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06MAT41

Fourth Semester B.E. Degree Examination, June/July 2011
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.***

PART – A

1 a. Using Taylor's series method, find y at x = 0.1 and x = 0.2 considering upto 4^{th} degree terms. Given that $\frac{dy}{dx} = x^2y - 1$ and y(0) = 1. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with y(0) = 1, find y at x=0.2 using Runge – Kutta method of 4^{th} order taking step – length h = 0.2 accurate upto 4^{th} decimal place. **(07 Marks)**

c. Given that $\frac{dy}{dx} = x^2(1+y)$ and y(1) = 1 ; y(1.1) = 1.233 ; y(1.2) = 1.548 ; y(1.3) = 1.979, find y at x = 1.4 using Adams – Bashforth predictor and corrector formula. **(07 Marks)**

2 a. Find Analytic function whose real part is $u = x^2 - y^2 + \frac{x}{x^2 + y^2}$. **(06 Marks)**

b. Under the transformation $W = e^Z$, prove that family of lines parallel to y – axis in Z – plane transforms into family of concentric circles in W – plane. **(07 Marks)**

c. Find Bilinear transformation, that transforms Z = -1, i, 1 on to points W = 1, i, -1, in W – plane respectively. Also find invariant points. **(07 Marks)**

3 a. Evaluate $\int_C \frac{e^{2Z}}{(Z+1)(Z+2)} dZ$, where 'C' is a circle | Z | = 3. **(06 Marks)**

b. Obtain the power series which represents the function $f(Z) = \frac{Z^2 - 1}{Z^2 + 5Z + 6}$ in the region $2 < |Z| < 3$. **(07 Marks)**

c. Using Cauchy's Residue theorem evaluate $\int_C \frac{2Z^2 + 1}{(Z+1)^2(Z-2)} dZ$, where 'C' is circle with | Z | = 3. **(07 Marks)**

4 a. Using Frobenius series solution method, solve $\frac{d^2y}{dx^2} + xy = 0$. **(06 Marks)**

b. Reduce the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (k^2x^2 - n^2)\ y = 0$ into Bessel's form and write the complete solutions for n is not integral or zero. **(07 Marks)**

c. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre's polynomial. **(07 Marks)**

PART – B

5 a. Fit the best possible curve of the form $y = a + bx$, using method of Least square for the data: **(06 Marks)**

X :	1	3	4	6	8	9	11	14
Y :	1	2	4	4	5	7	8	9

b. The lines of regressions are $x + 2y = 5$ and $2x + 3y = 8$. Find i) means of the variables x and y ii) correlation coefficient between x and y. **(07 Marks)**

c. Three typists A, B, C typed 50%, 30% and 20% of pages of a book. The percentage of defectively typed pages by them is 3, 4, 5 respectively. If a page is selected from the book at random, what is the probability that it is defectively typed and it is typed by 'A'? **(07 Marks)**

6 a. The random variable X has the following probability mass function

X :	0	1	2	3	4	5
P(X) :	K	3K	5K	7K	9K	11K

i) find K ii) find $P(X < 3)$ iii) find $P(3 < X \leq 5)$. **(06 Marks)**

b. Alpha – particles are emitted by a radio active source at an average of 5 emissions in 20 minutes. What is the probability that there will be i) exactly two emissions ii) at least two emissions in 20 minutes? **(07 Marks)**

c. A sample of 100 dry battery cells tested to find the length of life produced by a company and following results are recorded : mean life = 12 hours, standard deviation = 3 hours. Assuming data to be normally distributed, find the expected life of a dry cell :
i) have more than 15 hours ii) between 10 and 14 hours. **(07 Marks)**

7 a. Explain the following terms : i) Null hypothesis ii) Standard error iii) Test of significance. **(06 Marks)**

b. Find the range of number of heads out of 64 tosses of a coin which will ensure fairness of coin at 5% level of significance using binomial distribution. **(07 Marks)**

c. A survey conducted on 64 families with 3 children each and recorded as follows :

No. of Male children :	0	1	2	3
No. of families :	6	19	29	10

Apply Chi – Square test to test whether male and female children are equiprobable at 5% level of significance. **(07 Marks)**

8 a. The Joint probability distribution of two Random variable X and Y are given as :

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

i) find Marginal distribution of X and Y ii) find COV(X,Y). **(06 Marks)**

b. Find the unique fixed probability vector of the regular stochastic matrix.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$ **(07 Marks)**

c. A player's luck follows a pattern. If he wins a game the probability of winning next game is 0.6. However if he loses the game the probability of losing the next game is 0.7. There is an even chance of winning the first game. If so i) what is the probability of winning 2nd game ii) What is the probability of winning 3rd game? **(07 Marks)**

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06ME42A

Fourth Semester B.E. Degree Examination, June/July 2011
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.***

PART - A

1 a. Classify the various crystal imperfections. (05 Marks)
b. Determine the atomic packing for FCC structure. (05 Marks)
c. Explain the atomic diffusion mechanism and its applications. (05 Marks)
d. Differentiate between edge and screw dislocations. (05 Marks)

2 a. Explain the nature of stress – strain curve for both ductile and brittle material. (05 Marks)
b. Distinguish between slip and twinning. (05 Marks)
c. Explain the steps involved in determing the Brinell hardness number. (05 Marks)
d. Define the following terms : Tensile strength, Ductility, Resilience , Toughness, Hardness. (05 Marks)

3 a. Explain the different stages of ductile Cup and Cone fracture. (05 Marks)
b. Define creep. Explain the stages of creep deformation. (05 Marks)
c. Define fatigue. How to improve fatigue strength? (05 Marks)
d. Write a note on creep resistant material. (05 Marks)

4 a. State the Hume - Rothary rules for the formation of a solid solution. (06 Marks)
b. State Gibbs phase rule and explain each term. (06 Marks)
c. Explain the steps involved in construction of phase diagram. (08 Marks)

PART - B

5 a. Write the invariant reactions involved in Iron – Carbon system. (04 Marks)
b. Define the following : Martensite, Cementite, Austenite, Ferrite. (04 Marks)
c. Briefly explain the effect of adding important alloying elements to the steel. (04 Marks)
d. Explain the steps involved in construction of TTT diagram for plain carbon steel. (08 Marks)

6 a. List the various objectives of heat treatment process. (05 Marks)
b. Distinguish between annealing and normalizing. (05 Marks)
c. Define hardenability and how it is determined. (05 Marks)
d. Write a note on Age hardening of Aluminium – Copper alloy. (05 Marks)

7 a. List the practical applications of low, medium and high carbon steel. (06 Marks)
b. Draw the microstructure of various cast irons. (06 Marks)
c. Write a note on designation of steel. (04 Marks)
d. Classify the various brasses and list their applications. (04 Marks)

8 a. With the help of a sketch, explain the corrosion mechanism. (05 Marks)
b. List the various methods of corrosion prevention. (05 Marks)
c. Write a note on cathodic protection. (05 Marks)
d. Explain the concept of stress corrosion cracking. (05 Marks)

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06ME42B

Fourth Semester B.E. Degree Examination, June/July 2011
Mechanical Measurement and Metrology

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.***
2. Draw neat sketches, wherever necessary.

PART – A

1 a. Define the term metrology as applied to engineering industry. State and explain the objectives of metrology. **(06 Marks)**

b. Describe with sketch i) Imperial Standard Yard ii) International Prototype Meter. **(10 Marks)**

c. Write the slip gauge combination to build the following dimensions using M112 slip gauge set : i) 32.456 ii) 87.102. **(04 Marks)**

2 a. Design the general type GO and NO – GO gauge for components having 20H7 f8 fit. Given i) $i(\text{micron}) = 0.45(D)^{1/3} + 0.001\ D$ ii) Upper deviation of 'f' shaft $= -5.5\ D^{0.41}$ iii) 20mm falls in the diameter step of 18mm to 30mm iv) IT7 = 16 i v) IT8 = 25 I vi) Wear allowance 10% of gauge tolerance. **(12 Marks)**

b. Explain, with sketch, measurement of unknown angles of heavy components using SINE BAR. **(08 Marks)**

3 a. Explain with a neat sketch, the working of SIGMA comparator. **(08 Marks)**

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

c. Show the arrangement of angle gauges, with a neat sketch by selecting minimum number of gauges for an angle $33^0\ 9'\ 15''$. **(04 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. What are the various characteristics that you would measure in a screw thread? Also list the instruments / apparatus that are required for measuring these characteristics. **(06 Marks)**

c. Explain 3 – Wire method of measuring effective diameter of screw thread. **(06 Marks)**

PART – B

5 a. With a neat block diagram, explain the generalized measurement system with an example. **(08 Marks)**

b. Distinguish between i) Primary and Secondary transducers ii) Active and Passive transducers. **(06 Marks)**

c. Define the following terms with reference to measurement system : i) Calibration ii) Sensitivity iii) Hysterisis. **(06 Marks)**

6 a. With a neat sketch, explain the working principle of a CRO. **(08 Marks)**

b. State the advantages of electrical signal conditioning elements. **(04 Marks)**

c. Explain with a neat sketch, Ballast Circuit diagram. **(08 Marks)**

7 a. With a neat sketch, describe the Bridgeman gauge used for pressure measurement. **(08 Marks)**

b. With a neat sketch, explain the working principle of Proving Ring. **(06 Marks)**

c. Explain with suitable diagram, the working of Hydraulic Dynamometer. **(06 Marks)**

8 a. Sketch and explain the working principle of optical pyrometer. **(08 Marks)**

b. Describe the steps to be taken for the preparation of specimen and mounting of strain gauges. **(08 Marks)**

c. What is a Thermo couple? State the laws of thermo couple. **(04 Marks)**

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06ME43

Fourth Semester B.E. Degree Examination, June/July 2011

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 steam table and psychrometric chart is permitted.

PART – A

1 a. Explain the following with reference to combustion process :
   i) Percent excess air
   ii) Enthalpy of formation
   iii) Adiabetic flame temperature
   iv) Enthalpy of combustion. **(10 Marks)**

   b. Calculate the air-fuel ratio for burning of propane (C_3H_8) with 130 percent theoretical air. **(10 Marks)**

2 a. Compare the Otto, diesel and dual cycles on P-V diagram and T-S diagrams, when heat supplied to each cycle is same. **(10 Marks)**

   b. An engine of 250 mm bore and 375 mm stroke works on constant volume cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50°C. If maximum pressure is 25 bar, find :
   i) Air standard efficiency of cycle
   ii) Mean effective pressure **(10 Marks)**

3 a. Explain with a neat sketch, the difference between open and closed cycle gas turbine. **(10 Marks)**

   b. The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature 20°C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90 : 1. The flow rate of air is 3 kg/s. Find :
   i) Power developed ii) Thermal efficiency of the cycle. **(10 Marks)**

4 a. Derive an expression for the efficiency of a Rankine cycle with the help of neat sketches. State the advantages and disadvantages of reheating and regeneration over a simple Rankine cycle. **(12 Marks)**

   b. In a steam power cycle, the steam supply is at 15 bar and dry saturated. The condenser pressure is 0.4 bar. Calculate the Carnot and Rankine efficiencies of the cycle. Neglect pump work. **(08 Marks)**

PART – B

5 a. Obtain an expression for volumetric efficiency of a single stage air compressor in terms of pressure ratio, the clearance ratio, and the index of expansion, and explain the effect of clearance on the volumetric efficiency. **(12 Marks)**

   b. In a 2-stage air compressor, the work out-put is found to be 350 kJ/kg of air. It is used to compress 1kg of free air from 1 bar pressure and 32°C initial temperature. The value of n = 1.3 and R = 0.287 kJ/kg°K. Find the intermediate pressure. **(08 Marks)**

6 a. What do you mean by refrigerant, refrigeration and refrigerator? Explain with a neat sketch, working principle of vapour absorption refrigeration system. **(10 Marks)**

b. Find the least power of a perfect reversed heat engine that makes 400 kg of ice per hour at $-8^{\circ}C$ from feed water at $18^{\circ}C$. Assume specific heat of ice as 2.09 kJ/kg$^{\circ}$K and latent heat as 334 kJ/kg. **(10 Marks)**

7 a. Define and deduce an expression for the following terms :

i) Specific humidity
ii) Degree of saturation
iii) Relative humidity
iv) Enthalpy of moist air. **(10 Marks**

b. A sling psychrometer reads $40^{\circ}C$ D.B.T and $28^{\circ}C$ W.B.T. Calculate the following :

i) Specific humidity
ii) Relative humidity
iii) Vapour density in air
iv) Dew point temperature
v) Enthalpy of mixture per kg of dry air. **(10 Marks)**

8 a. Explain briefly the following frictional power determination methods:

i) William's line method
ii) Morse test method **(10 Marks)**

b. A rope brake was used to measure the brake power of a single cylinder, 4-stroke cycle petrol engine. It was found that the torque due to brake load is 175 N-m and the engine makes 500 rpm. Determine the brake power developed by the engine in horse power unit. **(05 Marks)**

c. Define following terms :

i) Indicated power
ii) Brake power
iii) Mechanical efficiency
iv) Specific fuel consumption
v) Frictional power. **(05 Marks)**

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06ME44

Fourth Semester B.E. Degree Examination, June/July 2011
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define :
i) Kinematic chain
ii) Machine
iii) Structure
iv) Self closed pair
v) Force closed pair. **(10 Marks)**

b. Sketch and explain any two inversions of four bar chain. **(10 Marks)**

2 Sketch and explain the following :

a. Whitworth quick return mechanism. **(08 Marks)**

b. Ratchet and pawl mechanism. **(08 Marks)**

c. Toggle mechanism. **(04 Marks)**

3 A four bar chain of links PQ, QR and RS are 62.5 mm, 175 mm and 120 mm long respectively, the link PS of chain PQRS is fixed and having length of 200 mm. The link PQ makes an angle of 60° with PS and rotates at 10 rad/ sec clockwise. Determine :
i) Angular velocity of links QR and RS
ii) Angular acceleration of link QR and RS. **(20 Marks)**

4 a. In a reciprocating engine the length of crank is 250 mm and length of connecting rod is 1000 mm. The crank rotates an uniform speed of 300 rpm. Determine the velocity and acceleration of piston, when the crank is 30° from inner dead centre, use Klein's construction. **(10 Marks)**

b. Locate all instantaneous centers for the following mechanism. **(10 Marks)**

Fig. Q4(b)(i)

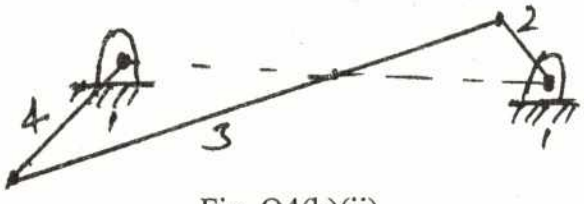

Fig. Q4(b)(ii)

PART – B

5 a. Explain the significance of loop closure equation, with example. **(05 Marks)**

b. The crank of an engine mechanism is 200 mm long and the ratio of connecting rod length to the crank radius is 4. Determine the acceleration of the piston when crank has turned through an angle 45° from inner dead centre and rotating at a speed of 240 rpm counter clockwise direction by complex number approach. **(15 Marks)**

6 a. What is interference in involute gears? Derive an expression for the length of arc of contact in a pair of meshed spur gears. **(10 Marks)**

b. Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 rpm. Determine :

i) Minimum no. of teeth on each wheel to avoid interference

ii) The number of pair of teeth in contact. **(10 Marks)**

7 An epicyclic gear train consist of a sun wheel S, a stationary internal gear 'E' and three identical planet wheels 'P' carried on a stat – shape planet carrier 'C'. The size of different toothed wheels are such that the planet carrier C rotates one revolution for every 5 revolutions of the sun wheel S. The minimum number of teeth on any wheel (say P) is 16. the driving torque on the sun wheel is 100 N –m. Determine

i) Number of teeth on different wheels of the train.

ii) Toque necessary to keep the internal gear stationary. **(20 Marks)**

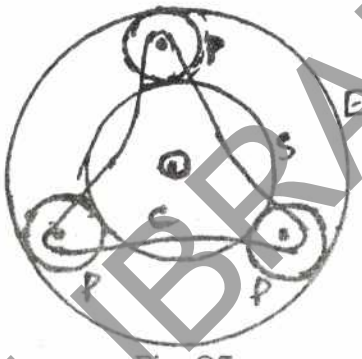

Fig. Q7

8 The following data relate to cam profile in which the roller follower moves with SHM during ascent and uniform acceleration and retardation motion during descent.

Minimum radium of cam = 30 mm
Roller radius = 8 mm
Lift = 28 mm
Offset of follower axis = 12 mm towards right
Angle of ascent = 90°
Angle of descent = 60°
Angle of dwell between ascent and descent = 45°
Speed of cam = 200 rpm

Draw the profile of cam and determine the maximum velocity and acceleration during outstroke and return stroke. **(20 Marks)**

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06ME45

Fourth Semester B.E. Degree Examination, June/July 2011
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. How is 'TOOL LIFE' defined? On what factors does the tool life depend? **(06 Marks)**

b. What is TAYLOR's Tool life equation? Calculate the cutting speed for a tool to have a tool life of 160 min. The same tool had a life of 9 minutes when cutting at 250 m/min. Take n = 0.22 in the Taylor's tool life equation. **(08 Marks)**

c. Why can relief or clearance angles never be zero or negative? What is the effect of cutting speed, feed rate and depth of cut on the force on cutting tool? **(06 Marks)**

2 a. Write short notes on the following cutting tool materials.
i) Carbon steels ii) High speed steels iii) Cemented carbides **(12 Marks)**

b. Discuss briefly "Temperature distribution in metal cutting". List the various methods of measuring chip-tool interface temperature. **(08 Marks)**

3 a. Differentiate between CAPSTAN and TURRET LATHES. **(06 Marks)**

b. How shapers are classified? Explain briefly "Quick Return Mechanism" used in shaper with neat sketch. **(10 Marks)**

c. State the main differences between SHAPER and PLANER. **(04 Marks)**

4 a. Draw a neat sketch of TWIST DRILL by showing various parts and explain its nomenclature. **(10 Marks)**

b. Find the time required to drill 6 holes of 16 mm dia each on a flange. Assume flange thickness = 30 mm, Cutting speed = 20 m/min, feed = 0.2 mm/rev. **(06 Marks)**

c. List various work holding devices used in a DRILLING machine. **(04 Marks)**

PART – B

5 a. Explain briefly with neat sketch the following MILLING operations:
i) Face Milling ii) Angular Milling iii) End Milling **(09 Marks)**

b. Show the calculation for indexing 28 equal divisions in a milling machine. The following index plates are available:

Plate No. 1	15	16	17	18	19	20
Plate No. 2	21	23	27	29	31	33
Plate No. 3	37	39	41	43	47	49

Find the simple indexing arrangement. **(06 Marks)**

c. List and explain briefly the various attachments used in milling machine. **(05 Marks)**

6 a. Explain the factors to be kept in mind in selecting a GRINDING WHEEL. **(08 Marks)**

b. Describe the "CENTRE LESS GRINDING PROCESS". What are the various feeding methods used in centreless grinding? **(08 Marks)**

c. What are natural and artificial abrasives? **(04 Marks)**

7 a. What is a LAP? What for it is used and how does it differ from grinding? **(06 Marks)**

b. Explain briefly the LAPPING PROCESS. Give the examples of LAPPING WORK. **(06 Marks)**

c. What is HONING? How are honing machines classified? List advantages and disadvantages of honing. **(08 Marks)**

8 a. Explain briefly with a neat sketch the working principle of PLASMA ARC machining. State also its characteristics, advantages and disadvantages with applications. **(10 Marks)**

b. Explain briefly with a neat sketch the working principle of ULTRA SONIC Machining. State also its characteristics, advantages and disadvantages with applications. **(10 Marks)**

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06ME46B

Fourth Semester B.E. Degree Examination, June/July 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 following terms and mention their SI units:
i) Specific weight ii) Dynamic viscosity iii) Kinematic viscosity
iv) Surface tension v) Capillarity. **(10 Marks)**

b. A differential U-tube manometer is used to measure the pressure difference between two points in a horizontal water pipe line. If the manometer shows a difference in mercury levels as 25 cm, find the pressure difference between the points in bar. **(10 Marks)**

2 a. State and prove Pascal's law. **(08 Marks)**

b. A wooden cylinder having specific gravity 0.7 is required to float in water. If the diameter of the cylinder is 'd' and the length '*l*'. Show that '*l*' cannot exceed 0.7715 d for the cylinder to float with its longitudinal axis vertical. **(08 Marks)**

c. Differentiate between stable, unstable and neutral equilibrium of a floating body. **(04 Marks)**

3 a. Define continuity equation and derive the same for a 3-dimensional fluid flow in Cartesian co-ordinates. **(10 Marks)**

b. The stream function for a 2-D flow is given by $\psi = 8xy$. Calculate the velocity at a point P(4, 5). Find also the velocity potential function. **(10 Marks)**

4 a. State and explain Buckingham π theorem. **(05 Marks)**

b. Explain kinematic and dynamic similarity. **(05 Marks)**

c. Velocity of fluid flow through a circular orifice, is dependent on head of flow 'H', orifice diameter 'D', absolute viscosity 'μ', mass density 'ρ' and gravitational acceleration 'g'. Using Buckingham's π theorem show that

$$V = \sqrt{2gH}\phi\left\{\frac{D}{H}, \frac{\mu}{\rho VH}\right\}$$ **(10 Marks)**

PART – B

5 a. Derive Euler's equation of motion along a stream line and hence reduce Bernoulli's equation. **(10 Marks)**

b. A vertical pipe currying oil of specific gravity 0.8 tapers uniformly from 20 cm diameter at the lower section to 10 cm diameter at the upper section. The vertical distance between the sections is 1 m. The pressure gauges installed at the lower and upper sections read 6 N/cm^2 and 8 N/cm^2 respectively, when the discharge is 30 litres/sec. Calculate the loss of head between the two sections and determine the direction of flow. **(10 Marks)**

6 a. With the help of a neat sketch, explain how a pilot tube is used to find the velocity in an open channel. **(04 Marks)**

b. Derive the expression for discharge through a venturimeter. **(08 Marks)**

c. Derive Darcy's equation for loss of head between the two sections. Determine the direction of flow. **(08 Marks)**

7 a. Derive Hagen Poiselli's equation for laminar flow through a circular pipe. **(12 Marks)**

b. Fuel is pumped up in a 30 cm diameter and 15 km long pipeline at the rate of 750 kg/min. The pipe is laid at an upgrade of 1:300. The specific gravity of fuel oil is 0.95 and its kinematic viscosity 20 stokes. Find the power required to pump oil. **(08 Marks)**

8 a. Explain the following :

i) Lift
ii) Drag
iii) Displacement thickness
iv) Mach number
v) Isentropic flow. **(10 Marks)**

b. A flat plate 1.8m×1.8m moves at 36 km/hr in a stationary air of mass density 1.2 kg/m^3. If the coefficients of drag and lift are 0.15 and 0.75 respectively. Determine

i) Drag force
ii) Lift force
iii) Resultant force
iv) Power required to keep the plate in motion. **(10 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2011
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Find the angle between any two diagonals of a cube. **(06 Marks)**

b. Show that the angle between the lines whose direction ratios are 2, 1, 1 and 4, $\sqrt{3}-1$, $-\sqrt{3}-1$ is 60°. **(07 Marks)**

c. Find the value of K such that the set of four points (0, -1, -1) (-4, 4, 4) (k, 5, 1) and (3, 9, 4) are co-planar. **(07 Marks)**

2 a. Derive the equation of the plane in the intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(06 Marks)**

b. Find the equation of the plane which passes through the point (3, -3, 1) and is perpendicular to the planes $7x + y + 2z = 6$ and $3x + 5y - 6z = 8$. **(07 Marks)**

c. Show that the lines : $\frac{x+3}{2}=\frac{y+5}{3}=\frac{z-7}{-3}$ and $\frac{x+1}{4}=\frac{y+1}{5}=\frac{z+1}{-1}$ are coplanar and hence find the equation of the plane in which they lie. **(07 Marks)**

3 a. Find a unit vector perpendicular to both the vectors $\vec{A}=2\hat{i}+\hat{j}-\hat{k}$ and $\vec{B}=\hat{i}-\hat{j}+2\hat{k}$. **(06 Marks)**

b. If $\vec{a},\vec{b},\vec{c}$ are any three vectors, prove that :

i) $[\vec{a}+\vec{b},\vec{b}+\vec{c},\vec{c}+\vec{a}]=2[\vec{a},\vec{b},\vec{c}]$

ii) $[\vec{b}\times\vec{c},\vec{c}\times\vec{a},\vec{a}\times\vec{b}]=[\vec{a},\vec{b},\vec{c}]^2$ **(07 Marks)**

c. Find the value of λ so that the vectors $\vec{a}=2\hat{i}-3\hat{j}+\hat{k}$ $\vec{b}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{c}=\hat{j}+\lambda\hat{k}$ are coplanar. **(07 Marks)**

4 a. A particle moves along a curve $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where t is the time variable. Determine its velocity and acceleration vectors and also the magnitudes of velocity and acceleration at $t = 2$. **(06 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x = z^2 + y^2 - 3$ at the point (2, -1, 2). **(07 Marks)**

c. Find the directional derivative of $\phi = xy^2 + yz^3$ at (2, -1, 1) in the direction of vector $\hat{i}+2\hat{j}+2\hat{k}$. **(07 Marks)**

5 a. Find the divergence and curl of the vector $\vec{F}=(3x^2y-z)\hat{i}+(xz^3+y^4)\hat{j}-(2x^3z^2)\hat{k}$. **(06 Marks)**

b. If $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$ show that i) $\nabla.\vec{r}=3$; ii) $\nabla\times\vec{r}=0$. **(07 Marks)**

c. Find the constants a, b, c, such that the vector field $\vec{f}=(x+y+az)\hat{i}+(bx+2y-z)\hat{j}+(x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

6 Find :

a. L (4 sinh5t – 5 cos4t) **(05 Marks)**

b. L (cos at cos bt) **(05 Marks)**

c. L (e^{-t} $\cos^2 t$) **(05 Marks)**

d. L (te^{-t} sint) **(05 Marks)**

7 Find :

a. $L^{-1}\left[\frac{1}{s+3}+\frac{3}{2s+7}-\frac{5}{3s-z}\right]$ **(05 Marks)**

b. $L^{-1}\left[\frac{2s+1}{(s-2)(s-3)}\right]$ **(05 Marks)**

c. $L^{-1}\left[\frac{s}{s^2+6s+13}\right]$ **(05 Marks)**

d. $L^{-1}\left[\log\left(\frac{s+1}{s-1}\right)\right]$ **(05 Marks)**

8 a. Using Laplace transform method solve, $\frac{d^2y}{dt^2}+\frac{3dy}{dt}+2y=0$ under the conditions $y(0)=1, y'(0)=0$. **(10 Marks)**

b. Solve by using Laplace transforms $\frac{dx}{dt}+y=\sin t$, $\frac{dy}{dt}+x=\cos t$, $x=1$, $y=0$ at $t=0$. **(10 Marks)**

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