USN | | | | | | | | | | |

10MAT41

Fourth Semester B.E. Degree Examination, June/July 2018

Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using the Taylor's series method, solve the initial value problem $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$ at $x = 0.1$ and $x_2 = 0.2$. **(06 Marks)**

b. Obtain an approximate solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$ with initial conditions $y = 1$ at $x = 0$ for the range $0 \le x \le 0.4$ in steps of 0.2, using Euler's modified method. Perform two modifications at each step. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.04$ and $y(0.3) = 2.09$, find $y(0.4)$ correct to five decimal places by employing the Milne's predictor-correct method. Use corrector formula twice. **(07 Marks)**

2 a. Find an approximate value of y and z corresponding to $x = 0.1$ given that $y(0) = 2$, $z(0) = 1$ and $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$. Using Picard's method. **(06 Marks)**

b. Solve, $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for $x = 0.2$, correct to four decimal places, with initial conditions $x = 0$, $y = 1$, $\frac{dy}{dx} = 0$, using Runge-Kutta method. **(07 Marks)**

c. Obtain an approximate solution at the point $x = 0.4$ of the initial value problem, $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, $y(0) = 1$, $y'(0) = 0.1$ using Milner's method. Given $y(0) = 1$, $y(0.1) = 1.03995$, $y(0.2) = 1.138036$, $y(0.3) = 1.29865$, $y'(0) = 0.1$, $y'(0.1) = 0.6955$, $y'(0.2) = 1.258$, $y'(0.3) = 1.873$. **(07 Marks)**

3 a. If $f(z) = u + iv$ is an analytic function, then prove that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$. **(06 Marks)**

b. Find an analytic function $f(z) = u + iv$, given that $u + v = \frac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$. **(07 Marks)**

c. Find an analytic function $f(z) = u + iv$ given the imaginary part $v = r^2\cos 2\theta - r\cos\theta + 2$. **(07 Marks)**

4 a. Find the bilinear transformation that transforms the points $z_1 = i$, $z_2 = 1$, $z_3 = -1$ onto the points $w_1 = 1$, $w_2 = 0$, $w_3 = \infty$ respectively. **(06 Marks)**

b. Evaluate $I = \int_{z=0}^{2+i} (\bar{z})^2 dz$ along the following curves:

i) The straight line $y = \frac{x}{2}$ from the origin θ to the point B(2 + i).

ii) The real axis from 0 to 2 and then vertically to 2 + i. **(07 Marks)**

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

PART – B

5 a. Obtain the series solution Bessel's differential equation leading to Bessel's function of first kind. **(08 Marks)**

b. If α and β are distinct roots of the equation $J_n(ax) = 0$, then prove that $\int_0^a x J_n(\alpha x).J_n(\beta x)dx = 0$. **(07 Marks)**

c. Evaluate $p_0(x)$, $p_1(x)$, $p_2(x)$, $p_3(x)$ by using the Rodrigue's formula. **(05 Marks)**

6 a. A husband and wife appear for two vacancies of a post. The probability of husband's selection is 1/7 and that of wife's selection is 1/5. What is the probability that (i) both of them will be selected? (ii)Only one of them is selected? (iii) Neither is selected? **(06 Marks)**

b. What are independent events? If A and B are independent prove that (i) A and $\bar{B}$ are independent, (ii) $\bar{A}$ and B are independent and (iii) $\bar{A}$ and $\bar{B}$ are independent. **(07 Marks)**

c. An author has four typists typing the manuscript of his latest book. Typist A does 30% of the typing; typist B 25%; typist C 20% and typist D, 25%. Errors occur on 5% of the pages typed by A, on 4% types by B, on 3% typed by C and on 2% typed by D. If a page is chosen at random what is the probability that it contains errors? If a page chosen contains errors, what is the probability that it was typed by typist A or typist B? **(07 Marks)**

7 a. A random variable x has the density function

$$f(x) = \begin{cases} kx^2, & -3 \le x \le 3 \\ 0, & \text{elsewhere} \end{cases}$$

Evaluate K, and find (i) $p(1 \le x \le 2)$ ii) $p(x \le 2)$ iii) $p(2 < x \le 3)$ and iv) $p(x > 1)$. **(06 Marks)**

b. Find the mean, variance and standard deviation for the binomial distribution. **(07 Marks)**

c. The life of a certain type of electrical lamps is normally distributed with mean of 2040 hrs and standard deviation 60 hours. In a consignment of 2000 lamps, find how many would be expected to burn for (i) more than 2150 hours (ii) less than 1950 hours, and (iii) between 1920 hours and 2160 hours given that A(1.5) = 0.4332, A(1.83) = 0.4664 and A(2) = 0.4772. **(07 Marks)**

8 a. The mean and standard deviation of marks scored by a sample of 100 students are 67.45 and 2.92. Find (i) 95% and (ii) 99% confidence intervals for estimating the mean marks of the student population. **(06 Marks)**

b. Consider the sample consisting of nine numbers 45, 47, 50, 52, 48, 47, 49, 53 and 51. The sample is drawn from a population whose mean is 47.5. Find whether the sample mean differs significantly from the population mean at 5% level of significance. **(07 Marks)**

c. Fit a binomial distribution to the following data:

x_i	0	1	2	3	4	5
f_i	2	14	20	34	22	8

Test the goodness of this fit at 5% level of significance. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10ME/AU43

Fourth Semester B.E. Degree Examination, June/July 2018
Applied Thermodynamics

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:
i) Higher and lower calorific values ii) Combustion efficiency
iii) Dew point temperature iv) Adiabatic flame temperature
v) Percent excess air **(10 Marks)**

b. One kg of ethane (C_2H_6) is burnt with 90% of theoretical air. Assuming complete combustion of hydrogen in the fuel determine the volumetric analysis of the dry products of combustion. **(10 Marks)**

2 a. What is air-standard cycle? State the assumptions made in the analysis of air standard cycle. **(05 Marks)**

b. Show that if an Otto cycle works between the temperature limits T_3 and T_1, the compression ratio for maximum workdone/cycle/kg is expressed as, $r_v = \left[\frac{T_3}{T_1}\right]^{\frac{1}{2(\gamma-1)}}$ where r_v is compression ratio. **(05 Marks)**

c. An engine operating on the ideal diesel cycle has a compression ratio 16:1. Heat is added during constant pressure process upto 8% of the stroke. If the engine inhales 0.04 m^3/s at 101 kPa and 25°C, determine:
i) The maximum pressure and temperature in the cycle.
ii) The thermal efficiency of the engine.
iii) The power developed. **(10 Marks)**

3 a. Derive an expression for indicated power of multi cylinder IC engine for Morse test. **(04 Marks)**

b. Define: i) Mean effective pressure
ii) Specific fuel consumption
iii) Volumetric efficiency **(06 Marks)**

c. A four cylinder 4-stroke petrol engine has a bore of 60 mm and a stroke of 90 mm. Its rated speed is 2800 rpm and it is tested at this speed against brake which has a torque arm of 0.37 m. The net brake load is 160 N and the fuel consumption is 8.966 litres/hr. The specific gravity of petrol used is 0.74 and it has a lower calorific value of 44100 kJ/kg. A Morse test is carried out and the cylinders are cut out in the order 1, 2, 3, 4 with corresponding brake loads of 110, 107, 104 and 110 N respectively. Calculate for this speed:
i) Brake power ii) Brake mean effective pressure
iii) Brake thermal efficiency iv) Mechanical efficiency **(10 Marks)**

4 a. Explain the effect of variation of pressure and super heat on Rankine cycle efficiency with the help of a T-S diagram. **(10 Marks)**

b. In a Rankine cycle the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine:
i) The pump work ii) The turbine work
iii) The Rankine efficiency iv) The dryness at the end of expansion.
Assume flow rate of steam is 9.5 kg/s. **(10 Marks)**

PART – B

5 a. Explain the condition for minimum work for a reciprocating compressor and also define isothermal efficiency based on the indicator diagram. **(05 Marks)**

b. Derive an expression for the volumetric efficiency of reciprocating air compressor. **(05 Marks)**

c. A single stage single acting air compressor delivers 0.6 kg of air per minute at 6 bar. The temperature and pressure at the end of suction stroke are 30°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of the swept volume. Assuming the index of compression and expansion to be 1.3, find:

i) Volumetric efficiency of the compressor
ii) Power required if the mechanical efficiency is 85% and
iii) Speed of the compressor (rpm). **(10 Marks)**

6 a. What is the role of combustion chamber in gas turbine plant? Explain how the actual gas turbine cycle differs from the theoretical cycle. **(06 Marks)**

b. Draw the flow diagram and h-s diagram for open cycle gas turbine with perfect intercooling. **(04 Marks)**

c. In a constant pressure open cycle gas turbine air enters at 1 bar and 20°C and leaves the compressor at 5 bar. The maximum cycle temperature is 680°C, pressure loss in the combustion chamber is 0.1 bar. Isentropic efficiencies of compressor and turbine are 85% and 80% respectively, $\gamma = 1.4$ and $C_p = 1.024$ kJ/kgK for air and gas. Find:

i) The quantity of air circulation if the plant develops 1065 KW.
ii) Heat supplied per kg of air.
iii) The thermal efficiency of the cycle. **(10 Marks)**

7 a. Derive an expression for COP for an air refrigeration system working on reversed Carnot cycle. **(10 Marks)**

b. A refrigeration system of 10.5 tonnes capacity at an evaporator temperature of –12°C and a condenser temperature of 27°C is needed in a food storage locker. The refrigerant ammonia is subcooled by 6°C before entering the expansion valve. The vapour is 0.95 dry as if leaves the evaporator coil. The compression in the compressor is of adiabatic type. Using p-h chart find:

i) Condition of volume at outlet of the compressor.
ii) Condition of vapour at entrance to evaporator
iii) C.O.P
iv) Power required in KW

Neglect valve throttling and clearance effect. **(10 Marks)**

8 a. With a neat sketch describe the working of summer air conditioning system for hot and dry weather. **(07 Marks)**

b. Define:

i) Dry bulb temperature
ii) Wet bulb temperature
iii) Relative humidity. **(03 Marks)**

c. Air at 20°C, 40% RH is mixed adiabatically with air at 40°C, 40% RH in the ratio of 1 kg of the former with 2 kg of the latter (on dry basis). Find the final condition of air. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10ME/AU44

Fourth Semester B.E. Degree Examination, June/July 2018
Kinematics of Machines

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 with an example each:
(i) Flexible link. (ii) Higher pair. (iii) Spherical pair.
(iv) Successfully constrained motion. (v) Unclosed pair. **(05 Marks)**

b. Determine the mobility of the system shown in Fig. Q2 (b). **(05 Marks)**

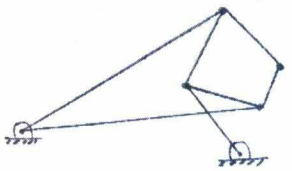

Fig. Q2 (b)

c. With neat sketch, explain (i) Oldham's coupling. (ii) Rotary engine. **(10 Marks)**

2 With neat sketch, explain (i) Quick return motion mechanism. (ii) Straight line mechanism (exact). (iii) Intermittent motion mechanism. **(20 Marks)**

3 In the mechanism shown in Fig. Q3 line OA = 320 mm, AC = 680 mm and OQ = 650 mm. Determine (i) the angular velocity of the cylinder. (ii) the sliding velocity of the plunger. (iii) the absolute velocity of the plunger. when the crank QA rotates at 20 rad/sec CW. **(20 Marks)**

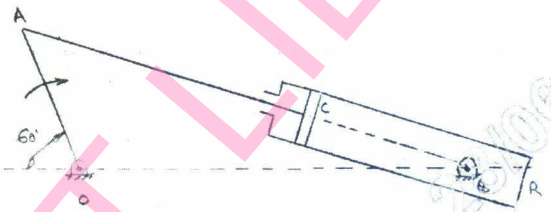

Fig. Q3

4 In the toggle mechanism shown in Fig. Q4, the slider D is constrained to move in a horizontal path. The crank OA is rotating in CCW direction at a speed of 180 rpm. The dimensions of the various links are as follows: OA=180 mm, CB=240 mm, AB=360 mm, BD=540 mm. Find:(i) Velocity of slider. (ii) Angular velocity of links AB, CB, BD using instantaneous centre method. **(20 Marks)**

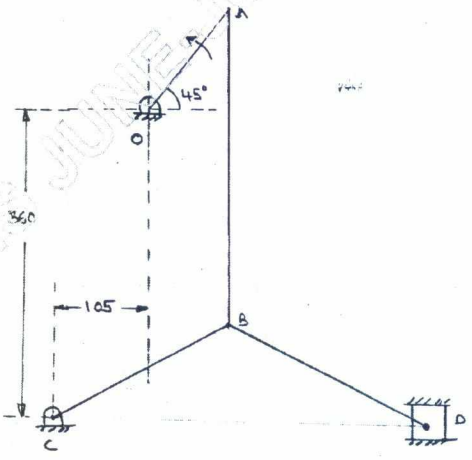

Fig. Q4

PART – B

5 In the 4-bar mechanism shown in Fig. Q5, link AB rotates uniformly at 2 rad/sec in CW 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)**

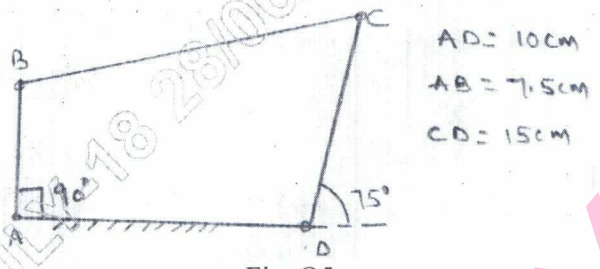

Fig. Q5

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

b. A standard full depth $14\frac{1}{2}^{\circ}$ gear have a module of 5 mm, pinion has 15 teeth while the wheel has 60 teeth knowing the addendum = 1 module,

(i) Show that the gear will interfere with the pinion.

(ii) What should be the pressure angle to avoid interference, if all other details remain same? **(16 Marks)**

7 Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft 'A'. A compound gear D-E gears with 'C' and an internal gear 'G', D has 20 teeth and gears with 'C' and 'E' has 35 teeth and gears with an internal gear 'G'. Gear 'G' is fixed and is concentric with the shaft axis. The compound gear D.E is mounted on a pin which projects from an arm keyed to the shaft 'B'.

(i) Sketch the arrangement.

(ii) Find the number of teeth on the internal gear G assuming that all gears have the same module.

(iii) If the shaft A rotates at 110 rpm, find the speed of shaft B. **(20 Marks)**

8 For a cam follower system shown in Fig. Q8, draw the displacement diagram for the follower and cam profile. Motion of the follower is as follows. Rise through 20° in 90° cam rotation in SHM, dwell in 90° cam rotation, fall in 90° cam rotation in SHM. The cam rotates in CW direction. **(20 Marks)**

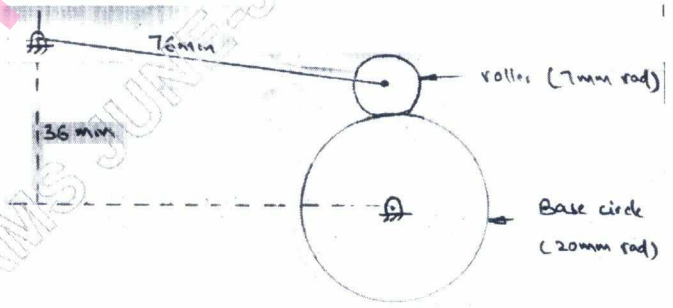

Fig. Q8

* * * * *

USN | | | | | | | | | | |

10ME/AU45

Fourth Semester B.E. Degree Examination, June/July 2018
Manufacturing Process - II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat sketches, briefly explain orthogonal and oblique cutting operations. **(08 Marks)**

b. Explain the significance of Merchant's circle. Diagram deriving Horizontal Cutting Force (F_c) , Thrust Force (F_t) , Shear Force (F_s) and Force normal to Shear Force (F_{nS}) developed during cutting operation. **(08 Marks)**

c. The tool life for HSS tool is expressed by the relation $VT^{1/7} = C_1$ and for tungsten carbide tool is $VT^{1/5} = C_2$. If the tool life for a cutting speed of 24m/min is 128 minutes. Compare the life of the two tools at a speed of 30m/min. **(04 Marks)**

2 a. Briefly explain the following cutting tool materials :
i) HSS ii) Carbides iii) Ceramics iv) Boron Nitride. **(08 Marks)**

b. Explain the functions and properties of cutting fluids. **(08 Marks)**

c. Sketch and explain the zones of heat generation in metal cutting. **(04 Marks)**

3 a. Sketch and explain the operations and tool layout for producing hexagonal bolt using capstan lathe. **(08 Marks)**

b. Sketch and explain the open and cross belt drive mechanism of a planer. **(08 Marks)**

c. A shaper makes 36 strokes per minute and the stroke length is 30cm. The shaper has a cutting stroke to return stroke ratio of 3:2. Determine the cutting speed in m/min without taking the clearance into account. **(04 Marks)**

4 a. Sketch and explain the following operations performed using Drilling machine :
i) Reaming ii) Boring iii) Tapping **(08 Marks)**

b. Briefly explain the co-ordinate systems employed in CNC machines. **(08 Marks)**

c. Sketch and indicate the Nomenclature of a Twist Drill. **(04 Marks)**

PART – B

5 a. Sketch and explain Horizontal Spindle column and Knee type milling machine. **(08 Marks)**

b. Sketch and explain the following milling operations :
i) Slot milling ii) Gang milling iii) Keyway milling. **(08 Marks)**

c. Briefly explain Compound Indexing. **(04 Marks)**

6 a. Briefly discuss the Grit, Grade and Structure of a Grinding wheel. **(08 Marks)**

b. Sketch and explain the principle of Centerless Grinding Machine. **(06 Marks)**

c. Briefly discuss Dressing and Truing of Grinding wheels. **(06 Marks)**

7 a. Sketch and explain Horizontal Continuous surface broaching machine. **(08 Marks)**

b. Sketch and explain the principle of Lapping process. **(08 Marks)**

c. Mention the advantages and limitations of Honing process. **(04 Marks)**

8 a. How do you classify Non – Traditional machining (NTM) processes? **(04 Marks)**

b. Sketch and explain Abrasive Jet Machining (AJM). **(08 Marks)**

c. Sketch and explain Electron Beam Machining (EBM). **(08 Marks)**

*****

USN | | | | | | | | | | |

10MEB406/10AUB406

Fourth Semester B.E. Degree Examination, June/July 2018
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Assume any missing data suitably.

PART – A

1 a. Differentiate between : (i) Newtonian and non-Newtonian fluids, (ii) Ideal and real fluids, (iii) Dynamic and kinematic viscosity of fluids, (iv) Vapour pressure and cavitation , (v) Mass density and specific weight. **(10 Marks)**

b. Derive an expression for capillary rise in water. **(03 Marks)**

c. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1.0 mm. **(07 Marks)**

2 a. Define centre of pressure and total pressure. Prove that centre of pressure lies below the centre of gravity of vertically immersed plane surface in a static fluid. **(10 Marks)**

b. A differential monometer is connected at the two points A & B of two pipes as shown in Fig.Q2(b). The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressure at A and B are 9.81 N/cm^2 and 17.65 N/cm^2 respectively. Find the difference in mercury level in the differential manometer. **(10 Marks)**

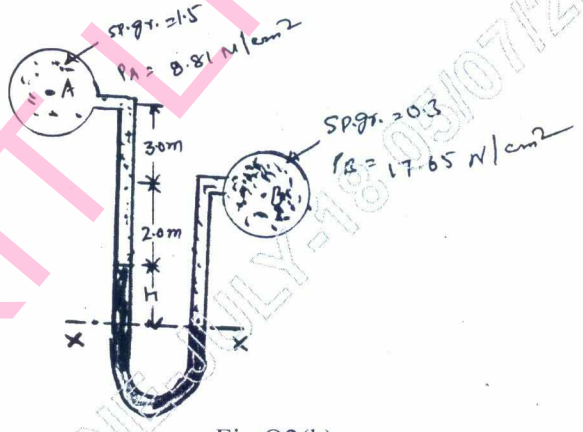

Fig.Q2(b)

3 a. Define the equation of continuity. Obtain the expression for continuity equation for a three dimensional flow. Simplify it to two dimensional steady incompressible flow. **(10 Marks)**

b. A ship 70m long and 10m broad has a displacement of 19620 kN. A weight of 343.35 kN is moved across the deck through a distance of 6m. The ship is tilted through 6°. The moment of inertia of the ship at water-line about its force and aft axis is 75% of M.O.I of the circumscribing rectangle. The centre of buoyancy is 2.25m below water-line. Find the meta-centre height and position of centre of gravity of ship. Specific weight of sea water is 10104 N/m^2. **(10 Marks)**

4 a. State and prove Bernoulli's equation for a fluid flow. Mention assumption made in derivation. **(10 Marks)**

b. The water is flowing through a taper pipe of length 100 m diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end, if the pressure at the higher level is 19.62 N/cm^2. **(10 Marks)**

PART – B

5 a. What is venturimeter? Derive an expression for the discharge through a venturimeter. **(08 Marks)**

b. Differentiate between Pitot tube and Orifice meter with neat sketches. **(04 Marks)**

c. The frictional torque T of a disc of diameter D rotating a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho}\right]$. Prove this by the Buckingham method of dimensions. **(08 Marks)**

6 a. Derive an expression for the head loss due to:
(i) Sudden expansion **(05 Marks)**
(ii) Sudden contraction **(05 Marks)**

b. Define hydraulic gradient line and total energy line. **(02 Marks)**

c. A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipe is given as 13.734 N/cm^2 and 11.772 N/cm^2 respectively. Find the loss of head due to contraction if $C_d = 0.62$. Also determine the rate of flow of water. **(08 Marks)**

7 a. Sketch the velocity and shear stress distribution across the section of the pipe for viscous flow through it. **(04 Marks)**

b. Derive Hagen – Poiseuille equation with usual notations. **(08 Marks)**

c. A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find (i) The pressure gradient (ii) The average velocity (iii) Reynold number of the flow **(08 Marks)**

8 a. Define the terms: (i) Boundary layer (ii) Boundary layer thickness (iii) Drag (iv) Lift. **(08 Marks)**

b. Define Mach number. What is the significance of mach number in compressible fluid flows? **(04 Marks)**

c. A flat plate 1.5m × 1.5m moves at 50 km/hr in stationary air of density 1.15 kg/m^2. If the coefficient 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. **(04 Marks)**

d. A projectile travels in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500 km/hr. Find the Mach number and the Mach angle. Take K = 1.4 and R = 287 J/kgK. **(04 Marks)**

* * * * *

USN | | | | | | | | | | |

10MEB402/10AUB402

Fourth Semester B.E. Degree Examination, June/July 2018
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. State the objectives of metrology. **(05 Marks)**

b. Using NPL method, derive equation for calibrating End standard from line standard. **(08 Marks)**

c. Four end bars A, B, C and D are to be calibrated using a calibrated length bar of 400 mm whose actual length is 399.9998 mm. The bar B is longer than bar A by 0.0004 mm, bar C is longer than bar A by 0.0003 mm, while bar D is shorter than bar A by 0.0001 mm. The four gauges together have a combination length of 400.0002 mm. Determine the actual length of each end bar. **(07 Marks)**

2 a. What is tolerance? Why it is necessary to give tolerance? **(04 Marks)**

b. Differentiate between the following:
(i) Unilateral tolerance and bilateral tolerance.
(ii) Hole basis system and shaft basis system. **(04 Marks)**

c. Design the general type 'GO' and 'NOGO' gauges for a component having $25H_7/f_8$ fit following details may be used:
(i) $i = 0.45\sqrt[3]{D} + 0.001D$ microns
(ii) Upper deviation for 'f' shaft is $= -5.5D^{0.41}$
(iii) $IT_7 = 16i$ and $IT_8 = 25i$
(iv) 25 mm falls in diameter step of 18-30 mm
(v) Wear allowance on gauge = 10% of gauge tolerance.
Also determine (i) Type of fit (ii) Allowance for the above fit. **(12 Marks)**

3 a. What is a comparator? How does it differ from a measuring device? **(04 Marks)**

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

c. Explain the use of sine bar for measuring a known and unknown angles of small component. **(08 Marks)**

4 a. With a neat sketch, explain the working principle of autocollimator. **(06 Marks)**

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

c. How do you measure the chord thickness of spur gear tooth using gear tooth vermier. Explain with a neat sketch. **(06 Marks)**

PART – B

5 a. Explain the concept of "Generalized measurement system" with a block diagram taking the working of bourdon pressure gauge as an example. **(08 Marks)**

b. Distinguish between systematic errors and random errors. **(06 Marks)**

c. What is a transducer? What are the advantages of electrical transducers? **(06 Marks)**

6 a. Explain the inherent problems present in mechanical modifying system. **(06 Marks)**
b. With a block diagram, explain the general telemetering system. **(06 Marks)**
c. With a neat sketch, explain the working principle of CRO. **(08 Marks)**

7 a. Sketch and explain the Platform balance method of measuring force. **(06 Marks)**
b. Sketch and explain the working of Prony brake dynamometer. **(04 Marks)**
c. Define the following:
(i) Absolute pressure (ii) Gauge pressure
(iii) Vacuum pressure (iv) Atmospheric pressure **(04 Marks)**
d. With a neat sketch, explain the working of Mcleod gauge. **(06 Marks)**

8 a. State the laws of thermocouple. **(04 Marks)**
b. Explain the construction and working of optical pyrometer. **(08 Marks)**
c. Write a note on strain gauge backing materials and bonding material. **(04 Marks)**
d. Write a note on calibration of strain gauge. **(04 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2018

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Find the ratio in which the point C, (9, 8, -10) divides the line segment joining the points A(5, 4, -6) and B(3, 2, -4). **(06 Marks)**

b. If cos α, cos β, cos γ are the direction cosines of a straight line, prove that (i) $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=2$ (ii) $\cos 2\alpha+\cos 2\beta+\cos 2\gamma=-1$. **(07 Marks)**

c. Find the constant K such that the angle between the lines with direction ratios (-2, 1, -1) and (1, -K, 1) is 90°. **(07 Marks)**

2 a. Show that the angles between the diagonals of a cube is $\theta=\cos^{-1}(1/3)$. **(06 Marks)**

b. Find the equation of the plane through the points (1, 0, -1) and (3, 2, 2) and parallel to the line $\frac{x-1}{1}=\frac{1-y}{2}=\frac{z-2}{3}$. **(07 Marks)**

c. Show that the points A(-6, 3, 2), B(3, -2, 4), C(5, 7, 3) and D(-13, 17, -1) are coplanar. Also find the equation of the plane containing them. **(07 Marks)**

3 a. Find the angle between the vectors $\vec{a}=2i+6j+3k$, $\vec{b}=12i-4j+3k$. **(06 Marks)**

b. Find the area of a parallelogram whose adjacent sides are $i-2j+3k$ and $2i+j-4k$. **(07 Marks)**

c. Find a unit vector perpendicular to both vectors $\vec{a}=2i-3j+k$, $\vec{b}=7i-5j+k$. **(07 Marks)**

4 a. Show that the four points whose position vectors are $3i-2j+4k$, $6i+3j+k$, $5i+7j+3k$ and $2i+2j+6k$ are coplanar. **(06 Marks)**

b. A particle moves along the curve $x=t^3+1$, $y=t^2$, $z=2t+3$ where t is the time. Find the components of velocity and acceleration at $t=1$ in the direction of $i+j+3k$. **(07 Marks)**

c. Find the directional derivative of $f(x,y,z)=xy^2+yz^3$ at the point (2, -1, 1) in the direction of vector $i+2j+2k$. **(07 Marks)**

5 a. Find div F and curl F where $F=\text{grad}(x^3+y^3+z^3-3xyz)$. **(06 Marks)**

b. Show that $F=x(y-z)i+y(z-x)j+z(x-y)k$ is solenoidal. **(07 Marks)**

c. Find the constants a and b so that the vector $\vec{F}=(axy+z^3)\hat{i}+(3x^2-z)\hat{j}+(bxz^2-y)\hat{k}$ is irrotational. **(07 Marks)**

6 a. Find the Laplace transforms of $1+2t^3-4e^{3t}+5e^{-t}$. **(07 Marks)**

b. Find the Laplace transform of $t^2\sin^2 t$. **(07 Marks)**

c. Find the Laplace transform of $\frac{\sin at}{t}$. **(06 Marks)**

7 a. Find the inverse Laplace transform of $\frac{3s-4}{16-s^2}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{1}{s^2+4s+9}$. **(07 Marks)**

c. Evaluate $L^{-1}\left\{\frac{1}{(s+1)(s+2)}\right\}$. **(07 Marks)**

8 a. Obtain the Laplace transforms of f′(t), f″(t). **(08 Marks)**

b. Solve the differential equation using Laplace transforms $y''-3y'+2y=1-e^{2t}$ under the conditions y(0) = 1, y′(0) = 0. **(12 Marks)**

* * * * *