CBCS SCHEME

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15MAT41

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

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing ONE full question from each module.*
2. *Use of statistical table can be provided.*

Module-1

1 a. Using Taylor's series method find, y(0.1) given that $\frac{dy}{dx} = x - y^2$, y(0) = 1 by considering upto third degree terms. **(05 Marks)**

b. Apply Runge Kutta method of fourth order to find an approximate value of y when x = 0.5 given that $\frac{dy}{dx} = \frac{1}{x+y}$ with $y(0.4) = 1$. Take h = 0.1. **(05 Marks)**

c. Evaluate y(0.4) by Milne's Predictor-Corrector method given that $\frac{dy}{dx} = \frac{y^2(1+x^2)}{2}$ and y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21. Apply the corrector formula twice. **(06 Marks)**

OR

2 a. Solve by Euler's modified method $\frac{dy}{dx} = \log_e(x+y)$; y(0) = 2 to find y(0.2) with h = 0.2. Carryout two modifications. **(05 Marks)**

b. Using Runge-Kutta method of fourth order find y(0.2) to four decimal places given that $\frac{dy}{dx} = 3x + \frac{y}{2}$; $y(0) = 1$. Take h = 0.2. **(05 Marks)**

c. Given $\frac{dy}{dx} = x^2(1+y)$; y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4) to four decimal places using Adam's-Bashforth predictor corrector method. Apply the corrector formula twice. **(06 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = y + x\frac{dy}{dx}$ with y(0) = 1, $y'(0) = 0$. Evaluate y(0.2) using Runge Kutta method of fourth order. Take h = 0.2. **(05 Marks)**

b. With usual notation prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(05 Marks)**

c. Express $f(x) = 2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomial. **(06 Marks)**

OR

4 a. Apply Milnes predictor corrector method to compute y(0.4) given that $\frac{d^2y}{dx^2} = 6y - 3x\frac{dy}{dx}$ and the following values: **(05 Marks)**

x	0	0.1	0.2	0.3
y	1	1.03995	1.138036	1.29865
y′	0.1	0.6955	1.258	1.873

b. State Rodrigue's formula for Legendre polynomials and obtain the expression for $P_4(x)$ from it. **(05 Marks)**

c. If α and β are the two roots of the equation $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(06 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equation in Cartesian form. **(05 Marks)**

b. Evaluate using Cauchy's residue theorem, $\int_C \frac{3z^2+z+1}{(z^2-1)(z+3)}dz$ where C is the circle $|z| = 2$. **(05 Marks)**

c. Find the bilinear transformation which maps the points $-1, i, 1$ onto the points 1, i, -1 respectively. **(06 Marks)**

OR

6 a. Find the analytic function, $f(z) = u + iv$ if $v = r^2\cos 2\theta - r\cos\theta + 2$. **(05 Marks)**

b. Evaluate $\int_C \frac{e^{2z}}{(z-1)(z-2)}dz$ where C is the circle $|z| = 3$ using Cauchy integral formula. **(05 Marks)**

c. Discuss the transformation $\omega = e^z$. **(06 Marks)**

Module-4

7 a. Find the constant C such that the function,

$$f(x) = \begin{cases} Cx^2 & \text{for } 0 < x < 3 \\ 0 & \text{Otherwise} \end{cases}$$ is a probability density function.

Also compute $P(1<X<2)$, $P(X \leq 1)$, $P(X>1)$. **(05 Marks)**

b. Out of 800 families with five childrens each, how many families would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) at most 2 girls, assume equal probabilities for boys and girls. **(05 Marks)**

c. Given the following joint distribution of the random variables X and Y.

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

Find (i) E(X) (ii) E(Y) (iii) E(XY) (iv) COV(X, Y) (v) ρ(X,Y) **(06 Marks)**

OR

8 a. Obtain the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on electric bulbs it was found that the life time of bulbs of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for,
(i) More than 2100 hours (ii) Less than 1950 hours (iii) Between 1900 and 2100 hours.
Given that $\phi(1.67) = 0.4525$, $\phi(0.83) = 0.2967$ **(05 Marks)**

c. A fair coin is tossed thrice. The random variables X and Y are defined as follows:
X = 0 or 1 according as head or tail occurs on the first toss.
Y = number of heads
Determine (i) The distribution of X and Y (ii) Joint distribution of X and Y. **(06 Marks)**

Module-5

9 a. In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant. **(05 Marks)**

b. The nine items of a sample have the following values : 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ from the assumed mean 47.5. Apply student's t – distribution at 5% level of significance ($t_{0.05} = 2.31$ for 8 d.f) **(05 Marks)**

c. Find the unique fixed probability vector of the regular stochastic matrix $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$. **(06 Marks)**

OR

10 a. A sample of 100 tyres is taken from a lot. The mean life of tyres is found to be 40,650 kms with a standard deviation of 3260. Can it be considered as a true random sample from a population with mean life of 40,000 kms (use 0.05 level of significance) Establish 99% confidence limits within which the mean life of tyres is expected to lie, (given $Z_{0.05} = 1.96$, $Z_{0.01} = 2.58$) **(05 Marks)**

b. In the experiments of pea breeding the following frequencies of seeds were obtained.

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

Theory predicts that the frequencies should be in proportions 9 : 3 : 3 : 1. Examine the correspondence between theory and experiment.
$\left(\chi^2_{0.05} = 7.815 \text{ for } 3 \text{ d.f}\right)$ **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B is to A. If C was the first person to throw the ball find the probabilities that after the three throws.
(i) A has the ball (ii) B has the ball (iii) C has the ball. **(06 Marks)**

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15MATDIP41

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the rank of the matrix by
$A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ by applying elementary row transformations. **(06 Marks)**

b. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Caylery-Hamilton theorem. **(05 Marks)**

c. Solve the following system of equations by Gauss elimination method.
$2x + y + 4z = 12$, $4x + 11 - z = 33$, $8x - 3y + 2z = 20$ **(05 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ by reducing it to echelon form. **(06 Marks)**

b. Find the eigen values of $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(05 Marks)**

c. Solve by Gauss elimination method: $x + y + z = 9$, $x - 2y + 3z = 8$, $2x + y - z = 3$ **(05 Marks)**

Module-2

3 a. Solve $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$ **(05 Marks)**

b. Solve $y'' - 4y' + 13y = \cos 2x$ **(05 Marks)**

c. Solve by the method of undetermined coefficients $y'' + 3y' + 2y = 12x^2$ **(06 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^x$ **(05 Marks)**

b. Solve $y'' + 4y' - 12y = e^{2x} - 3\sin 2x$ **(05 Marks)**

c Solve by the method of variation of parameter $\frac{d^2y}{dx^2} + y = \tan x$ **(06 Marks)**

Module-3

5 a. Find the Laplace transform of
i) $e^{-2t}\sin h\,4t$ ii) $e^{-2t}(2\cos 5t - \sin 5t)$ **(06 Marks)**

b. Find the Laplace transform of $f(t) = t^2$ $0 < t < 2$ and $f(t + 2) = f(t)$ for $t > 2$. **(05 Marks)**

c. Express $f(t)=\begin{cases} t & 0<t<4 \\ 5 & t>4 \end{cases}$ interms of unit step function and hence find L[f(t)]. **(05 Marks)**

OR

6 a. Find the Laplace transform of i) t cosat ii) $\frac{\cos at-\cos bt}{t}$ **(06 Marks)**

b. Given $f(t)=\begin{cases} E & 0<t<a/2 \\ -E & a/2<t<a \end{cases}$ where f(t + a) = f(t). Show that $L[f(t)]=\frac{E}{S}\tan h\left(\frac{as}{4}\right)$. **(05 Marks)**

c. Express $f(t)=\begin{cases} 1 & 0<t<1 \\ t & 1<t\le 2 \\ t^2 & t>2 \end{cases}$ interms of unit step function and hence find L[f(t)]. **(05 Marks)**

Module-4

7 a. Find the inverse Laplace transform of i) $\frac{2s-1}{s^2+4s+29}$ ii) $\frac{s+2}{s^2+36}+\frac{4s-1}{s^2+25}$ **(06 Marks)**

b. Find the inverse Laplace transform of $\log\sqrt{\frac{s^2+1}{s^2+4}}$ **(05 Marks)**

c. Solve by using Laplace transforms $y''+4y'+4y=e^{-t}$, given that y(0) = 0, y'(0) = 0. **(05 Marks)**

OR

8 a. Find the inverse Laplace transform of $\frac{1}{(s+1)(s+2)(s+3)}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\cot^{-1}\left(\frac{s+a}{b}\right)$. **(05 Marks)**

c. Using Laplace transforms solve the differential equation $y'''+2y''-y'-2y=0$ given y(0) = y'(0) = 0 and y''(0) = 6. **(05 Marks)**

Module-5

9 a. State and prove Baye's theorem. **(06 Marks)**

b. The machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage of defective output 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 was produced by machine "C". **(05 Marks)**

c. The probability that a team wins a match is 3/5. If this team play 3 matches in a tournament, what is the probability that i) win all the matches ii) lose all the matches. **(05 Marks)**

OR

10 a. If A and B are any two events of S, which are not mutually exclusive then $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. **(06 Marks)**

b. If A and B are events with $P(A\cup B)=7/8$, $P(A\cap B)=1/4$, $P(\overline{A})=5/8$. Find P(A), P(B) and $P(A\cap\overline{B})$. **(05 Marks)**

c. The probability that a person A solves the problem is 1/3, that of B is 1/2 and that of C is 3/5. If the problem is simultaneously assigned to all of them what is the probability that the problem is solved? **(05 Marks)**

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CBCS SCHEME

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15ME43

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With suitable assumptions, P-V and T-S diagrams, derive an expression for the air standard efficiency of a diesel cycle in terms of compression ratio and cut off ratio. **(10 Marks)**

b. A certain quantity of air at a pressure of 1 bar and temperature of 70°C is compressed isentropically until the pressure is 7 bar in an Otto cycle engine. 465 kJ of heat per kg of air is now added at constant volume. Determine: (i) Compression ratio of the engine (ii) Temperature at the end of compression (iii) Temperature at the end of heat addition. **(06 Marks)**

OR

2 a. Derive an expression for optimum pressure ratio for maximum specific work output for an ideal gas turbine cycle. **(06 Marks)**

b. A gas turbine unit has a pressure ratio of 6:1. The maximum cycle temperature is 610°C. The isentropic efficiencies of compressor and turbine are 0.8 and 0.82 respectively. Calculate the power output in KW of an electric generator geared to the turbine when the air enters the compressor at 15°C at the rate of 16 kg/s. Take C_p = 1.005 kJ/kgK and γ = 1.4 for compression, combustion and expansion processes. **(10 Marks)**

Module-2

3 a. With a neat schematic diagram, P-V and T-S diagrams, explain the working of Rankine cycle. Derive the thermal efficiency expression for the same. **(08 Marks)**

b. A 40 MW steam power plant working on Rankine cycle operates between boiler pressure of 40 bar and condenser pressure of 0.1 bar. The steam leaves the boiler and enters the steam turbine at 400°C. The isentropic efficiency of the turbine is 85%. Determine: (i) The cycle efficiency (ii) The quality of exhaust steam from the turbine (iii) Steam flow rate in kg/hr considering pump work. **(08 Marks)**

OR

4 a. With a schematic diagram and T-S diagram, explain the working of regenerative vapour cycle with open feed water heaters. Derive the thermal efficiency expression for the same. **(08 Marks)**

b. A steam power plant operates on a reheat cycle. Steam in boiler at 150 bar, 550°C expands through high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through low pressure turbine to a condenser at 0.1 bar. Find: (i) Quality of steam at turbine exhaust (ii) Cycle efficiency (iii) Steam rate in kg/KWhr **(08 Marks)**

Module-3

5 a. Define the following:
i) Stoichiometric air ii) Excess air iii) Enthalpy of formation
iv) Internal energy of combustion v) Combustion efficiency **(10 Marks)**

b. Find the stoichiometric air fuel ratio for the combustion of Propane (C_3H_8) on molar and mass basis. **(06 Marks)**

OR

6 a. Explain how the frictional power of a multi cylinder engine is determined using Morse Test. **(06 Marks)**

b. During a test on a single cylinder 4-stroke cycle oil engine, the following observations were made: Bore = 30 cm, Stroke = 45 cm, duration of trial = 1 hour, total fuel consumption = 7.6 kg/hr, Speed = 200 rpm, Calorific value of fuel = 45000 kJ/kg, MFP = 6 bar, Net brake load = 1470 N, Brake drum diameter = 1.8 m, Rope diameter = 3 cm, Mass of cooling water circulated = 550 kg/hr, water enters at 15°C and leaves at 60°C, exhaust gas temperature = 300°C, ambient temperature = 20°C. Calculate: (i) Indicated power and brake power (ii) Mechanical efficiency. Draw the heat balance sheet on minute basis. Take mass of air = 360 kg/hr, C_{pg} = 1.1 kJ/kgK. **(10 Marks)**

Module-4

7 a. With a neat sketch, explain the working of a vapour absorption refrigeration system. **(06 Marks)**

b. An air refrigeration plant is to be designed according to the following specifications: Pressure of air at compressor inlet = 101 kPa, pressure of air at compressor outlet = 404 kPa, pressure loss in the inter cooler = 12 kPa, pressure loss in the cold chamber = 3 kPa, temperature of air at compressor inlet = 6°C, temperature of air at turbine inlet = 27°C, compressor and turbine efficiency = 0.85. Determine: (i) COP (ii) Power required to produce one TR (iii) Air circulation rate/TR. **(10 Marks)**

OR

8 a. Define the following terms:
(i) Specific humidity (ii) Relative humidity
(iii) Degree of saturation (iv) Dry bulb temperature. **(08 Marks)**

b. Following data refers to an air conditioning system to be designed for an industrial process for hot and wet climate:
Outside conditions = 30°C DBT, 75% RH
Required inside conditions = 20°C DBT, 60% RH
Amount of free air circulated = 20m^3/min
The required condition is to be achieved first by cooling and dehumidifying and then by heating. Find: (i) Capacity of the cooling coil in TR (ii) Capacity of the heating coil in KW (iii) Amount of water vapour removed per hour. **(08 Marks)**

Module-5

9 a. Derive an expression for the volumetric efficiency of a reciprocating air compressor. **(08 Marks)**

b. A single stage single acting compressor delivers 0.6 kg/min of air at 6 bar. The temperature and pressure at the end of suction 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 efficiency of the motor is 0.85 (iii) speed of the compressor. **(08 Marks)**

OR

10 a. Explain the following types of flows in a nozzle: (i) Frictionless adiabatic flow (ii) Frictional adiabatic flow (iii) Super saturated flow **(06 Marks)**

b. The inlet condition to a steam nozzle is 10 bar and 250°C. The exit pressure is 2 bar. Assuming isentropic expansion and negligible inlet velocity, determine: (i) throat area (ii) exit velocity (iii) exit area of the nozzle. Assume the index of expansion for super heated steam at inlet = 1.3 and mass flow rate of steam = 0.2 kg/s. **(10 Marks)**

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CBCS SCHEME

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following properties of fluid with their units:
i) Specific volume ii) Viscosity iii) Vapour pressure
iv) Compressibility v) Newtonian fluid vi) Gauge pressure **(06 Marks)**

b. State and prove Pascal's law. **(06 Marks)**

c. A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.80 and having vacuum pressure is flowing. The other end is open to atmosphere. Estimate the vacuum pressure in pipe if the difference of mercury level in the two limbs is 40 cm and the height of the fluid in the left limb from the center of pipe is 15 cm below. **(04 Marks)**

OR

2 a. Define the following:
i) Center of pressure ii) Buoyancy
iii) Meta center iv) Meta centric height **(04 Marks)**

b. Develop an expression for total force and depth of center of pressure for an inclined surface submerged in water. **(08 Marks)**

c. A solid cylinder of diameter 4.0 m has a height of 3m. Evaluate the meta centric height of the cylinder when floating in water with its axis vertical. The specific gravity of the cylinder is 0.60. **(04 Marks)**

Module-2

3 a. Compare:
i) Steady and unsteady flow
ii) One dimensional and two dimensional flow
iii) Stream line and path line **(06 Marks)**

b. Derive continuity equation in 3-D Cartesian coordinates. **(06 Marks)**

c. The velocity potential function is given by $\phi = 5(x^2 - y^2)$. Estimate the velocity components at the point (4, 5). **(04 Marks)**

OR

4 a. Explain impulse momentum equation. **(02 Marks)**

b. Derive an expression for Bernoulli's equation from first principles with assumptions made. **(10 Marks)**

c. Determine the velocity of the flow of an oil through a pipe when the difference of mercury level in a differential U-tube manometer connected to the two toppings of the pitot tube is 100 mm. Take coefficient of pitot tube 0.98 and specific gravity of oil = 0.80. **(04 Marks)**

Module-3

5 a. Define Reynold's number. Explain its importance. **(04 Marks)**

b. Analyze couette flow of fluid between two parallel plates. **(08 Marks)**

c. An oil of viscosity 10 poise flow between two parallel fixed plates which are kept at a distance of 50 mm apart. Estimate the rate of flow of oil between the plates. If the drop of pressure in a length of 1.2 m be 3.0 N/cm^2. The width of oil plate is 200 mm. **(04 Marks)**

OR

6 a. Differentiate between major loss and minor loss in pipes. **(06 Marks)**

b. What do you understand by (i) pipe in series (ii) pipes in parallel (iii) equivalent size of the pipe? **(06 Marks)**

c. Estimate the head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 lit/s. **(04 Marks)**

Module-4

7 a. Explain: (i) Boundary layer thickness (ii) Displacement thickness (iii) Momentum thickness. **(06 Marks)**

b. Illustrate the method of preventing the separation of boundary layer. **(04 Marks)**

c. An airfoil of Chord length 2m and of span 15m has an angle of attack as 6°. The air foil is moving with a velocity of 80 m/s in air where density is 1.25 kg/m^3. Estimate the weight of the airfoil and the power required to drive it. The values of coefficient of drag and lift corresponding to angle of attack are given as 0.03 and 0.5 respectively. **(06 Marks)**

OR

8 a. Explain dimensionless numbers: (i) Euler number (ii) Reynolds number (iii) Fraud number (iv) Weber number **(04 Marks)**

b. Analyze the Rayleigh's method of dimensional analysis. **(06 Marks)**

c. The frictional torque 't' of a disc of diameter 'D' rotating at a speed 'N' in a fluid at viscosity 'μ' and density 'ρ' in a turbulent flow is given by $T = D^5N^2\rho\phi\left[\frac{\mu}{D^2N\rho}\right]$. Prove this by the method of dimensions. **(06 Marks)**

Module-5

9 a. List and explain the basic thermodynamic relations of a perfect gas. **(08 Marks)**

b. What is Mach number? Explain its significance in compressible flow. **(04 Marks)**

c. A projectile travels in air of pressure 15 N/cm^2 at 10°C at speed of 1500 km/hr. Formulate the Mach number and Mach angle. Assume ν = 1.4 and R = 287 J/kg-K. **(04 Marks)**

OR

10 a. List applications, advantages and limitations of CFD. **(08 Marks)**

b. Explain with neat sketch stagnation properties of compressible flows. **(04 Marks)**

c. Evaluate the stagnation pressure, temperature, and density at the stagnation point on the nose of a plane which is flying at 800 km/hour through still air having a pressure 8.0 N/cm^2 (abs) and temperature 10°C. Take R = 287 J/kg and K = 1.4. **(04 Marks)**

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15ME45B/15MEB405

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What are machine tools? Briefly explain the types of Lathe. **(08 Marks)**

b. Differentiate any 8 differences between centre, turret and capstan lathes. **(08 Marks)**

OR

2 a. What is milling? Explain horizontal spindle column and knee type milling machine. **(08 Marks)**

b. Define Grinding. With a neat sketch explain centreless grinding machine. **(08 Marks)**

Module-2

3 a. What machining operations can be performed on Lathe, explain any 4 with neat sketch. **(08 Marks)**

b. Explain with a neat sketch, the process of
(i) Broaching (ii) Grinding
(iii) Tapping (iv) Threading **(08 Marks)**

OR

4 a. With a neat sketch explain
(i) Form milling (ii) Slot milling
(iii) Gang milling (iv) Angular milling **(08 Marks)**

b. With a neat sketch explain any 4 operations that can be performed on Drilling machine. **(08 Marks)**

Module-3

5 a. List and explain any four types of cutting tool materials. **(08 Marks)**

b. What are cutting fluids, list the functions and types of cutting fluids. **(08 Marks)**

OR

6 a. Briefly explain the terms and Angles of a single point cutting tool. **(08 Marks)**

b. What is surface finish? List and discuss the factors affecting surface finish. **(08 Marks)**

Module-4

7 a. With a neat sketch, compare between Oblique and Orthogonal cutting. **(08 Marks)**

b. With a neat diagram, explain the Basic elements of machining. Explain two different types of chip formation. **(08 Marks)**

OR

8 a. By the help of Merchant's circle diagram derive expressions to calculate all forces. **(08 Marks)**

b. In an orthogonal cutting process the following data were obtained:
Chip length obtained = 96 mm Uncut chip length = 240 mm
Rake angle used = 20° Depth of cut = 0.6 mm
Horizontal component of cutting force = 2400 N
Vertical components of cutting force = 240 N.
Calculate for the given data:
(i) Shear plane angle (ii) Chip thickness
(iii) Friction Angle (iv) Resultant cutting force **(08 Marks)**

Module-5

9 a. Explain the different tool wear mechanisms. **(08 Marks)**

b. What is tool failure? Explain the types of tool failures. **(08 Marks)**

OR

10 a. What is tool life? Explain the factors affecting the tool life. **(08 Marks)**

b. The following equation for tool life is given for a turning operation $VT^{0.13}f^{0.77}d^{0.37} = C$ at V = 30 m/min, f = 0.30 mm/rev and depth of cut d = 2.5 mm. Calculate the change in tool life if the cutting speed, feed, depth of cut are increased by 25% individually and also taken together. **(08 Marks)**

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CBCS SCHEME

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15ME46B/15MEB406

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the term Metrology. State and explain the objectives of metrology. **(06 Marks)**

b. Discuss the characteristics of Line standards and End standards. **(10 Marks)**

OR

2 a. With a neat sketch, explain the working principle of Sine bar and mention its limitations. **(08 Marks)**

b. Build the angle gauges for the given angles :
i) $37^0\ 9'\ 18''$ ii) $35^0\ 32'\ 36''$ by using following table :

Degree	1	3	9	27
Minutes	1	3	9	27
Seconds	3	6	18	30

(08 Marks)

Module-2

3 a. Design a general type GO and Not GO gauges for component having 25 H_7/f_8 fit being given with usual notations.
i) i (microns) = $0.43\sqrt[3]{D} + 0.001D$ (D in mm)
ii) Upper deviation for f shaft = $-5.5\ D^{0.41}$.
iii) 25mm falls in the dia step of 18 and 30.
Take wear allowance as 10% of the gauge tolerance also determine
i) Type of fit ii) Allowance for the above fit. **(12 Marks)**

b. State the Taylor's principle for the design of limit gauge. **(04 Marks)**

OR

4 a. List the characteristics of comparators and what are the advantages of mechanical comparators. **(08 Marks)**

b. With a neat sketch, explain principal of optical comparator. **(08 Marks)**

Module-3

5 a. Explain with neat sketches, the method of measuring minor diameter of external thread and internal thread. **(08 Marks)**

b. Explain with neat sketches : i) Three wire method ii) Best size wire. **(08 Marks)**

OR

6 a. Illustrate the principle of Interferometry. **(08 Marks)**

b. With a neat sketch, explain the Tool maker's microscope. With the applications. **(08 Marks)**

Module-4

7 a. Define the following terms : i) Accuracy ii) Precision iii) Threshold iv) Calibration v) Sensitivity vi) Repeatability. **(06 Marks)**

b. Define Error. How Errors are classified? **(04 Marks)**

c. Explain any two mechanical transducers. **(06 Marks)**

OR

8 a. With a neat sketch, explain the cathode ray oscilloscope. **(08 Marks)**

b. What are Piezo – Electric transducers? Explain with neat sketches modes of operation of piezoelectric crystals. **(08 Marks)**

Module-5

9 a. With the help of neat sketch, explain working principle of proxy brake dynamometer. **(08 Marks)**

b. Describe with a neat sketch, Mcleod vaccum gauge. **(08 Marks)**

OR

10 a. What is Thermocouple? State the laws of thermo couple. **(08 Marks)**

b. Explain : i) Bonded resistance strain gauge ii) Piezo resistive strain gauge. **(08 Marks)**

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