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17MAT41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. From Taylor's series method, find y(0.1), considering upto fourth degree term if y(x) satisfying the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$. **(06 Marks)**

b. Using Runge-Kutta method of fourth order $\frac{dy}{dx} + y = 2x$ at $x = 1.1$ given that $y = 3$ at $x = 1$ initially. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find $y(0.4)$ correct upto four decimal places by using Milne's predictor-corrector formula. **(07 Marks)**

OR

2 a. Using modified Euler's method find y at $x = 0.2$ given $\frac{dy}{dx} = 3x + \frac{1}{2}y$ with $y(0) = 1$ taking $h = 0.1$. **(06 Marks)**

b. Given $\frac{dy}{dx} + y + zy^2 = 0$ and $y(0) = 1$, $y(0.1) = 0.9008$, $y(0.2) = 0.8066$, $y(0.3) = 0.722$. Evaluate $y(0.4)$ by Adams-Bashforth method. **(07 Marks)**

c. Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

Module-2

3 a. Apply Milne's method to compute $y(0.8)$ given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(06 Marks)

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

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ leading to $J_n(x)$. **(07 Marks)**

OR

4 a. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$, compute $y(0.2)$ and $y'(0.2)$ using fourth order Runge-Kutta method. **(06 Marks)**

b. Prove $J_{-1/2}(k) = \sqrt{\frac{2}{\pi x}}\cos x$. **(07 Marks)**

c. Prove the Rodfigues formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n y}{dx^n}(x^2-1)^n$ **(07 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equations in Cartesian form. **(06 Marks)**

b. Discuss the transformation $w = z^2$. **(07 Marks)**

c. By using Cauchy's residue theorem, evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}dz$ if C is the circle $|z| = 3$. **(07 Marks)**

OR

6 a. Prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ **(06 Marks)**

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

c. Find the bilinear transformation which maps $z = \infty, i, 0$ into $w = -1, -i, 1$. **(07 Marks)**

Module-4

7 a. Find the mean and standard of Poisson distribution. **(06 Marks)**

b. In an examination 7% of students score less than 35 marks and 89% of the students score less than 60 marks. Find the mean and standard deviation if the marks are normally distributed given A(1.2263) = 0.39 and A(1.4757) = 0.43 **(07 Marks)**

c. The joint probability distribution table for two random variables X and Y is as follows:

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine:

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y **(07 Marks)**

OR

8 a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

Find K and evaluate $P(x \geq 6)$, $P(3 < x \leq 6)$. **(06 Marks)**

b. The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that

i) Exactly 2 are defective

ii) Atleast two are defective

iii) None of them are defective. **(07 Marks)**

c. The length of telephone conversation in a booth has been exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made

i) Ends in less than 5 minutes

ii) Between 5 and 10 minutes. **(07 Marks)**

Module-5

9 a. A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the dia cannot be regarded as an unbiased die. **(06 Marks)**

b. A group of 10 boys fed on diet A and another group of 8 boys fed on a different disk B for a period of 6 months recorded the following increase in weight (lbs):

Diet A:	5	6	8	1	12	4	3	9	6	10
Diet B:	2	3	6	8	10	1	2	8		

Test whether diets A and B differ significantly t.05 = 2.12 at 16df. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(07 Marks)**

OR

10 a. Define the terms:
i) Null hypothesis
ii) Type-I and Type-II error
iii) Confidence limits **(06 Marks)**

b. The t.p.m. of a Markov chain is given by $P = \begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$. Find the fined probabilities vector. **(07 Marks)**

c. Two boys B_1 and B_2 and two girls G_1 and G_2 are throwing ball from one to another. Each boy throws the ball to the other boy with probability 1/2 and to each girl with probability 1/4. On the other hand each girl throws the ball to each boy with probability 1/2 and never to the other girl. In the long run how often does each receive the ball? **(07 Marks)**

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Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the rank of the matrix:

$$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$$ by elementary row transformations. **(08 Marks)**

b. Solve by Gauss elimination method

$$2x + y + 4z = 12$$
$$4x + 11y - z = 33$$
$$8x - 3y + 2z = 20$$ **(06 Marks)**

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(06 Marks)**

OR

2 a. Reduce the matrix

$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$ into its echelon form and hence find its rank. **(06 Marks)**

b. Applying Gauss elimination method, solve the system of equations

$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$ **(06 Marks)**

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(08 Marks)**

Module-2

3 a. Solve $\frac{d^4y}{dx^4} - \frac{2d^3y}{dx^3} + \frac{d^2y}{dx^2} = 0$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - \frac{6dy}{dx} + 9y = 5e^{-2x}$ **(06 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \sec x$ by the method of variation of parameters. **(08 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3} + y = 0$ **(06 Marks)**

b. Solve $y'' + 3y' + 2y = 12x^2$ **(06 Marks)**

c. Solve by the method of undetermined coefficients :
$y'' - 4y' + 4y = e^x$ **(08 Marks)**

Module-3

5 a. Find the Laplace transforms of $\sin 5t \cos 2t$ **(06 Marks)**

b. Find the Laplace transforms of $(3t + 4)^3$ **(06 Marks)**

c. Express $f(t) = \begin{cases} \sin 2t & 0 < t < \pi \\ 0 & t > \pi \end{cases}$,
in terms of unit step function and hence find $L[f(t)]$. **(08 Marks)**

OR

6 a. Find the Laplace transforms of $\frac{\sin^2 t}{t}$ **(06 Marks)**

b. Find the Laplace transform of $2^t + t \sin t$ **(06 Marks)**

c. If $f(t) = t^2$, $0 < t < 2$ and $f(t + 2) = f(t)$, for $t > 2$, find $L[f(t)]$. **(08 Marks)**

Module-4

7 a. Find the Laplace Inverse of
$\frac{1}{(s+1)(s-1)(s+2)}$ **(08 Marks)**

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

c. Solve $y'' + 2y' - 3y = \sin t$, $y(0) = 0$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find the inverse Laplace transform of
$\log\left(\frac{s+a}{s+b}\right)$ **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{4s-1}{s^2+25}$ **(06 Marks)**

c. Find the inverse Laplace of $y'' - 5y' + 6y = e^t$ with $y(0) = y'(0) = 0$. **(08 Marks)**

Module-5

9 a. State and prove Addition theorem on probability. **(05 Marks)**

b. A student A can solve 75% of the problems given in the book and a student B can solve 70%. What is the probability that A or B can solve a problem chosen at random. **(06 Marks)**

c. Three machines A, B, C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4 and 5 respectively. If an item is selected at random, what is the probability that it is defective? If a selected item is defective, what is the probability that it is from machine A? **(09 Marks)**

OR

10 a. Find the probability that the birth days of 5 persons chosen at random will fall in 12 different calendar months. **(05 Marks)**

b. A box A contains 2 white balls and 4 black balls. Another box B contains 5 white balls and 7 black balls. A ball is transferred from box A to box B. Then a ball is drawn from box B. Find the probability that it is white. **(06 Marks)**

c. State and prove Baye's theorem. **(09 Marks)**

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17ME42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain: (i) Kinematic pair (ii) Types of links (iii) Grashaf's criterian **(06 Marks)**

b. Explain with neat sketches:
(i) Ratchet and Pawl mechanism
(ii) Toggle mechanism **(10 Marks)**

c. Define: (i) Inversion (ii) Degree of freedom
(iii) Mechanism (iv) Kinematic chain **(04 Marks)**

OR

2 a. Explain the construction and working of Peaucillier's mechanism with a neat sketch. Prove that it generates an exact straight line. **(10 Marks)**

b. With neat sketch, explain Geneva wheel mechanism. **(10 Marks)**

Module-2

3 The crank of a slider crank mechanism is 480 mm long and rotates at 20 rad/sec in the counter clockwise direction. It has a connecting rod of 1600 mm long. Determine the following when the crank is at 60° from the 1 DC. Determine:
(i) Velocity of slider
(ii) Angular velocity of connecting rod
(iii) Position and velocity of a point "P" on the connecting rod and having least absolute velocity. **(20 Marks)**

OR

4 a. Explain Klein's construction for slider crank mechanism. **(10 Marks)**

b. Define instantaneous centre and state, explain the types of instantaneous centres. **(10 Marks)**

Module-3

5 Using complex algebra derive expression for velocity and acceleration of the piston and angular acceleration of connecting rod for a reciprocating engine mechanism. Use these expressions to find the above, if the crank length is 50 mm, connecting rod is 200 mm long crank angle is 30°. The crank rotates at a constant speed of 3000 rpm. **(20 Marks)**

OR

6 In a four bar mechanism ABCD, link AB = 300 mm, BC = 360 mm, CD = 360 mm and the fixed link AD is 600 mm. The angle BAD = 60°. The link AB has an angular velocity of 10 rad/sec and angular acceleration of 30 rad/sec both clockwise. Determine the angular velocity and angular acceleration of link BC and CD by using complex algebra method. **(20 Marks)**

Module-4

7 a. Derive an expression for minimum number of teeth on pinion to avoid interference. **(10 Marks)**

b. A 2.5 mm module, 20° pinion with 36 teeth drives a gear with 60 teeth. If the centre distance is increased by 0.65 mm. Calculate:
(i) The radii of the operating pitch circle
(ii) The operating pressure angle
(iii) Backlash produced **(10 Marks)**

OR

8 An epicyclic gear train, the internal wheels A, B and the compound wheel C and D rotate independently about the axis "O". The wheel E and F rotate on pin fixed to the arm G. E gears with A and C, and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C = 28, D = 26.
(i) Sketch the arrangement
(ii) Find the number of teeth on A and B
(iii) If arm G makes 150 rpm CW and A is fixed, find speed of B. **(20 Marks)**

Module-5

9 Construct the profile of a cam to suit the following specification.
Cam shaft diameter = 40 mm
Least radius of CAM = 25 mm
Diameter of roller = 25 mm
Angle of lift = 120°
Angle of fall = 150°
Lift of the follower = 40 mm
Number of pauses are two of equal interval between motions. During the lift the motion is SHM. During the fall the motion is UARM. The speed of the cam shaft is uniform. The line of stroke is center of the cam. **(20 Marks)**

OR

10 a. Define the following terms related to cam:
(i) Lift
(ii) Dwell
(iii) Pressure angle
(iv) Base angle **(08 Marks)**

b. Derive an expression for displacement, velocity and acceleration for a circular arc cam operating a flat faced follower when the contact is on the circular flank. **(12 Marks)**

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17ME43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of thermodynamics data hand book is permitted.***

Module-1

1 a. Show the compression ratio (r_c) for maximum work should be per kg of air in an Otto cycle between upper and lower limits of absolute temperature T_3 and T_3 is given $r_C = \left(\frac{T_3}{T_1}\right)^{\frac{1}{2(\gamma-1)}}$ and also show that $T_2, T_4 = (T_1\ T_3)^{1/2}$ **(10 Marks)**

b. Compression ratio of diesel cycle is 14 and cut off ratio is 2.2 at beginning of cycle, air is 0.98 bar and 100°C. Find: (i) The temperature and pressure at salient points (ii) Air standard efficiency. **(10 Marks)**

OR

2 a. With a neat sketch, explain the working of Ramjet. **(10 Marks)**

b. In an open cycle gas turbine plant, air enters the compressor at 1 bar and 27°C. The pressure after compression is 4 bar. The isentropic efficiencies of the turbine and the compressor are 85% and 80% respectively. Air fuel ratio is 80:1 calorific value of the fuel used is 42000 kJ/kg. Mass flow rate of air is 2.5 kg/sec. Determine the power output from the plant and the cycle efficiency. Assume the value of Cp = 1.005 kJ/kgK and $\gamma = 1.4$. **(10 Marks)**

Module-2

3 a. Discuss with the help of T-S diagram the effect of Boiler pressure, condenser pressure and super heat on the performance of a Rankine cycle. **(10 Marks)**

b. A 40 MW steam power plant working on Rankine cycle operator between boiler pressure of 40 bar and condenser pressure of 0.1 bar. Steam leaves the boiler and enters the turbine at 400°C. The isentropic efficiency of steam turbine is 84%. Determine:
i) Efficiency ii) Quality of exhaust iii) Steam flow rate in kg/hr. **(10 Marks)**

OR

4 a. A steam power plant operates on a theoretical reheat cycle. Steam at boiler outlet 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-S and h-s diagrams. Find:
(i) Quality of steam at turbine exhaust
(ii) Cycle efficiency
(iii) Steam rate in kg/KWh. **(10 Marks)**

b. With the help of neat diagram, explain the working of regenerative Rankine cycle and derive the efficiency of the cycle. **(10 Marks)**

Module-3

5 a. Explain the following terms with reference to a combustion process:
(i) Adaibatic flame temperature
(ii) Enthalpy of formation
(iii) Stoichiometric air
(iv) Enthalpy of combustion
(v) Combustion efficiency **(10 Marks)**

b. Methane (CH_4) is burned with atmospheric air. The analysis of the products on a dry basis is as follows: $CO_2 = 10\%$, $O_2 = 2.37\%$, $CO = 0.53\%$, $N_2 = 87.10\%$.
(i) Determine the combustion equation
(ii) Calculate the air-fuel ratio
(iii) Percent theoretical air **(10 Marks)**

OR

6 a. Explain the following:
(i) Heat balance sheet
(ii) Morse test **(10 Marks)**

b. A single cylinder 4-stroke diesel engine give the following results while running on full load, area of indicator diagram = 300 mm^2, length of diagram = 40 mm. The spring constant = 1 bar/mm, speed of the engine = 400 rpm, load on the brake = 370 N, spring balance reading = 50 N, diameter of brake drum = 1.2 m, fuel consumption = 2.8 kg/hr, calorific value fuel = 41800 kJ/kg, diameter of cylinder = 160 mm, stroke = 200 mm. Calculate IP, BP, Brake mean effective pressure, brake specific fuel consumption, brake thermal efficiency, indicator thermal efficiency. **(10 Marks)**

Module-4

7 a. With a neat sketch, describe clearly the working of a Bell-Coleman cycle. **(06 Marks)**

b. Write a brief note on properties of refrigerants. **(04 Marks)**

c. For food-storage purpose, a refrigeration plant of 10.5 TR is required at an evaporation temperature of –12°C and condenser temperature of 27°C. The refrigerant is ammonia. It is sub-cooled by 6°C before entering the expansion valve. The vapour is 0.95 dry as it leaves the evaporator coil. The compression is adiabatic using p-h chart. Calculate:
(i) Condition of vapour at outlet of the compressor
(ii) Condition of vapour at entrance to evaporator
(iii) CoP
(iv) Power required in KW.
Neglect throttling and clearance effect. **(10 Marks)**

OR

8 a. Define the following:
(i) Dry bulb temperature (ii) Dew point temperature
(iii) Relative humidity (iv) Specific humidity
(v) Degree of saturation **(10 Marks)**

b. An air-conditioning plant is to be designed for a small office for winter conditions. Outdoor condition = 10°C DBT and 8°C WBT. Required indoor conditions = 20°C DBT and 60% RH. Amount of air circulation = 0.3 m^3/min/person seating capacity of the office = 50. The required condition is achieved first by heating and then by adiabatic humidifying. Find the followings:
(i) Heating capacity of the coil in KW and the surface temperature required if the bypass factor of the coil is 0.32
(ii) The capacity of the humidifier. **(10 Marks)**

Module-5

9 a. Define the following with respect to a compressor:
i) Isothermal efficiency ii) Adiabatic efficiency iii) Mechanical efficiency
iv) Overall efficiency v) Volumetric efficiency **(10 Marks)**

b. An air compressor takes in air at 1 bar and 20°C and compresses the same according to the law $PV^{1.2} = C$. It is the delivered to a receiver at a constant pressure of 10 bar.
Determine:
(i) Temperature at the end of compression
(ii) Work done and heat transferred during compression per kg of air R = 0.287 kJ/kgK.
(10 Marks)

OR

10 a. Prove the maximum flow rate of steam per unit area through a nozzle occurs when the ratio of pressure at throat to the inlet pressure is equal to $P_2 / P_1 = \left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$ where n is polytropic index of expansion. **(10 Marks)**

b. Dry saturated steam at a pressure of 11 bar enters a convergent divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic frictionless. Determine: (i) Exit velocity of steam (ii) Ratio of cross-section area at exit and at throat. Assume the index of adiabatic expansion to be 1.135. **(10 Marks)**

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17ME44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the following fluid properties :
i) Density ii) Specific weight iii) Specific volume iv) Specific gravity. **(04 Marks)**

b. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190 rpm. Calculate the power lost is the bearing for a sleeve length of 90mm. The thickness of the of film is 1.5mm. **(08 Marks)**

c. A U tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipe line. It left end is connected to the pipe and the right limb is open to the atmosphere. The under of pipe is 100mm below the level of mercury (specific gravity of mercury = 13.6) in the right limb. If the difference of mercury level in the two limbs is 160mm. Determine the absolute pressure of the oil in the pipe. **(08 Marks)**

OR

2 a. Derive an expression for total pressure force and depth of centre of pressure for an inclined plane surface submerged in liquid. **(10 Marks)**

b. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4m where if immersed vertically in an oil of specific gravity 0.9 the base of the plate coincides with the free surface of oil. **(06 Marks)**

c. Define the terms : i) Buoyancy ii) Centre of buoyancy
iii) Meta centre iv) Meta centric height. **(04 Marks)**

Module-2

3 a. Derive continuity equation is Cartesian co-ordinates for a fluid flow in 3 dimensions. **(08 Marks)**

b. Distinguish between :
i) Steady and unsteady flow
ii) Uniform and non uniform flow
iii) Laminar and turbulent flow. **(06 Marks)**

c. Obtain a stream function to the following velocity components $u = x + y$ and $v = x - y$. **(06 Marks)**

OR

4 a. The water is flowing through taper pipe of length 100m having diameters 600mm at upper end and 300mm at the longer 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. **(08 Marks)**

b. Derive an expression for discharge through a triangular notch. **(06 Marks)**

c. An oil of specific gravity 0.8 is flowing through venturimeter having inlet diameter 20cm and throat diameter 10cm. The oil mercury differential nanometer shows a reading of 25cm. calculate the discharge of oil through horizontal venturimeter. Take $C_d = 0.98$. **(06 Marks)**

Module-3

5 a. Derive an expression for velocity distribution for Hagen – Poiseuille flow occurring in a circular pipe. Hence prove that the maximum velocity is twice the average velocity of the flow. **(10 Marks)**

b. A fluid viscosity 0.7Ns/m^2 and specific graivity 1.3 is flowing through a circular pipe of diameter 100mm, the maximum shear stress. At the pipe wall is given as 196.2N/m^2. Find i) the pressure gradient ii) the average velocity iii) Reynolds number of the flow. **(10 Marks)**

OR

6 a. Derive the Darcy Weisbach equation. **(08 Marks)**

b. Differentiate between major and minor energy losses. **(04 Marks)**

c. An oil of specific gravity 0.7 is flowing through a pipe of diameter 300mm at the rate of 500 litre/sec. find the head lost due to friction and power required to maintain. The flow for a length of 1000m. Take v = 0.29 stokes. **(08 Marks)**

Module-4

7 a. Write a short note on boundary layer separation and method to control it. **(08 Marks)**

b. A flat plate 1.5m × 1.5m moves at 50km/hr in stationary air of density 1.15kg/m^3. If the coefficient of drag and left are 0.15 and 0.75 respectively. Determine :
i) the lift force ii) the drag force iii) the resultant force iv) power required to keep the plate in motion. **(08 Marks)**

c. State the difference between stream lined body and bluff body with neat sketch. **(04 Marks)**

OR

8 a. What is dimensional homogeneity? Explain with examples. **(04 Marks)**

b. What is similitude? Explain the following : i) Geometric similarity ii) Dynamic similarity **(08 Marks)**

c. Show by Buckingham's π theorem that the frictional torque T of a disc of diameter D rotating at speed N in a fluid of viscosity μ and density 'ρ' in a flow is given by $T = D^5N^2\rho\phi\left[\frac{\mu}{D^2N\rho}\right]$. **(08 Marks)**

Module-5

9 a. Define : i) Mach number ii) Subsonic flow iii) Sonic flow iv) Supersonic flow. **(08 Marks)**

b. An Airplane is flying at an height of 15km. where the temperature is -50°C. The speed of the plane is corresponding to M = 2.0. Assuming K = 1.4 and R = 287 J/kg K. find the speed of plane. **(06 Marks)**

c. A projectile is travelling in air having pressure and temperature as 8.829 N/cm^2 and 2°C if the mach angle is 40° find the velocity of the projectile Take K = 1.4 and R = 287 J/kg K. **(06 Marks)**

OR

10 a. Explain the meaning of CFD and its application. **(06 Marks)**

b. Define the following terms and write the relevant equation for the same i) stagnation temperature ii) stagnation pressure. **(08 Marks)**

c. Find the velocity of bullet fired in standard air. If the mach angle is 30°.
Take R = 287.14 J/kg K and K = 1.4 for air. Assume temperature is 15°C. **(06 Marks)**

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17ME45B/17MEB405

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define machine tool. Give the classification of machine tool. **(08 Marks)**

b. Explain with neat sketch working principle of horizontal milling machine. **(12 Marks)**

OR

2 a. With neat sketch explain the working principle of center type cylindrical grinding machine. **(12 Marks)**

b. Explain with neat sketch, quick return mechanism of shaper. **(08 Marks)**

Module-2

3 a. Explain the various machining parameters involved during turning operation on lathe machine. **(08 Marks)**

b. Explain the following milling operations:
(i) Face milling (ii) Slab milling
(iii) Slotting (iv) Straddle milling **(12 Marks)**

OR

4 a. With a neat sketch, explain principle of broaching process. **(05 Marks)**

b. Explain with example working motion for following machining processes:
(i) Shaping (ii) Planning (iii) Slotting
(iv) Drilling (v) Lathe **(15 Marks)**

Module-3

5 a. Explain the salient features of the following cutting tool materials:
(i) CBN (ii) Ceramics (iii) Cemented Carbides **(12 Marks)**

b. What are the properties of a good cutting fluid? **(08 Marks)**

OR

6 a. What is meant by tool signature? Explain each term of a tool designated as:
8 – 12 – 10 – 7 – 5 – 15 – 1.5 **(10 Marks)**

b. Find the machining time required for machining a surface 600 × 800 mm on a shaping machine. Assume cutting speed as 8m/min. The ratio of return to cutting stroke is 1:4 and the feed is 2 mm/double stroke. The clearance at each end is 70 mm. **(10 Marks)**

Module-4

7 a. Derive an expression for shear angle in terms of chip thickness ratio and rake angle for orthogonal cutting. **(12 Marks)**

b. What are the conditions favorable for built-up-edge formation? **(08 Marks)**

OR

8 a. A 12 mm hole is to be drilled through a 20 mm thick plate. The cutting speed is 12 m/min and the feed rate is 0.12 mm/rev. Estimate the machining time. Take the over travel plus clearance of the tool as 5 mm. **(10 Marks)**

b. The following details relates to an orthogonal cutting operation. Feed = 1.25 mm/rev, chip thickness = 2 mm, rake angle of tool = 10°. Calculate :
(i) Chip thickness ratio and shear angle
(ii) If the shear strength is 6000 kg/cm^2, width of cut = 10 mm, cutting speed = 30 mpm and coefficient of friction = 0.9, determine the following:
(1) shearing force (2) friction angle (3) cutting force **(10 Marks)**

Module-5

9 a. What is tool wear? Why does the tool fail during cutting? Explain giving reasons. **(10 Marks)**

b. Write short notes on Taylor's tool life equation. **(10 Marks)**

OR

10 a. List the cutting conditions which have an important influence upon metal cutting in machining. **(12 Marks)**

b. A 50 mm bar of steel was turned at 284 rpm and tool failure occurred after 10 min. The speed was changed to 232 rpm and the tool failed in 60 min of cutting time. What cutting speed should be used to obtain 30 mins of tool life? **(08 Marks)**

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CBCS SCHEME

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17ME46B/17MEB406

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Metrology. What are the objectives of metrology? **(06 Marks)**

b. Differentiate line and end standards with examples. **(06 Marks)**

c. Four length bars A, B, C, D of approximately 250mm each are to be calibrated with standard calibrated metre bar which is actually 0.0008mm less than a metre. It is also found that, bar 'B' is 0.0002mm longer than bar 'A', bar 'C' is 0.0004mm longer than bar 'A' and bar 'D' is 0.0001mm shorter than bar 'A'. The length of all four bars put together is 0.0003mm longer than the calibrated standard metre. Determine the actual dimensions of each bar. **(08 Marks)**

OR

2 a. Explain with neat sketches wringing phenomena of slip gauges. **(06 Marks)**

b. Build the following lengths by using M-112 set of slip gauges and write their combinations:
i) 29.875mm ii) 101.345mm iii) 78.3665mm **(09 Marks)**

c. Explain with neat sketches how a sine bar can be used to measure an unknown angle. **(05 Marks)**

Module-2

3 a. Define tolerance with types. **(06 Marks)**

b. Define fit. Explain different types of fits with sketches. **(08 Marks)**

c. Discuss hole and shaft basic system with neat sketches. **(06 Marks)**

OR

4 a. List essential considerations and materials used for construction of gauges. **(04 Marks)**

b. Determine the tolerances on the hole and the shaft for a precision running fit designated by $50H_7g_6$. Given:
i) 50mm lies between 30-50 mm
ii) i(Microns) = $0.45 (D)^{1/3} + 0.001D$
iii) Fundamental deviation for, H = 0
iv) Fundamental deviation for "g" shaft = $-2.5D^{0.34}$.
v) $IT_7 = 16i$ and $IT_6 = 10i$ **(08 Marks)**

c. Explain with neat sketches double ended plug and snap gauges. **(08 Marks)**

Module-3

5 a. Explain terminology of screw thread. **(06 Marks)**

b. Derive an equation for measuring effective diameter of screw thread by using 2-wire method. **(08 Marks)**

c. With neat sketch, explain tool Maker's microscope. **(06 Marks)**

OR

6 a. Illustrate the principle of interferometry with sketches. **(10 Marks)**
b. Explain construction and working of co-ordinate measuring machine. **(10 Marks)**

Module-4

7 a. Explain the concept of generalized measurement system with block diagram with bourdon pressure gauge as an example. **(08 Marks)**
b. Define the following terms: i) Precision ii) Hysterisis iii) Sensitivity **(06 Marks)**
c. Explain linear variable differential transducer (LVDT) with neat sketch. **(06 Marks)**

OR

8 a. Explain with a block diagram telemetering receiving system. **(04 Marks)**
b. Explain with a neat sketch cathode ray oscilloscope. **(08 Marks)**
c. What are X-Y plotters? With block diagram explain working of X-Y plotters. **(08 Marks)**

Module-5

9 a. Explain working of proving ring with neat sketch. **(06 Marks)**
b. With a neat sketch, explain the working of prony brake dynamometer. **(08 Marks)**
c. Discuss the working of McLeod gauge. **(08 Marks)**

OR

10 a. State and explain the laws of thermocouple. **(06 Marks)**
b. Discuss the construction and working of an optical pyrometer. **(10 Marks)**
c. Describe the steps to be taken for the preparation of specimen and mounting and strain gauges. **(04 Marks)**

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