CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

Note:1) ***Answer any FIVE full questions, choosing ONE full question from each module.***
2) ***Use of Statistical tables allowed.***

Module-1

1 a. Use Taylor's series to obtain approximate value of y at x = 0.1 for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$. **(06 Marks)**

b. Apply Runge Kutta method of fourth order to find an approximate value of y when x = 0.2 for the equation $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ taking h = 0.2. **(07 Marks)**

c. Using Milne's predictor – corrector method, find y when x = 0.8 given $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. **(07 Marks)**

OR

2 a. Given that $\frac{dy}{dx} = \log(x + y)$ and $y(1) = 2$, then find $y(1.2)$ in step of 0.2 using modified Euler's method carry out two iterations. **(06 Marks)**

b. Using fourth order Runge-Kutta method to find y at x = 0.2 equation given that $\frac{dy}{dx} = x + y$, $y(0) = 1$ and h = 0.2. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2(1 + y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$. Evaluate $y(1.4)$ by Adam's-Bashforth predictor-corrector method. **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method, solve $\frac{d^2y}{dx^2} = x\frac{dy}{dx} - y^2$ for x = 0.2, correct to three decimal places, with initial conditions $y(0) = 1$, $y'(0) = 0$. **(06 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

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

OR

4 a. Apply Milne's predictor-corrector method to compute y(0.4) given the differential equation $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ and the following initial values:
$y(0) = 1, y(0.1) = 1.1103, y(0.2) = 1.2427, y(0.3) = 1.399$
$y'(0) = 1, y'(0.1) = 1.2103, y'(0.2) = 1.4427, y'(0.3) = 1.699$ **(06 Marks)**

b. With usual notation, show that
$$J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$$ **(07 Marks)**

c. With usual notation, derive the Rodrigue's formula $P_n(x) = \frac{1}{(2^n)n!}\frac{d^n}{dx^n}(x^2-1)^n$. **(07 Marks)**

Module-3

5 a. Find the bilinear transformation which map the points z = 0, 1, ∞ into the points $w = -5, -1, 3$ respectively. **(06 Marks)**

b. Derive Cauchy-Riemann equations in Cartesian form. **(07 Marks)**

c. Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)}dz$ where $C: |z| = 2.5$ by residue theorem. **(07 Marks)**

OR

6 a. If $f(z)$ is a regular function of z, 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. Discuss the transformation $W = Z^2$. **(07 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}$, where C is the circle $|z| = 3$, using Cauchy residue theorem. **(07 Marks)**

Module-4

7 a. The probability density function of a variate x given by the following table:

X	−3	−2	−1	0	1	2	3
P(X)	K	2K	3K	4K	3K	2K	K

Find the value of K, mean and variance. **(06 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for, (i) more than 2150 hours, (ii) less than 1950 hours, (iii) more than 1920 hours and but less than 2160 hours.
Given : $A(0 < z < 1.83) = 0.4664$, $A(0 < z < 1.33) = 0.4082$ and $A(0 < z < 2) = 0.4772$ **(07 Marks)**

c. A joint probability distribution is given by the following table:

X \ Y	−3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Determine the marginal probability distributions of X and Y. Also find COV(X, Y). **(07 Marks)**

OR

8 a. Derive mean and variance of the Poisson distribution. **(06 Marks)**

b. In a certain town the duration of a shower is exponentially distributed within mean 5 minute. What is the probability that a shower will last for,
(i) less than 10 minutes (ii) 10 minutes or more
(iii) between 10 and 12 minutes. **(07 Marks)**

c. Given,

Y / X	0	1	2	3
0	0	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	0

(i) Find Marginal distribution of X and Y.
(ii) Find E(X), E(Y) and E(XY). **(07 Marks)**

Module-5

9 a. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. **(06 Marks)**

b. Five dice were thrown 96 times and number 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as follows:

No. of dice showing 1, 2 or 3 :	5	4	3	2	1	0
Frequency :	7	19	35	24	8	3

Test the hypothesis that the data follow a binomial distribution at 5% level of significance $\left(\chi^2_{0.05} = 11.07 \text{ for d.f is } 5\right)$. **(07 Marks)**

c. A student's study habits are as follows:
If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night he is 60% sure not to study the next night. In the long run how often does he study? **(07 Marks)**

OR

10 a. If $p = \begin{pmatrix} 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$, find the fixed probabilities vector. **(06 Marks)**

b. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Does this supports the hypothesis that the population mean of I.Q's is 100 at 5% level of significance? ($t_{0.05} = 2.262$ for 9 d.f) **(07 Marks)**

c. Explain : (i) Transient state (ii) Absorbing state (iii) Recurrent state. **(07 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, Aug./Sept. 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 $A=\begin{bmatrix}1 & 2 & 3 & -1\\ 2 & -1 & -3 & -1\\ 1 & 0 & 1 & 1\\ 0 & 1 & 1 & -1\end{bmatrix}$. **(07 Marks)**

b. Find the inverse of the matrix $\begin{bmatrix}3 & 1\\ 1 & 2\end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

c. Find the Eigen values of the matrix $\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$. **(06 Marks)**

OR

2 a. Solve the system of equation by Gauss elimination method,

$2x+y+4z=12$

$4x+11y-z=33$

$8x-3y+2z=20$ **(07 Marks)**

b. Using Cayley-Hamilton theorem find A^{-1}, given

$A=\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$. **(07 Marks)**

c. Find the rank of the matrix by reducing in to row echelon form, given

$A=\begin{bmatrix}1 & 2 & 3 & 2\\ 2 & 3 & 5 & 1\\ 1 & 3 & 4 & 5\end{bmatrix}$. **(06 Marks)**

Module-2

3 a. Solve by method of undetermined co-efficient $y''-4y'+4y=e^x$. **(07 Marks)**

b. Solve $\frac{d^3y}{dx^3}-2\frac{d^2y}{dx^2}+4\frac{dy}{dx}-8y=0$. **(07 Marks)**

c. Solve $y''+2y'+y=2x$. **(06 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2}+y=\sec x\tan x$ by method of variation of parameter. **(07 Marks)**

b. Solve $y''-4y'+13y=\cos 2x$. **(07 Marks)**

c. Solve $6\frac{d^2y}{dx^2}+17\frac{dy}{dx}+12y=e^{-x}$. **(06 Marks)**

Module-3

5 a. Express the following function into unit step function and hence find $L[f(t)]$ given $f(t) = \begin{cases} t, & 0 < t < 4 \\ 5, & t > 4 \end{cases}$. **(07 Marks)**

b. Find $L\left[\frac{1-e^{-at}}{t}\right]$. **(07 Marks)**

c. Find $L[t.\cos at]$. **(06 Marks)**

OR

6 a. Find $L[\sin 5t.\cos 2t]$. **(07 Marks)**

b. Find $L[e^{-t}\cos^2 3t]$. **(07 Marks)**

c. Find $L[\cos 3t.\cos 2t.\cos t]$. **(06 Marks)**

Module-4

7 a. Employ Laplace transform to solve the equation $y'' + 5y' + 6y = 5e^{2x}$ given $y(0) = 2,\ y'(0) = 1$. **(07 Marks)**

b. Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)(s+3)}\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\frac{s+5}{s^2-6s+13}\right]$. **(06 Marks)**

OR

8 a. Using Laplace transforms solve $y'' + 4y' + 4y = e^{-t}$ given $y(0) = 0,\ y'(0) = 0$. **(07 Marks)**

b. Find $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\frac{2s-5}{4s^2+25}\right] + L^{-1}\left[\frac{8-6s}{16s^2+9}\right]$. **(06 Marks)**

Module-5

9 a. State and prove Baye's theorem. **(07 Marks)**

b. A shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out of 3 shots. Find the probability that the target is being hit.

(i) When both of them try.

(ii) By only one shooter. **(07 Marks)**

c. If A and B are any two mutually exclusive events of S, then show that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

OR

10 a. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective out put of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item non produced by machine C. **(07 Marks)**

b. Prove the following : (i) $P(\phi) = 0$ (ii) $P(\overline{A}) = 1 - P(A)$ **(07 Marks)**

c. If A and B are events with $P(AUB) = \frac{7}{8}$, $P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{5}{8}$ find P(A), P(B) and $P(A \cap \overline{B})$. **(06 Marks)**

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CBCS SCHEME

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17ME42

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Kinematics of Machinery

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:
(i) Kinematic chain (ii) Mechanism (iii) Structure (iv) Inversion
(v) Degree of freedom **(10 Marks)**

b. Describe with neat figures two inversions of double slider-crank mechanism. **(10 Marks)**

OR

2 a. With neat sketch, explain crank and slotted lever quick return motion mechanism. **(07 Marks)**

b. Draw a line diagram and explain peaucellier exact straight line mechanism. **(07 Marks)**

c. The length of the fixed link of a crank and slotted lever mechanism is 250 mm and that of the crank is 100 mm. Determine (i) Angle between extreme positions of slotted lever (ii) Ratio of the time of cutting stroke to that of the return stroke. **(06 Marks)**

Module-2

3 In the mechanism shown in Fig. Q3. The crank 2 rotates at 3000 rpm. Find the acceleration of point C in magnitude and direction. Also find the angular acceleration of link 3. OA = 50 mm, AB = 175 mm, AC = 75 mm and AB = 125 mm. **(20 Marks)**

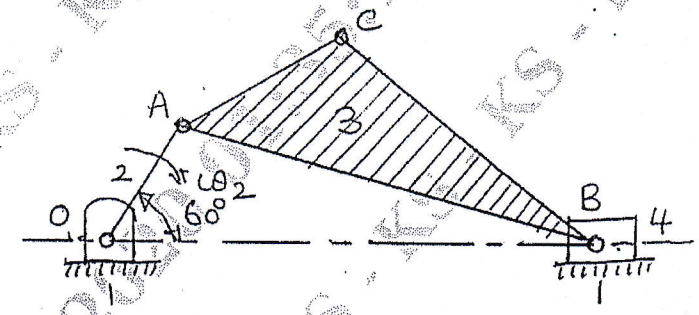

Fig. Q3

OR

4 a. State and Prove Kennedy's theorem. **(06 Marks)**

b. Determine the velocity and acceleration of the piston by Klein construction to the following specification: Stroke = 300 mm, Ratio of length of connecting rod to crank radius = 4, Speed of the engine = 300 rpm, Position of crank = 45° with inner dead centre. **(14 Marks)**

Module-3

5 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 the crank has turned through an angle of 45° from the inner dead centre and rotating at a speed of 240 rpm counter clockwise direction by complex number approach. **(20 Marks)**

OR

6 a. Explain function generation for 4-bar mechanism. (05 Marks)

b. Design a 4 link mechanism, if the motion of input and output links are governed by a function $y = x^{1.5}$ and x varies from 1 to 4. Assume θ is vary from 30° to 120° and ϕ from 60° to 130°. The length of the fixed link is 30 mm. Use Chebyshev spacing of accuracy points. (15 Marks)

Module-4

7 a. State and prove law of gearing. (06 Marks)

b. Derive an expression for path of contact. (06 Marks)

c. The two spur gears 19 and 47 teeth are in mesh. The module is 6.5 mm and pressure angle is 20°. Determine the number of pair in contact and the angle turned by the larger gear when one pair of teeth in contact. (08 Marks)

OR

8 a. Explain reverted gear train with neat figure. (05 Marks)

b. An epicyclic gear train consists of a sunwheel (S), a stationary internal gear (E) and 3 Identical planet wheels (P) carried on a star shaped planet carrier (C). The size of different toothed wheels are such that the planet carrier C rotates at $\frac{1}{5}$ of the speed of the sun wheel. The minimum number of teeth on any wheel is 16. The drilling torque on the sunwheel is 100 N-m. Determine (i) The number of teeth on different wheels of train. (ii) Torque necessary to keep the internal gear stationary. (15 Marks)

Module-5

9 The following data relate to cam profile in which the roller moves with SHM during ascent and UARM during descent. Minimum radius of cam = 30 mm, Roller radius = 8 mm, Lift = 28 mm, Offset of the 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 in counter clockwise direction. Draw the profile of the cam and determine the maximum velocity and acceleration during outstroke and return stroke. (20 Marks)

OR

10 A suction valve of a 4-stroke petrol engine is operated by a symmetrical circular cam with a flat faced follower. The details are as follows, lift = 10 mm, least radius = 20 mm, nose radius = 2.5 mm, crank angle when suction valve opens after TDC = 4°, Crank angle when suction valve closes after BDC = 50°, Cam shaft speed = 600 rpm. Determine maximum velocity of the valve and its maximum acceleration and retardation. Also determine the minimum force exerted by the springs to overcome the inertia of moving parts weighing 250 gm. (20 Marks)

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CBCS SCHEME

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17ME43

Fourth Semester B.E. Degree Examination, Aug./Sept. 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 thermodynamic data hand book is permitted.***

Module-1

1 a. State any 2 assumptions for Air Standard Cycle and obtain air standard efficiency expression for diesel cycle. **(10 Marks)**

b. An air standard limited pressure cycle has a compression ratio of 15 and compression begins at 0.1 MPa, 40°C. The maximum pressure is limited to 6 MPa and the heat added is 1.675 MJ/kg. Compute (i) The heat supplied at constant volume per kg of air (ii) The heat supplied at constant pressure per kg of air (iii) The cycle efficiency (iv) The cut-off ratio (v) The M.E.P of the cycle. **(10 Marks)**

OR

2 a. With the help of line diagram and T-S diagram, explain intercooling and reheating in gas turbine cycles. **(10 Marks)**

b. A gas turbine working on Brayton cycle receives air at 1 bar and 27°C . The air is compresed adiabatically to 6.2 bar with efficiency of the compressor being 88%. The fuel has a heating value of 44180 kJ/kg and the fuel air ratio is 0.017 kg fuel/kg air. The efficiency of the turbine is 90%. Calculate (i) Compressor work (ii) Turbine work and (iii) Thermal efficiency. **(10 Marks)**

Module-2

3 a. Explain the types of feed water heater using flow and T-S diagram. **(10 Marks)**

b. A turbine is supplied with steam at a pressure of 32 bar and temperature of 410°C. The steam then expands isentropically to a pressure of 0.08 bar. Find the dryness fraction at the end of expansion and thermal efficiency of the cycle.
If the steam is reheated at 5.5 bar to a temperature of 400°C and then expanded isentropically to a pressure of 0.08 bar, what will be the dryness fraction and thermal efficiency of the cycle. **(10 Marks)**

OR

4 a. Discuss the effect of condenser pressure and Boiler pressure in Rankine cycle. **(08 Marks)**

b. Write any two desirable characteristics of the working fluid used in vapour power cycle. **(02 Marks)**

c. A 40 MW steam power plant working on Rankine cycle operates between boiler pressure of 4 MPa and condenser pressure of 10 KPa. The steam leaves the boiler and enters the steam turbine at 400°C. The isentropic efficiency of the steam turbine is 85%.
Determine (i) The cycle efficiency (ii) The quality of exhaust steam from the turbine and (iii) the steam flow rate in kg per hour. Consider pumpwork. **(10 Marks)**

Module-3

5 a. Define stoichimetric air, actual air, excess air and combustion efficiency. **(08 Marks)**

b. Calculate the air-fuel ratio for burning of propane (C_3H_8) with 130 percent theoretical air. **(08 Marks)**

c. Explain Detonation in SI engine. **(04 Marks)**

OR

6 a. With P-θ diagram, explain the stages of combustion in SI engine. **(08 Marks)**

b. In a test on a 3-cylinder, 4-stroke IC engine with 22 cm bore and 26 cm stroke, the following were the observations during a trail period of one hour.
Fuel consumption = 8 kg, Calorific value = 45000 kJ/kg
Total revolutions of the Crankshaft = 12000
Mean effective pressure = 6 bar
Net load on brake = 1.5 kN
Brake drum diameter = 1.8 m, Rope diameter = 3 cm
Mass of cooling water = 550 kg
Inlet temperature of water = 27°C
Exit temperature of water = 55°C
Air consumed = 300 kg, Ambient temperature = 30°C
Exhaust gas temperature = 310°C
Specific heat of gases = 1.1 kJ/kg K
Calculate (i) Indicated and brake power (ii) Mechanical efficiency
(iii) Indicated thermal efficiency
Also draw a heat balance sheet on minute and percent basis. **(12 Marks)**

Module-4

7 a. Explain any two factors affecting the performance of a simple vapour compression system. **(06 Marks)**

b. With a neat sketch, explain steam jet refrigeration. **(06 Marks)**

c. A simple vapour compression plant produces 5 tonnes of refrigeration. The enthalpies of the working fluid at inlet to the compressor, at exit of compressor and at exit from the condenser are 183.19 KJ/kg, 209.41 KJ/kg and 74.59 KJ/kg respectively. Estimate (i) The refrigerant flow rate (ii) COP of the plant (iii) Power required to drive the compressor and (iv) the rate of heat rejection in the condenser. Assume that vapour is dry saturated at the end of compression. **(08 Marks)**

OR

8 a. Explain the following: (i) Adiabatic mixing of air (ii) Heating and Humidification (iii) Cooling and dehumidification. **(12 Marks)**

b. The dry and the wet bulb temperature of atmosphere air at 1 atm (101.325 KPa) pressure are measured with a sling psychrometer and determined to be 25 and 15°C respectively. Determine (i) Specific humidity (ii) Relative humidity (iii) The enthalpy of air (iv) DPT. Use properties of table only. **(08 Marks)**

Module-5

9 a. Derive an expression for workdone with clearance volume. **(08 Marks)**

b. A single acting air compressor has a cylinder bore of 15 cm and a piston stroke of 25 cm. The crank speed is 600 rpm. Air taken from atmosphere (1 bar and 27°C) is delivered at 11 bar. Assuming that both the compression and expansion processes are according to the law $PV^{1.25}$ = constant and the clearance is 5%. Determine (i) Power required to drive the compressor, assuming mechanical efficiency as 80% (ii) The time required to deliver 1 m^3 of air as measured at compressor outlet conditions, (iii) Volumetric efficiency. **(12 Marks)**

OR

10 a. Explain the shapes of nozzle. **(06 Marks)**

b. In a 2-stage air compressor, the work output is found to be 350 KJ/kg of air. It is used to compress 1 kg of free air from 1 bar pressure and 32°C initial temperature. The value of n = 1.3 and R = 0.287 KJ/kgK. Find the intermediate pressure. **(06 Marks)**

c. Obtain an expression for volumetric efficiency of compressor. **(08 Marks)**

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CBCS SCHEME

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17ME44

Fourth Semester B.E. Degree Examination, Aug./Sept.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. Explain the following properties of fluids, state their units of measurements in S.I.
(i) Weight density (ii) Specific volume
(iii) Dynamic viscosity (iv) Kinematic viscosity **(08 Marks)**

b. Explain the phenomenon of capillarity. Obtain an expression for capillarity rise of a liquid. **(06 Marks)**

c. Find the kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second. **(06 Marks)**

OR

2 a. What do you understand by
(i) total pressure
(ii) centre of pressure
(iii) gauge pressure
(iv) vacuum pressure **(08 Marks)**

b. A circular plate 3m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4m and 1.5m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. **(06 Marks)**

c. A position of 15696 kN displacement is floating in water. A weight of 245.25 kN is moved through a distance of 8m across the deck of pontoon, which tilts the pontoon through an angle 4°. Find meta centric height of the pontoon. **(06 Marks)**

Module-2

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

b. Derive continuity equation for the 3-dimensional flow in Cartesian coordinates. **(08 Marks)**

c. The stream function for a two dimensional flow is given by $\psi = 2xy$. Calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ. **(06 Marks)**

OR

4 a. What is pitot tube? How will you determine the velocity at any point with the help of pitot tube? **(06 Marks)**

b. A horizontal venturimeter with inlet dia 20 cms and throat dia 10 cms is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 lit/s. Find the reading of the oil mercury differential manometer. Take $C_d = 0.98$. **(08 Marks)**

c. A pipe of diameter 400 mm carries water at a velocity of 25 m/s. The pressure at the points A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively. While the datum head at A and B are 28 m and 30 m. Find the loss of head between A and B. **(06 Marks)**

Module-3

5 a. Derive Hagen Poiseuille equation for laminar flow through a circular pipe. **(10 Marks)**

b. An oil of viscosity 0.2 NS/m^2 and specific gravity 0.85 flows through a circular pipe of diameter 75 mm and length 250 m. The rate of flow of oil though the pipe is 5 lps. Find the pressure drop in a length of 250 m and the shear stress at the pipe wall. **(10 Marks)**

OR

6 a. Derive Darcy-Weigh Bach equation for a fluid flow through a pipe. **(10 Marks)**

b. Determine the rate of flow of water through a pipe of diameter 20 cms and length 50 m when one end of the pipe is connected to a tank and the other end of the pipe is open to the atmosphere. The pipe is horizontal and height of water in the tank is 4m above the centre of the pipe. Consider all minor losses and take coefficient of friction f = 0.009. **(10 Marks)**

Module-4

7 a. Define: (i) Drag (ii) Lift (iii) Stream line body
(iv) Bluff body (v) Displacement thickness **(10 Marks)**

b. A flat plate 1.5 m × 1.5 m moves at 50 km/hr in stationary air of density 1.15 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) power required to keep the plate in motion **(10 Marks)**

OR

8 a. Define the terms dimensional analysis and model analysis. **(04 Marks)**

b. What are the methods of dimensional analysis? Describe the Rayleigh method of the dimensional analysis. **(06 Marks)**

c. Using Bucklingham's π-theorem, show that the velocity through a circular orifice is given $V = \sqrt{29H}\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H is the head causing the flow, D is the diameter of the orifice, μ is coefficient of viscosity, ρ is the mass density and g is acceleration due to gravity. **(10 Marks)**

Module-5

9 a. Define the following terms:
(i) Internal energy (ii) Enthalpy (iii) Mach number
(iv) Subsonic (v) Supersonic **(10 Marks)**

b. A projectile travels at speed of 1500 km/hr at 20°C temperature and 0.1 MPa air pressure. Calculate the Mach number and Mach angle. Take γ = 1.4 for air and R = 287 J/kgK. **(10 Marks)**

OR

10 a. Explain the necessity of CFD. Mention its applications and limitations. **(10 Marks)**

b. Find the Mach number when an aeroplane is flying at 1100 km/hr through still air having a pressure of 7 N/cm^2 and temperature −5°C. Wind velocity may be taken as zero. Take R = 287.14 J/kgK. Calculate the pressure, temperature and density of air at stagnation point on the nose of the plane. Take γ = 1.4. **(10 Marks)**

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CBCS SCHEME

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17ME45B/17MEB405

Fourth Semester B.E. Degree Examination, Aug./Sept.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. How machine tools are classified? **(08 Marks)**
b. With a neat sketch, explain the specification of lathe. **(08 Marks)**
c. Differentiate between upmilling and down milling. **(04 Marks)**

OR

2 a. Draw a neat sketch of a lathe and briefly explain its parts. **(10 Marks)**
b. Draw a neat sketch of a drilling machine and explain construction. **(10 Marks)**

Module-2

3 a. List out the different types of motions in machine tool. **(08 Marks)**
b. Differentiate between shaper and planer machine tool. **(08 Marks)**
c. Explain briefly about the effect of machining parameters. **(04 Marks)**

OR

4 a. List out the different lathe operations. Explain any two of them. **(08 Marks)**
b. List out the different milling operations. Explain Gang-milling and End milling operations. **(08 Marks)**
c. Explain the working principal of cylindrical grinding machine. **(04 Marks)**

Module-3

5 a. Briefly discuss the characteristics of cutting tool materials. **(08 Marks)**
b. With a neat sketch, explain the geometry of single point cutting tool. **(08 Marks)**
c. Mention the functions of cutting fluids. **(04 Marks)**

OR

6 a. List out the different types of cutting tool materials. Explain H.S.S. and cemented carbide. **(08 Marks)**
b. Briefly explain the nomenclature of drill bit with a neat sketch. **(06 Marks)**
c. List out the different types of cutting fluids. Explain any two of them. **(06 Marks)**

Module-4

7 a. Briefly explain the different types of chips formed during metal cutting process. **(08 Marks)**
b. Draw a merchant's circle diagram, mention its notations and state its assumptions. **(08 Marks)**
c. The following details relates to an orthogonal cutting operation. Feed = 1.25mm/rev, chip thickness = 2mm, rake angle of tool = 10°. Calculate the chip thickness ratio and shear angle. **(04 Marks)**

OR

8 a. Explain orthogonal and oblique cutting in metal cutting process. **(08 Marks)**
b. With a neat sketch, explain mechanics of drilling operation. **(06 Marks)**
c. Index 87 divisions on a work piece using compound indexing. **(06 Marks)**

Module-5

9 a. Define tool wear. Explain the forms of tool wear. **(08 Marks)**
b. Explain briefly about different choices to minimize the cost of tool life and production time. **(06 Marks)**
c. A 50mm bar of steel was turned at 284rpm and tool failure occurred after 10min. The speed was changed to 232rpm and the tool failed in 60min of cutting time. What cutting speed should be used to obtain 30min of tool life? **(06 Marks)**

OR

10 a. Briefly discuss about the effect of cutting parameters on tool life. **(08 Marks)**
b. Explain the Taylor's tool life equation. **(06 Marks)**
c. Briefly explain the tool wear mechanisms. **(06 Marks)**

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CBCS SCHEME

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17ME46B/17MEB406

Fourth Semester B.E. Degree Examination, Aug./Sept.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 from Industrial point of view? **(08 Marks)**

b. Explain the necessary sketch the imperial standard yard and highlight the significance of Airy points. **(06 Marks)**

c. What care should be taken for the Metrological Instruments in the laboratory? **(06 Marks)**

OR

2 a. Three 100mm end bars are measured on a level comparator by first wiring them together and comparing with 300mm bar. There was error of 0.03 mm and three bars together have total error of 0.064mm less than the standard bar. Bar A is 0.02mm longer than bar B and 0.025mm longer than bar C. Determine actual dimensions of all end bars. **(08 Marks)**

b. Explain with an example for optical Instrument for angular measurements. **(08 Marks)**

c. Describe with a neat sketch wringing phenomenon of slip gauge. **(04 Marks)**

Module-2

3 a. Define a fit. Explain the types of the fits. **(06 Marks)**

b. Explain the hole basis system and shaft basis system **(08 Marks)**

c. Write a short notes on Geometric Dimensional Tolerances (GD and T) **(06 Marks)**

OR

4 a. With a neat sketch, explain Johansson Mikrokator. **(08 Marks)**

b. What are comparators? How do they differ from measuring Instruments? **(06 Marks)**

c. Differentiate measuring instruments, gauges and comparators. **(06 Marks)**

Module-3

5 a. Explain the two wire method of measuring the effective diameter of the screw.thread. **(08 Marks)**

b. Derive an expression for the Chordal thickness is measured by using gear tooth vernier caliper. **(08 Marks)**

c. With a sketch show the terminology of spur gear. **(04 Marks)**

OR

6 a. Illustrate the principles of Interferometry with sketch. **(08 Marks)**

b. Explain the latest Trends in Metrology. **(06 Marks)**

c. State the advantages and applications of co-ordinate measuring machine. **(06 Marks)**

Module-4

7 a. Define Measurement. With block diagram explain the working principle of Generalized measurement system with example. **(08 Marks)**

b. Define an Error. How the errors in measurements classified? Give the reasons for each type of Errors. **(06 Marks)**

c. What are transducers? List out advantages and disadvantages of Mechanical transducer. **(06 Marks)**

OR

8 a. Explain the inherent problems observed in mechanical type intermediate modifying device. **(06 Marks)**

b. With a sketch explain the construction and important parts of a cathode ray oscilloscope. **(08 Marks)**

c. With a block diagram explain the general telemetry system. **(06 Marks)**

Module-5

9 a. Explain the working principles of hydraulic dynometer for torque measurements. **(08 Marks)**

b. Sketch and explain the working of a pirani gauge. **(06 Marks)**

c. Explain with sketches working of Proving ring. **(06 Marks)**

OR

10 a. State the laws of thermocouples. **(04 Marks)**

b. Explain the construction and working of optical pyrometer. **(08 Marks)**

c. Define gauge factor. Explain the Wheatstone bridge arrangement for strain measurements. **(08 Marks)**

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