CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, June/July 2019
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. If $y' + y + 2x = 0$, $y(0) = -1$ then find $y(0.1)$ by using Taylor's series method. Consider upto third order derivative term. **(06 Marks)**

b. Find $y(0.2)$ by using modified Euler's method, given that $y' = x + y$, $y(0) = 1$. Take $h = 0.1$ and carry out two modifications at each step. **(07 Marks)**

c. If $y' = \frac{1}{x+y}$, $y(0) = 2$, $y(0.2) = 2.0933$, $y(0.4) = 2.1755$, $y(0.6) = 2.2493$ then find $y(0.8)$ by Milne's method. **(07 Marks)**

OR

2 a. Use Taylor's series method to find $y(0.1)$ from $y' = 3x + y^2$, $y(0) = 1$. Consider upto fourth derivative term. **(06 Marks)**

b. Use Runge – Kutta method to find $y(0.1)$ from $y' = x^2 + y$, $y(0) = -1$. **(07 Marks)**

c. Use Adam – Bashforth method to find $y(0.4)$ from $y' = \frac{1}{2}xy$, $y(0) = 1$, $y(0.1) = 1.0025$, $y(0.2) = 1.0101$, $y(0.3) = 1.0228$. **(07 Marks)**

Module-2

3 a. Express $x^3 - 5x^2 + 6x + 1$ in terms of Legendre polynomials. **(06 Marks)**

b. Find $y(0.1)$, by using Runge – Kutta method , given that $y'' + xy' + y = 0$, $y(0) = 1$, $y'(0) = 0$. **(07 Marks)**

c. Solve Bessel's operation leading to $J_n(x)$. **(07 Marks)**

OR

4 a. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(06 Marks)**

b. Find $y(0.4)$ by using Milne's method, given that $y(0) = 1$, $y'(0) = 1$, $y(0.1) = 1.0998$, $y'(0.1) = 0.9946$, $y(0.2) = 1.1987$, $y'(0.2) = 0.9773$, $y(0.3) = 1.2955$, $y'(0.3) = 0.946$. **(07 Marks)**

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

Module-3

5 a. Derive Cauchy – Riemann equations in Cartesian coordinates. **(06 Marks)**

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

c. Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$, c is $|z| = 3$ by residue theorem. **(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. Discuss the transformation $W = Z^2$. **(07 Marks)**

c. Find a bilinear transformation that maps the points ∞ , i , o in Z – plane into -1 , -i , 1 in W – plane respectively. **(07 Marks)**

Module-4

7 a. In a sampling a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2, out of 1000 such samples , how many would be expected to contain atleast 3 defective parts? **(06 Marks)**

b. If X is a normal variate with mean 30 and standard deviation 5, find the probabilities that
i) $26 \le X \le 40$ ii) $X > 45$ iii) $|X - 30| > 5$.
Given that $\phi(0.8) = 0.288$, $\phi(2.0) = 0.4772$, $\phi(3) = 0.4987$, $\phi(1) = 0.3413$. **(07 Marks)**

c. The joint density function of two continuous random variables X and Y is given by

$$f(x, y) = \begin{cases} K\,xy, & 0 \le x \le 4, \quad 1 < y < 5 \\ 0, & \text{otherwise} \end{cases}$$

Find i) K ii) E(x) iii) E(2x + 3y). **(07 Marks)**

OR

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

b. The joint probability distribution for two random variables X and Y as follows :

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

Find i) Expectations of X, Y , XY ii) SD of X and Y iii) Covariance of X, Y iv) Correlation of X and Y. **(07 Marks)**

c. In a certain town the duration of shower has mean 5 minutes. What is the probability that shower will last for i) 10 minutes or more ii) Less than 10 minutes iii) Between 10 and 12 minutes. **(07 Marks)**

Module-5

9 a. A group of boys and girls were given in Intelligence test. The mean score , SD score and numbers in each group are as follows : **(06 Marks)**

	Boys	Girls
Mean	74	70
SD	8	10
X	12	10

Is the difference between the means of the two groups significant at 5% level of significance? Given that $t_{0.05} = 2.086$ for 20 d.f.

b. The following table gives the number of accidents that take place in an industry during various days of the week. Test if accidents are uniformly distributed over the week.

Day	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	14	18	12	11	15	14

Given that $X^2 = 11.09$ at 5% level for 5 d.f. **(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 following terms :
i) Type I error and type II error.
ii) Transient state.
iii) Absorbing state. **(06 Marks)**

b. A certain stimulus administered to each of the 12 patients resulted in the following increases of blood pressure : 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will be general be accompanied by an increase in blood pressure. Given that $t_{0.05} = 2.2$ for 11 d.f. **(07 Marks)**

c. If $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$. Find the corresponding stationary probability vector. **(07 Marks)**

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17ME42

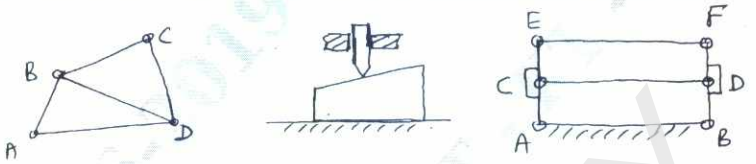
Fourth Semester B.E. Degree Examination, June/July 2019
Kinematics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define 'degree of freedom' and find degree of freedom for the chains shown in Fig.Q1(a).



(i) (ii) (iii) AB = CD = EF & AE = BF

Fig.Q1(a) **(10 Marks)**

b. Define 'inversion of a kinematic chain'. A four bar mechanism has links of lengths 150mm, 250mm, 300mm and frame L_0 mm. Find the range of L_0 if the mechanism has to work as (i) Double crank mechanism (ii) Crank-rocker mechanism. **(10 Marks)**

OR

2 a. Sketch a neat, proportionate 'Peaucellier's mechanism'. State geometric relationships among links. Identify the point tracing the straight line and prove that the point traces straight line. **(10 Marks)**

b. Draw 'Crank and Slotted lever' type of quick return motion mechanism showing the positions of crank clearly for extreme positions of lever. If the crank and frame are 200 mm, 800mm, find the ratio of time of return to time of cutting if the crank rotates uniformly. Also find angle of oscillation of lever. **(10 Marks)**

Module-2

3 In a four bar mechanism ABCD, AD is fixed link of 120 mm long. The crank AB is 30mm and rotates at 100 rpm clockwise, while CD = 60 mm oscillates about D. BC and AD are of same length. Find the angular velocity of link CD when angle BAD = 60° by
(i) relative velocity method (ii) instantaneous centre method. **(20 Marks)**

OR

4 a. State and prove Kennedy's theorem. **(08 Marks)**

b. Explain the procedure to construct 'Klein's construction' to determine the velocity and acceleration of a slider crank mechanism in which crank is rotating uniformly. **(12 Marks)**

Module-3

5 a. For the slider crank mechanism shown in Fig.Q5(a), write (i) loop closure equation (ii) differentiate loop closure equation with respect to time to get velocity equation (iii) differentiate velocity equation with respect to time to get acceleration equation.

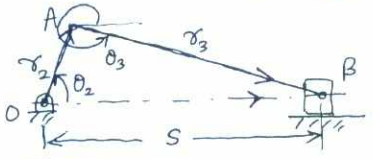


Fig.Q5(a) **(08 Marks)**

b. In Fig.Q5(a), if r_2 = 100mm r_3 = 350mm, θ_2 = 60°, find angular velocity and angular acceleration of connecting rod if crank rotates uniformly at 600 rpm in CCW direction. **(12 Marks)**

OR

6 a. For the 4-bar mechanism shown in Fig.Q6, obtain Frendenstein's equation. **(08 Marks)**

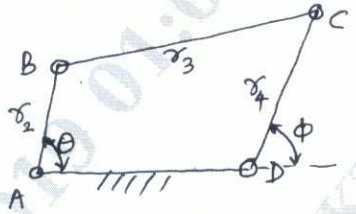


Fig.Q6

b. Find r_2, r_3 and r_4 to generate a function $y = x^3$, $1 \le x \le 3$ accurate at x = 1.1339, x = 2 and x = 2.866 if r_1 = 100mm, $\theta_s = 30°$, $\theta_f = 90°$, $\phi_s = 45°$ and $\phi_f = 135°$ with respect to Fig.Q6. **(12 Marks)**

Module-4

7 a. Define 'pitch circle', 'circular pitch', 'diametral pitch' and 'module'. **(08 Marks)**

b. Obtain an expression for the minimum number of teeth on pinion to avoid interference. **(12 Marks)**

OR

8 An epicyclic gear train consists of a sun-wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. The size of different tooth wheels are such that the planet carrier C rotates at $1/5^{th}$ of the speed of the sunwheel S. The no. of teeth on sun-wheel is 16. The driving torque on the sun-wheel is 100 N-m. Determine (i) no. of teeth on P and E. (ii) Torque required to keep the internal gear stationary. **(20 Marks)**

Module-5

9 From the following data draw the profile of a cam in which the follower moves with SHM during ascent while it moves with uniform acceleration and deceleration during descent.

Cam rotates in anticlockwise ; Lift of follower : 4 cm

Least radius of cam : 5 cm ; Angle of ascent : 48°

Angle of dwell between ascent and descent : 42° ;

Angle of descent = 60°

The diameter of roller = 3 cm

If cam rotates at 360 rpm, find maximum velocity and acceleration of the follower during descent. **(20 Marks)**

OR

10 a. Explain with sketch in brief 'radial cam' and 'cylindrical cam'. **(06 Marks)**

b. Obtain expressions for displacement, velocity and acceleration for a flat faced follower in contact with circular flank of a cam. **(14 Marks)**

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17ME43

Fourth Semester B.E. Degree Examination, June/July 2019
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. Draw neat P-V and T-S diagram of air standard dual cycle and derive an expression for air standard efficiency in terms of compression ratio, explosion ratio and cut-off ratio. Under what conditions the dual cycle becomes Otto and Diesel cycle. **(10 Marks)**

b. An air standard diesel cycle has a compression ratio 16. The temperature before compression is 27°C and the temperature after expansion is 627°C. Compute:
i) Cut-off ratio
ii) The net work output per unit mass of air
iii) Thermal efficiency
iv) Mean effective pressure in bar. **(10 Marks)**

OR

2 a. Explain with schematic diagram and T-S diagram Brayton cycle with i) Regenerator and ii) Inter-cooler and write equation for the thermal efficiency. **(10 Marks)**

b. Derive an expression for optimum pressure ratio and maximum pressure ratio for maximum work output in terms of minimum temperature, maximum temperature of Brayton cycle and what is the relation between the two. **(10 Marks)**

Module-2

3 a. With the help of schematic diagram, T-S diagram and h-s diagram, explain regenerative vapour power cycle with one open feed water heater and derive an expression for its thermal efficiency. **(10 Marks)**

b. A simple Rankine cycle works between the boiler pressure of 30bar and condenser pressure of 0.04Bar. The supply steam to the turbine is drysaturated, determine Rankine cycle efficiency. If the supply steam to the turbine is superheated by 66°C, what is the effect on the Rankine efficiency? **(10 Marks)**

OR

4 a. With the help of schematic diagram and T-S diagram explain binary vapour power cycle. List the properties of an ideal binary fluid. **(10 Marks)**

b. A reheat cycle operating between 30 bar and 0.04 bar pressure. The temperature of steam supplied from boiler is 450°C. The first stage of expansion takes place till the steam is dry saturated and then reheated to 450°C and then expanded in second in stage.
Determine:
i) Reheat pressure
ii) Quality of exhaust steam
iii) Ideal cycle efficiency
iv) Steam Rate
v) Back-pressure ratio. **(10 Marks)**

Module-3

5 a. List the methods used for finding out indicated power of an internal combustion engine. Explain the method applicable to multi-cylinder engine. **(08 Marks)**

b. The products of combustion of an unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat's apparatus:
$CO_2 = 8\%$, $CO = 0.9\%$, $O_2 = 8.8\%$, $N_2 = 82.3\%$. Determine:
i) The composition of fuel
ii) A:F ratio
iii) The percentage excess air used. **(12 Marks)**

OR

6 a. Explain the following terms with reference to a combustion process:
i) Enthalpy of formation
ii) Adiabatic flame temperature
iii) Combustion efficiency
iv) Stoichiometric air. **(08 Marks)**

b. A gas engine working on constant volume cycle gave the following results during a one hour test run:
Cylinder diameter : 24cm, stroke 48cm, effective diameter of brake drum 1.25m, net load on the brake 1236N, Average speed 226.7 RPM, Average explosions per minute 77, MEP 7.5 bar, gas used 13m^3 at 15°C and 771 mm of mercury pressure, calorific value of gas 22000 kJ/m^3 at NTP. Cooling water used 625kg, rise in temperature of cooling water 35°C. Determine, mechanical efficiency, brake thermal efficiency indicated thermal efficiency, also draw up a heat balance sheet for the engine on percentage basis. Take NTP conditions as 760mm of mercury and 0°C. **(12 Marks)**

Module-4

7 a. With the help of schematic diagram and appropriate psychrometric diagram explain summer air conditioning system for hot and dry outdoor condition. **(10 Marks)**

b. A vapor compression plant uses R-12 and is to develop 5 tonnes of refrigeration. The condenser and evaporator temperature are to be 40°C and -10°C respectively. The vapor is dry saturated at compressor inlet and there is no under cooling. Determine:
i) Refrigerant flow rate in kg/sec
ii) The compressor discharge temperature
iii) The pressure ratio
iv) COP of the plant. **(10 Marks)**

OR

8 a. Explain the following with the help of P-h and T-S diagram the effect of under cooling the liquid refrigerant and super heating the vapor refrigerant on the performance of VCR cycle. **(10 Marks)**

b. It is required to design an air conditioning plant for a office room with the following conditions:
Outdoor conditions – 14°C DBT and 10°C WBT
Required conditions – 20°C DBT and 60% RH
Amount of air circulation – 0.30m^3/min/person
Seating capacity of office – 60 persons.
The required condition is achieved by heating and then by adiabatic humidification. Determine: i) Heating capacity of the coil in KW and surface temperature required if the bypass factor of the coil is 0.4 ii) The capacity of the humidifier. Also draw the flow diagram. **(10 Marks)**

Module-5

9 a. Obtain an expression for the volumetric efficiency of a single stage air compressor in terms of pressure ratio, clearance and 'h' the exponent of expansion and compression. Why intercooling is necessary in multistage compression? **(10 Marks)**

b. A singe stage single acting air compressor has cylinder bore of 15cm and Piston stroke of 25cm. The crank speed is 600rpm. The air taken from the atmosphere is at 1 bar and 27°C and delivered at 11 bar. Assuming both expansion and compression processes are according to the law $PV^{1.25}$ = constant and clearance is 5%. Determine: i) Power required to drive the compressor, assuming mechanical efficiency as 80%; ii) What will be change in power required to drive the compressor if clearance is 10% with other conditions remaining same. **(10 Marks)**

OR

10 a. What is critical pressure ratio? Derive an expression for pressure ratio which gives maximum discharge through the nozzle. **(10 Marks)**

b. The steam expands from 3 bar to 1 bar in a nozzle. The initial velocity is 90m/s and initial temperature is 150°C. Determine the exit velocity of steam:

i) If expansion is isentropic in nozzle

ii) The nozzle efficiency is 95%. **(10 Marks)**

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17ME44

Fourth Semester B.E. Degree Examination, June/July 2019
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 properties of fluids with their SI units:
(i) Mass Density (ii) Weight Density (iii) Dynamic viscosity (iv) Kinematic viscosity. **(08 Marks)**

b. Derive an expression for pressure intensity in case of a soap bubble. **(04 Marks)**

c. A cubical block of sides 1m and weighing 350 N slides down on inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5 vertical to 12 horizontal and has an oil film of 1.0mm thickness. Calculate the dynamic viscosity of oil in poise. **(08 Marks)**

OR

2 a. Define (i) Buoyancy (ii) Centre of Buoyancy (iii) Meta-centre (iv) Meta-centric height. **(08 Marks)**

b. Explain the method to find the Meta-centric height experimentally. **(04 Marks)**

c. A block of wood of specific gravity 0.7 floats in water. Determine te Meta-centric height of the block, if its size is 2m × 1m × 0.8m. **(08 Marks)**

Module-2

3 a. Explain different types of fluid flows with examples. **(08 Marks)**

b. Derive the continuity equation for the 3-Dimensional flow in Cartesian co-ordinates. **(08 Marks)**

c. A stream function is given by $\psi = 3xy$. Determine whether the flow is possible or not. **(04 Marks)**

OR

4 a. Derive an expression for force exerted by the jet on stationary flat vane. **(04 Marks)**

b. Derive Euler's equation of motion along a stream line and deduce Bernoulli's equation. State the assumptions made. **(10 Marks)**

c. A sub-marine moves horizontally in sea, A pitot static tube placed in front of sub-marine and along its axis is connected to the two limbs of U-tube manometer containing mercury. The difference of mercury level is found to be 200mm. Find the speed of the sub-marine in km/hr. take specific of gravity of mercury as 13.6 and sea water as 1.026, $C_V = 0.98$. **(06 Marks)**

Module-3

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

b. Oil is to be transported from a tanker to the shore at the rate of 5 lt/sec, using a 300mm diameter pipe for 20km length. If $\mu = 0.1$ N-m/s^2 and $\rho = 900$ kg/m^3 for the oil, calculate the power required to maintain the flow. **(10 Marks)**

OR

6 a. Write a short note on Moody's diagram. **(04 Marks)**

b. Three pipes of lengths 800m, 500m and 400m and diameters 500mm, 400mm and 300mm respectively are connected in series. These pipes are replaced by a single pipe of 1700m length. Find the diameter of the single pipe. **(06 Marks)**

c. Water is supplied to the inhabitants of a college campus through a supply main. The following data is obtained:
- Distance of the reservoir from the campus = 4 km
- Number of inhabitants = 3000
- Consumption of water per day of each inhabitant = 180 litre.
- Loss of head due to friction = 18 m
- Co-efficient of friction for the pipe, f = 0.007

If half of the daily supply is pumped in 08 hours, determine the size (diameter) of the supply main. **(10 Marks)**

Module-4

7 a. Define the drag force and lift force. Also derive their expressions. **(10 Marks)**

b. Derive an expression for displacement thickness and momentum thickness of a flow over a plat. **(10 Marks)**

OR

8 a. Explain the dimensional homogeneity with examples. **(04 Marks)**

b. Check whether the following equations (with their usual notations) are dimensionally homogeneous or not:

(i) $V = \sqrt{2gh}$ (ii) $h_f = \frac{4f\,LV^2}{2gd}$ (iii) P = WQH **(06 Marks)**

c. Show by the method of dimensional analysis that, for a screw propeller, the relation between the thrust 'F', torque 'T', diameter 'D', speed of travel 'U', speed of rotation 'N', density 'ρ' and viscosity 'μ' may be put in the form

$$F = \rho D^2 U^2 \phi\left[\frac{\rho D^3 U^2}{T}, \frac{DN}{U}, \frac{\rho UD}{\mu}\right]$$

[Hint: take D, U and ρ as repeating variables.] **(06 Marks)**

Module-5

9 a. Define the following terms:
(i) Sub-Sonic flow (ii) Sonic flow (iii) Super-Sonic flow (iv) Mach Number **(08 Marks)**

b. Derive an expression for velocity of sound in terms of Bulk modulus. **(06 Marks)**

c. An aeroplane flying at a height of 15 km, where the temperature is – 50°C. The speed of the plane corresponding to Mach number is 2.0. Assuming K = 1.4 and R = 287 J/kg.K, find the speed of the plane. **(06 Marks)**

OR

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

b. What are normal and oblique shocks? Explain. **(04 Marks)**

c. Find the velocity of a bullet fired in air, if the Mach angle is 30°. Temperature of air is 15°C. Assume K = 1.4 and R = 287.14 J/kg.K. **(06 Marks)**

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17ME45B/17MA45

Fourth Semester B.E. Degree Examination, June/July 2019
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. With an illustration explain construction of engine lathe. **(10 Marks)**

b. Differentiate between the following:
i) Shaper and Planner
ii) Multiple spindle and gang drilling machines. **(10 Marks)**

OR

2 a. With an illustration explain column and knee type milling machine. **(10 Marks)**

b. Give a broad classification of grinding machines. Explain horizontal spindle reciprocating table surface grinder. **(10 Marks)**

Module-2

3 a. With an illustration explain the following:
i) Thread cutting operation
ii) Horizontal and vertical shaping operations. **(10 Marks)**

b. Differentiate between the following:
i) Drilling and boring operating
ii) Reaming and milling operations. **(10 Marks)**

OR

4 Explain the following operations:
a) Planning b) Slotting c) Gear cutting d) Grinding e) Turning. **(20 Marks)**

Module-3

5 a. Explain the desirable properties of cutting tool materials. **(05 Marks)**

b. With an illustration explain geometry of single point cutting tool. **(10 Marks)**

c. What are cutting fluids and mention its characteristic? **(05 Marks)**

OR

6 a. Define the following: i) Speed ii) Feed iii) Depth of cut. **(06 Marks)**

b. A brass pin is of 500mm length and 40mm diameter. Find the turning time to reduce the pin to 38.8mm in one pass, when cutting speed is 60 metres/minute and feed is 0.8 mm/min. **(06 Marks)**

c. Find the time required for taking a complete cut on a plate 600 × 900mm, if the cutting speed is 9 metre/minute. The return time to cutting time ratio is 1:4, and the feed is 3mm. The clearance at each end is 75mm. **(08 Marks)**

Module-4

7 a. With an illustration explain orthogonal and oblique cutting process. **(10 Marks)**

b. With an illustration explain Merchants circle model for orthogonal cutting process. **(10 Marks)**

OR

8 a. In a orthogonal cutting process following data were observed, chip thickness ratio is 0.4 and rake angle used was 20° and depth of cut 0.5mm. The horizontal and vertical component of cutting forces F_H and F_V where 2000N and 200N respectively. Determine the shear plane angle, chip thickness, angle of friction and resultant cutting force. **(10 Marks)**

b. An experiment was conducted on a mild steel tube of 200mm diameter and 3mm thick. An orthogonal cut was taken with a cutting speed of 80mm and 0.15mm per revolution feed with a cutting tool having back rake angle of -10°. It was determined that cutting force = 150N, feed force = 40N. Net horse power for cutting was 3hp and chip thickness was 0.25mm. Calculate the shear strain and strain energy per volume. **(10 Marks)**

Module-5

9 a. Define tool life and explain tool life equation by Taylor relationship between cutting speed and tool life. **(10 Marks)**

b. Using Taylarian tool-life equation for machining C-40 steel with 18-4-1 HSS cutting tool at a feed of 0.2mm/rev and depth of cut of 2mm. The following V and T observations have been noted.

V (speed), m/min	25	35
T (Time), min	90	20

Calculate :

i) n and C in Taylorian equation

ii) Hence recommend the cutting speed for a desired tool life of 60 minutes. **(10 Marks)**

OR

10 a. Discuss the variation of cost elements with cutting speed in a single cut, single pass machining operation. **(10 Marks)**

b. Explain the following in connection with machining process:

i) Tool life for minimum cost

ii) Minimum production time

iii) Machining at maximum efficiency. **(10 Marks)**

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CBCS SCHEME

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17ME46B/17MEB406

Fourth Semester B.E. Degree Examination, June/July 2019
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. What is Metrology? What are the objectives of metrology? **(07 Marks)**
b. Explain Subdivision of Standards. **(08 Marks)**
c. Define Wavelength Standard. What are the advantages of wavelength standard? **(05 Marks)**

OR

2 a. Explain the Wringing Phenomena of Slip gauges. **(05 Marks)**
b. With a neat sketch, explain the working of Sine bar and mention its limitations. **(08 Marks)**
c. With a neat sketch, explain the working of Auto collimator. **(07 Marks)**

Module-2

3 a. Explain the principle of Interchangeability and Selective assembly. **(08 Marks)**
b. With neat sketches, explain different types fit. **(07 Marks)**
c. State and explain Taylor's prinoiple of gauge design. **(05 Marks)**

OR

4 a. Define Comparator. What is the need of a comparator? **(05 Marks)**
b. With a neat sketch, explain Dial Indicator. What are the advantages? **(07 Marks)**
c. Sketch and explain the working of LVDT. **(08 Marks)**

Module-3

5 a. With a neat sketch, explain screw thread terminology. **(06 Marks)**
b. Derive an expression for Best wire size for screw thread measurement. **(07 Marks)**
c. With a neat sketch, explain the working of Tools maker's microscope. **(07 Marks)**

OR

6 a. With a neat sketch, explain Gear teeth terminology. **(06 Marks)**
b. With neat sketch, explain the working of laser interferometer. **(07 Marks)**
c. With a neat sketch, explain the working of co-ordinate measuring machine. **(07 Marks)**

Module-4

7 a. Explain Generalized measurement system, with block diagram. **(07 Marks)**
b. Define : i) Accuracy ii) Threshold iii) Calibration iv) Hysteresis v) Error. **(05 Marks)**
c. What is Transducer? Sketch and explain the principle of Electronic Transducer. What are the advantages of Electronic transducers? **(08 Marks)**

OR

8 a. With a circuit diagram, explain Ballast circuit. **(08 Marks)**
b. With a block diagram, explain Telemetring system. **(06 Marks)**
c. With a neat sketch, explain stylus type Oscillography. **(06 Marks)**

Module-5

9 a. With a neat sketch, explain working of Prony brake dynamometer. What are its limitations? **(10 Marks)**

b. With a neat sketch, explain McLeod gauge. **(10 Marks)**

OR

10 a. Define Strain gauge. With a neat sketch, explain wheat stone bridge circuit. **(10 Marks)**

b. Define Thermocouple. State the law's of thermocouple and explain. **(06 Marks)**

c. Write a note on :

i) Thermo couple materials ii) Advantages and disadvantages of thermocouples . **(04 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2019
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 $\begin{bmatrix} 2 & 3 & 4 \\ -1 & 2 & 3 \\ 1 & 5 & 7 \end{bmatrix}$ by elementary row operations. **(08 Marks)**

b. Test for consistency and solve $x+y+z=6$, $x-y+2z=5$, $3x+y+z=8$. **(06 Marks)**

c. Solve the system of equations by Gauss elimination method :
$x+y+z=9$ $x-2y+3z=8$ $2x+y-z=3$ **(06 Marks)**

OR

2 a. Find all the eigen values and the corresponding eigen vectors of the matrix
$A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(08 Marks)**

b. Solve by Gauss elimination method $x_1-2x_2+3x_3=2$, $3x_1-x_2+4x_3=4$, $2x_1+x_2-2x_3=5$. **(06 Marks)**

c. If $A=\begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$ find A^{-1} by Cayley Hamilton theorem. **(06 Marks)**

Module-2

3 a. Solve $\frac{d^3y}{dx^2}-2\frac{d^2y}{dx^2}+4\frac{dy}{dx}-8y=0$. **(08 Marks)**

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

c. Solve $y''-4y'+13y=\cos 2x$. **(06 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3}+6\frac{d^2y}{dx^2}+11\frac{dy}{dx}+6y=0$. **(08 Marks)**

b. Solve $y''+2y+y=\frac{e^{\frac{x}{2}}+e^{-\frac{x}{2}}}{2}$. **(06 Marks)**

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

Module-3

5 a. Find $L[\cosh at]$. **(08 Marks)**

b. Find $L[e^{-2t}\sinh 4t]$ **(06 Marks)**

c. Find $R\{t\sin 2t\}$. **(06 Marks)**

OR

6 a. Show that $\int_0^\infty t^3 e^{-st} \sin t dt = 0$. **(08 Marks)**

b. If $f(t) = t^2$, $0 < t < 2$ and $f(t + 2) = f(t)$ for $t > 2$, find $L[f(t)]$. **(06 Marks)**

c. Express $f(t) = \begin{cases} t, & 0 < t < 4 \\ 5, & t > 4 \end{cases}$ in terms of unit step function and hence find their Laplace Transforms. **(06 Marks)**

Module-4

7 a. Find the inverse Laplace Transform of $\frac{3}{s^2} + \frac{2e^{-s}}{s^3} - \frac{3e^{-2s}}{s}$. **(08 Marks)**

b. Find $L^{-1}\left[\frac{s^3 + 6s^2 + 12s + 8}{s^6}\right]$. **(06 Marks)**

c. Find the inverse Laplace Transform of $\frac{s+5}{s^2 - 6s + 13}$. **(06 Marks)**

OR

8 a. Solve by using Laplace Transform $\frac{d^2y}{dt^2} + k^2 y = 0$, given that $y(0) = 2$, $y'(0) = 0$. **(08 Marks)**

b. Find inverse Laplace Transform of $\frac{1}{(s+1)(s+2)(s+3)}$. **(06 Marks)**

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

Module-5

9 a. Find the probability that a leap year selected at random will contain 53 Sundays. **(08 Marks)**

b. A six faced die on which the numbers 1 to 6 are marked is thrown. Find the probability of (i) 3 (ii) an odd number coming up. **(06 Marks)**

c. State and prove Bayee's theorem. **(06 Marks)**

OR

10 a. A problem is given to three students A, B, C whose chances of solving it are $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}$ respectively. Find the probability that the problem is solved. **(08 Marks)**

b. For any three events A, B, C, prove that $P\{(A \cup B)/C\} = P(A/C) + P(B/C) - P\{(A \cap B)/C\}$. **(06 Marks)**

c. Three machines A, B and C produce respectively 60%, 30% and 10% of the total number of items of a factory. The percentages 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. **(06 Marks)**

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