain the rules behind the solid solubility. **(05 Marks)**

PART – B

5 a. Construct the Ag-Cu phase diagram using following data:
Melting point of Ag = 960.5°C
Melting point of Cu = 1085°C
Eutectic point = 779.4°C
Eutectic composition = 28.1% Cu
Maximum solubility of Ag in Cu and Cu in Ag is 8%.
Maximum solubility of Cu in Ag and Ag in Cu is 2%.
Assume the liquidus, solidus and solvus lines are straight. Calculate:
i) Amount of eutectic in 20% Cu, 80% Ag alloy at 700°C and
ii) Percentages and compositions of solid phases in 60% Cu and 40% Ag alloy at 400°C. **(10 Marks)**

b. What is level rule? Explain how it is useful. **(05 Marks)**

c. What are phase diagrams? How are they classified? **(05 Marks)**

6 a. Draw Iron-Carbon equilibrium diagram and explain primary crystallization of steel hypoeutectic cast iron and hypereutectic cast iron. **(10 Marks)**

b. Define the following annealing, normalizing, tempering, carburizing and nitriding. **(10 Marks)**

7 a. How cast iron are classified? What are the properties of cast iron? **(08 Marks)**

b. How generally steels are classified? Consider at least two composition mixtures, mention its application and advantages. **(08 Marks)**

c. Explain the composition, properties and uses of at least two copper based alloys. **(04 Marks)**

8 a. Derive an expression for load distribution in a composite for longitudinal loading of fiber reinforced composite. **(10 Marks)**

b. With a neat diagram, explain the hand laminating process. **(10 Marks)**

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10ME42B/AU42B/TL42

Fourth Semester B.E. Degree Examination, June/July 2013
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define metrology. What are the objectives of metrology from industrial point of view? **(06 Marks)**

b. Describe with neat sketch, i) Imperial standard yard ii) International prototype meter. **(10 Marks)**

c. Build a dimension of 35.4875 mm using M112 sets. **(04 Marks)**

2 a. A hole and a shaft pair has the following designation 70H8e9. The diameter falls in the step of 50–80 mm. Given $i = 0.45(D)^{\frac{1}{3}} + 0.001D$, where D is in mm and i is in microns. Fundamental deviations for "e" type shaft is $-11D^{0.41}$.

i) Calculate the limits for both shaft and hole.
ii) Mention the type of fit and the allowance
iii) Design GO and NO-GO gauges as per British system in which same gauges are used for inspection and workshop.
iv) IT8 = 25i and IT9 = 40i.
v) Sketch the gauges designed by you. **(16 Marks)**

b. What is the difference between unilateral and bilateral tolerances? **(04 Marks)**

3 a. What are comparators? How do they differ from the measuring instruments? **(04 Marks)**

b. Explain with a neat sketch the construction and working of a Johansson's Mikrokator. **(08 Marks)**

c. Explain with a neat sketch the construction and working of an LVDT. **(08 Marks)**

4 a. What is the best size wire? Derive the expression for the same in terms of the pitch and angle of the thread. **(08 Marks)**

b. Explain 3-wire method of measuring effective diameter of screw thread. **(06 Marks)**

c. Explain how chordal addendum is measured by using geartooth vernier caliper. **(06 Marks)**

PART – B

5 a. With a neat block diagram, explain the three stages of a generalized measurement system with an example. **(10 Marks)**

b. Define an error and explain the classification of errors. **(10 Marks)**

6 a. With a neat block diagram, explain the working principle of a CRO. **(10 Marks)**

b. With a block diagram, explain the working of an X-Y plotter. **(10 Marks)**

7 a. Explain with a neat sketch, the working of McLeod gauge. **(08 Marks)**

b. Explain with neat sketch, the working of Hydraulic Dynamometer. **(06 Marks)**

c. With a neat sketch, explain the working principle of proving ring. **(06 Marks)**

8 a. What are thermocouples? State the laws of thermocouple. **(04 Marks)**

b. Derive the expression for the gauge factor of the strain gauges in terms of Poisson's ratio. Why gauge factor is less than two for most of the materials? **(08 Marks)**

c. Sketch and explain the working principle of an optical pyrometer. **(08 Marks)**

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Important Note : 1. On completing your answers, compulsorily 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.

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10ME/AU43

Fourth Semester B.E. Degree Examination, June/July 2013
Applied Thermodynamics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following:
i) Enthalpy of formation ii) Combustion efficiency iii) Enthalpy of combustion
iv) Complete combustion v) Incomplete combustion **(10 Marks)**

b. The products of combustion of hydrocarbon fuel of unknown composition have the following composition on dry basis:
$CO_2 = 8.0\%$, $CO = 0.9\%$, $O_2 = 8.8\%$, $N_2 = 82.3\%$
Calculate: i) Airfuel ratio ii) Composition of fuel on mass basis.
iii) The percentage of theoretical air on mass basis. **(10 Marks)**

2 a. Derive an expression of air standard efficiency of a dual cycle, stating the assumptions made. **(10 Marks)**

b. A diesel engine operating on an air standard diesel cycle has 20 mm bore and 30 mm stroke. The clearance volume is 4.2×10^{-4} m^3. The fuel is injected for constant pressure for 5% of the stroke, calculate the air standard efficiency. If the cut-off is delayed from 5% to 8%, what will be the effect on efficiency? **(10 Marks)**

3 a. Explain the following: i) Motoring test method ii) Willian's line method. **(08 Marks)**

b. A two stroke diesel engine was motored when meter reading was 1.5 kW. Test on engine was carried for one hour and data observed were as follows: Brake torque = 120 N-m; C_P(gas) = 1.05 kJ/kg-K, Speed = 600 rpm, Room temperature = 27°C, Fuel used = 2.5 kg, A : F ratio = 32 : 1, Calorific value = 40.3 MJ/kg, Cooling water = 818 kg, Rise in temperature of cooling water = 10°C, Exhaust gas temperature = 347°C.
Determine brake power, indicated power, brake thermal efficiency. And draw the heat balance sheet on minute basis. **(12 Marks)**

4 a. Sketch the flow diagram and corresponding T-S diagram of a reheat vapour cycle and derive an expression for the reheat cycle efficiency. What are the advantages gained by reheating the steam in between stages? **(10 Marks)**

b. A steam power station uses the following cycle: steam boiler outlet : 150 bar, 550°C Reheat at 0.1 bar, using the Mollier diagram and assuming the ideal process find,
i) Quality of steam at turbine exhaust.
ii) Cycle efficiency. **(10 Marks)**

PART – B

5 a. Derive an expression for minimum work I/P by two stage compressor with intercooler. **(10 Marks)**

b. The following data refer to a single stage double acting air compressor in which air is drawn at 1 bar and compressor in which air is drawn at 1 bar and compressed to 16 bar, according to the law $PV^{1.25} = C$. Input to compressor is 50 kW. The speed of the compressor is 300 rpm. The piston speed is 180 m/min. The volumetric efficiency is 80%. Calculate the diameter and stroke of the cylinder. **(10 Marks)**

6 a. With neat sketches, explain turbojet and ramjet propulsions. **(10 Marks)**

b. A gas turbine receives air at 100 kPa and 300 K and compresses it to 620 kPa. With compressor efficiency of 88%. The fuel has a heating value of 44180 kJ/kg and fuel air ratio is 0.017 kg of fuel per kg of air. The turbine efficiency is 90%. Calculate the compressor work, turbine work and thermal efficiency. **(10 Marks)**

7 a. Explain the effect of super heating and sub-cooling with the aid of T-S and P-H diagrams. **(06 Marks)**

b. Explain steam jet refrigeration. **(04 Marks)**

c. A vapour compression refrigeration uses Freon-12, has its temperature - 10°C and 30°C. The vapour enters the compressor dry and under cooled by 5°C in the condenser. For the capacity of 15 TO R, find

i) COP

ii) Mass of Freon

iii) Power required C_P (vapour) = 0.56 kJ/kg-K and C_P (liquid) = 1.003 kJ/kg-K **(10 Marks)**

8 a. Define the following:

i) Wet bulb temperature

ii) Dew point temperature

iii) Relative humidity

iv) Specific humidity

v) Degree of saturation. **(10 Marks)**

b. A sling thermometer reads 40°C DBT and 28°C WBT. Find the following:

i) Specific humidity ii) Relative humidity

iii) Dew point temperature iv) Vapour density **(10 Marks)**

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10ME/AU/PM/TL44

Fourth Semester B.E. Degree Examination, June/July 2013
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Graphical Solutions can be done either on Graph Sheets or on Answer Book itself.***

PART – A

1 a. Define : i) Machine and ii) Mechanism. State an example for each. **(06 Marks)**

b. Five binary links of lengths 5 cm, 8 cm, 15 cm, 19 cm and 28 cm are available for constructing a crank-rocker mechanism. Select four links required for the construction of this mechanism. Sketch (need not be to scale) the mechanism and clearly show the fixed link, crank and rocker. **(06 Marks)**

c. Sketch a 'Double slider crank chain'. A mechanism is obtained from this by fixing a binary link having two turning pairs. State an application for this mechanism and sketch the same. **(08 Marks)**

2 a. The length of the fixed link of a crank and slotted-lever mechanism (quick return motion) is 250 mm and that of the crank is 100 mm. Determine : i) angle between extreme positions of slotted lever, and ii) Ratio of the time of cutting stroke to that of return stroke. **(06 Marks)**

b. Draw a neat proportionate 'Peaucellier Mechanism'. Indicate the geometric relations among the links and show the point tracing the straight line. Prove that the point traces a straight line perpendicular to the fixed link. **(14 Marks)**

3 In the slotted-lever quick-return mechanism shown in Fig. Q3, the crank O_2A rotates at a constant speed of 30 rpm (CCW). For the position shown, determine the velocity and acceleration of the point C. Given O_2A = 12 cm, O_2O_4 = 30 cm, O_4B = 60 cm and BC = 15 cm. The line of movement of C is 30 cm above the point O_2. **(20 Marks)**

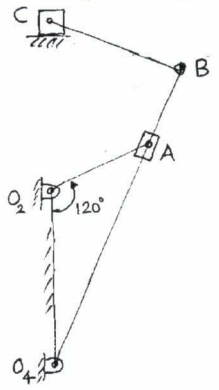
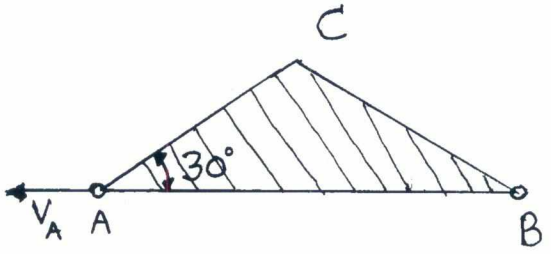


Fig. Q3

4 a. What is instantaneous centre of rotation? State Kennedy's theorem. **(06 Marks)**

b. A binary link of a mechanism having two turning pairs at A and B is in the shape of an isosceles triangle as shown in Fig. Q4 (b) (complete mechanism is not shown). Velocity of A is 20 cm/s along AB in the direction shown in the Fig. Q4 (b). Determine the instantaneous centre of the link if the path of B at the instant is along BC. Also determine the magnitude and direction of, i) angular velocity of the link ii) Velocity of C. **(06 Marks)**

Q.No.4 (b) Contd…



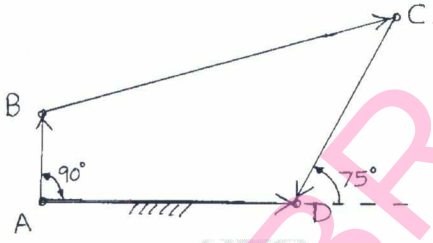
AB = 500 mm
AC = BC
∠CAB = 30°

Fig. Q4 (b)

c. Explain the procedure to construct 'Klein's construction to determine the velocity and acceleration of a slider Crank mechanism in which crank is rotating uniformly. **(08 Marks)**

PART – B

5 In the 4-bar mechanism shown in Fig. Q5, link AB rotates uniformly at 2 radians per second in clockwise sense. Using complex algebra write loop closure equation for this. Determine magnitude and directions of angular velocity and angular acceleration of links BC and CD using vector algebra. Also state whether the magnitudes of angular velocity of these links tend to increase or decrease at the instant. **(20 Marks)**



AD = 10 cm
AB = 7.5 cm
CD = 15 cm

Fig. Q5

6 a. State and prove law of gearing. **(08 Marks)**

b. The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20° involute profile and the module is 6 mm. If the length of arc of contact is 1.75 times the circular pitch, find the addendum. **(08 Marks)**

c. Compare involute and cycloidal tooth profile of a gear with respect to, i) Pressure angle ii) Interference. **(04 Marks)**

7 An epicyclic gear train has a fixed annular wheel 'C' concentric with sun wheel 'A'. A planet wheel 'B' gears with 'A' and 'C' and can rotate freely on a pin carried by an arm 'D' which rotates about an axis co-axial with that of 'A' and 'C'. If T1 and T2 are the numbers of teeth on 'A' and 'C' respectively, show that the ratio of speeds of 'D' to 'A' is $\frac{T_1}{T_1 + T_2}$. If the least number of teeth on any wheel is 18 and $T_1+T_2 = 120$, find the greatest and least speeds of D when wheel 'A' rotates at 500 rpm. **(20 Marks)**

8 a. Draw neat sketch for each of the following:
i) Plate or disc cam with a translating follower.
ii) Wedge cam with translating follower.
iii) Cylindrical cam with translating follower. **(06 Marks)**

b. Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates in an anticlockwise sense at a uniform velocity of 120 rpm and has a least radius of 25 mm. What will be the maximum velocity and acceleration of the follower during the lift. **(14 Marks)**

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10ME/AU/TL45

Fourth Semester B.E. Degree Examination, June/July 2013
Manufacturing Process – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Briefly explain the different types of chips produced during metal cutting with neat sketches. **(06 Marks)**

b. In an orthogonal cutting operation, following data have been observed. Un cut chip thickness = 0.127 mm; Width of cut = 6.14 mm; Cutting speed = 2.6 m/sec; Rake angle = 20°; Cutting force = 589 N; Thrust force = 225 N; Chip thickness = 0.226 mm. Determine shear angle, friction angle and chip velocity. **(08 Marks)**

c. With a neat sketch, explain crater wear and flank wear. **(06 Marks)**

2 a. List the desired properties of cutting tool materials and explain any four. **(10 Marks)**

b. List the techniques to measure tool-tip temperature and explain tool-work thermocouple technique with a neat sketch. **(10 Marks)**

3 a. With a neat sketch, explain the constructional features of a Capstan lathe. **(10 Marks)**

b. Explain hydraulic driving mechanism of a shaper with a neat sketch. **(10 Marks)**

4 a. With a neat sketch, explain the constructional features of a radial drilling machine tool. **(08 Marks)**

b. With neat sketches, explain the following operations;
i) Drilling ii) Boring iii) Counter sinking iv) Trepanning. **(08 Marks)**

c. Write a note on CNC machines. **(04 Marks)**

PART – B

5 a. With a neat sketch, explain the constructional features of horizontal spindle column and knee milling machine. **(08 Marks)**

b. Differentiate up milling and down milling with a neat sketch. **(06 Marks)**

c. List the methods of indexing and explain any one. **(06 Marks)**

6 a. Explain the types of abrasives used in grinding wheel. **(04 Marks)**

b. With a neat sketch, explain the constructional features of a centreless grinding machine. **(08 Marks)**

c. Explain the factors to be considered while selecting a grinding wheel. **(08 Marks)**

7 a. What are the advantages and limitations of broaching process? **(08 Marks)**

b. Explain the principle of lapping with a neat sketch. **(06 Marks)**

c. Explain the principle of honing with a neat sketch. **(06 Marks)**

8 a. Explain laser beam machining with a neat sketch. **(10 Marks)**

b. Explain ultrasonic machining with a neat sketch. **(10 Marks)**

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10ME/AU46B

Fourth Semester B.E. Degree Examination, June/July 2013
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following properties of fluid:
   i) Specific weight.
   ii) Specific gravity.
   iii) Vapour pressure.
   iv) Capillarity.
   v) Surface tension. **(10 Marks)**

   b. A shaft of 250mm diameter rotates inside a sleeve of 120mm long at 200 rpm. If the thickness of oil film between shaft and sleeve is 1.5mm, find the power lost in friction. The dynamic viscosity of oil used is 8 poise. **(10 Marks)**

2 a. Obtain the total pressure and the centre of pressure on an inclined plain surface immersed in a fluid. **(10 Marks)**

   b. A differential U-tube mercury manometer is used to measure the difference of pressure between two water pipes A and B. Find the pressure at A if the level difference in mercury in the manometer is 150mm as shown in figure. The pressure at B is 300 kPa. **(10 Marks)**

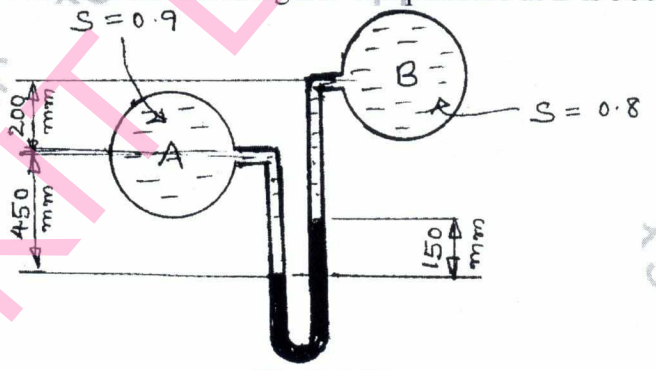

Fig.Q.2(b)

3 a. Explain the method to find the metacentric height experimentally. **(08 Marks)**

   b. The stream function for a two-dimensional flow is given by $\psi = 2xy$. Find the velocity at the point P(4, 2). Also find the velocity potential function. **(12 Marks)**

4 a. Obtain the Euler's equation of motion along a stream line and hence derive Bernaulis equation for a steady incompressible fluid flow. **(10 Marks)**

   b. A 10m long water pipe is laid at a slope of 3 in 4. The diameters of the lower end and upper end are 120mm and 180mm respectively pressure gauges fixed at the lower end and upper end reads 0.2MPa and 0.3MPa respectively. Determine the flow rate of water through the pipe. **(10 Marks)**

PART – B

5 a. Derive an expression for discharge through a rectangular notch. **(10 Marks)**

b. Using Buckingham's π-theorem prove that the frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by

$$T = D^5 N^2 \rho \phi \left[\frac{M}{D^2 N \rho} \right].$$ **(10 Marks)**

6 a. Derive Darcy's equation for the loss of head due to friction in a circular pipe. **(10 Marks)**

b. Water is supplied to a town having a population of 1 lakh from a reservoir 6km away from the town and is stipulated that half of the daily supply of 180 litres per head should be delivered in 8 hrs. What should be the diameter of the supply pipe? The loss of head due to friction in the pipe line is 12m. Take f = 0.002. **(10 Marks)**

7 a. Derive Hagen-Poiseuille's equation for viscous flow through a circular pipe. **(10 Marks)**

b. A pipe of diameter 240mm and length 20km is laid at a slope of 1 in 250. An oil of specific gravity 0.85 and viscosity 180cp is pumped up at a rate of 18 litres/sec. Find the head lost due to friction and the power required to pump the oil. **(10 Marks)**

8 a. Explain the following:

i) Drag
ii) Lift
iii) Momentum thickness
iv) Mach number
v) Mach cone. **(10 Marks)**

b. A flat plate 2m × 2m moves at 40 km/hr in a stationary air of density 1.2 kg/m^3. If the coefficients of drag and lift are 0.15 and 0.75 respectively determine:

i) The lift force
ii) The drag force
iii) The resultant force
iv) The power required to keep the plate in motion. **(10 Marks)**

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