CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
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. Using Taylor's series method, compute the solution of $\frac{dy}{dx} = x - y^2$ with $y(0) = 1$ at $x = 0.1$, correct to fourth decimal place. **(06 Marks)**

b. Using modified Euler's formula, solve the $\frac{dy}{dx} = x + |\sqrt{y}|$ with $y(0.2) = 1.23$ at $x = 0.4$ by taking $h = 0.2$. **(07 Marks)**

c. The following table gives the solution of $\frac{dy}{dx} = x^2 + \frac{y}{2}$. Find the value of y at $x = 1.4$ by using Milne's Predictor-Corrector method.

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514

(07 Marks)

OR

2 a. Using modified Euler's method, solve $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 at $x = 20.2$ by taking $h = 0.2$. **(06 Marks)**

b. Employ the Range-Kutta method of fourth order to solve $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ at $x = 0.1$ by taking $h = 0.1$. **(07 Marks)**

c. Using Adams-Bashforth method, find y when $x = 1.4$ given $\frac{dy}{dx} = x^2(1+y)$, with y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979 **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method of fourth order solve the differential equation, $\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right)$ for $x = 0.1$. Correct to four decimal places with initial conditions $y(0) = 1$, $y'(0) = 0.5$. **(06 Marks)**

b. Obtain the series solution of Legendre Differential equation leading to Pn(x). **(07 Marks)**

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

OR

4 a. Apply Milne's method to compute y(1.4) given that $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	3.0657

(06 Marks)

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

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

Module-3

5 a. State and prove Cauchy-Riemann equations in polar form. **(06 Marks)**

b. If $V = e^{-2y} \sin 2x$, find the analytic function f(z). **(07 Marks)**

c. Find the bilinear transformation that maps the points 0, i, ∞ onto the points 1, $-i$, -1. **(07 Marks)**

OR

6 a. State and prove Cauchy's theorem on complex integration. **(06 Marks)**

b. Evaluate $\oint_C \frac{z^2+5}{(z-2)(z-3)} dz$, where $C: |z| = \frac{5}{2}$. **(07 Marks)**

c. Discuss the transformation $W = Z + \frac{1}{Z}$. **(07 Marks)**

Module-4

7 a. A box contains 100 transistors, 20 of which are defective and 10 are selected at random, find the probability that (i) all are defective (ii) at least one is defective (iii) all are good (iv) at most three are defective. **(06 Marks)**

b. Show that mean and standard deviation of exponential distribution are equal. **(07 Marks)**

c. The joint probability is,

X \ Y	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 distributions of X and Y.

(ii) Also find E(X), E(Y) and E(XY). **(07 Marks)**

OR

8 a. Find the mean and variance of binomial distribution. **(06 Marks)**

b. In an examination taken by 500 candidates the average and the standard deviation of marks obtained (normally distributed) are 40% and 10%. Find approximately,

(i) How many will pass, if 50% is fixed as a minimum?

(ii) What should be the minimum if 350 candidates are to pass?

(iii) How many have scored marks above 60%? **(07 Marks)**

c. Suppose X and Y are independent random variables with the following distributions:

x_i	1	2
$f(x_i)$	0.7	0.3

y_j	−2	5	8
$g(y_j)$	0.3	0.5	0.2

Find the joint distribution of X and Y. Also find the expectations of X and Y and covariance of X and Y. **(07 Marks)**

Module-5

9 a. The average income of persons was Rs.210 with a standard deviation of Rs.10 in sample of 100 people of a city. For another sample of 150 persons, the average income was Rs.220 with standard deviation of Rs.12. The standard deviation of the incomes of the people of the city was Rs.11. Test whether there is any significant difference between the average incomes of the localities. (Use $Z_{0.05} = 1.96$) **(06 Marks)**

b. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure : 5, 2, 8, −1, 3, 0, 6, −2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure? ($t_{0.05}$ for 11 d.f = 2.201). **(07 Marks)**

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

OR

10 a. Explain the following terms:
(i) Type I and Type II errors.
(ii) Null hypothesis.
(iii) Level of significance.
(iv) Confidence limits. **(06 Marks)**

b. Eleven school boys were given a test in mathematics carrying a maximum of 25 marks. They were given a month's extra coaching and a second test of equal difficulty was held thereafter. The following table gives the marks in two tests.

Boy	1	2	3	4	5	6	7	8	9	10	11
Marks (I test)	23	20	21	18	18	20	18	17	23	16	19
Marks (II test)	24	19	18	20	20	22	20	20	23	20	17

Do the marks give evidence that the students have benefitted by extra coaching? (Given $t_{0.05} = 2.228$ for 10 d.f) **(07 Marks)**

c. Three boys A, B and 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 as to A. If C was the first person to throw the ball, find the probabilities that after three throws (i) A has the ball, (ii) B has the ball, (iii) C has the ball. **(07 Marks)**

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CBCS SCHEME

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17ME42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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 terms : i) Inversion ii) Degree of freedom iii) Structure iv) Mechanism. **(04 Marks)**

b. Explain with neat sketch, Beam Engine and Whit worth quick return mechanism. **(10 Marks)**

c. Find the degrees of freedom (F) for the given diagram. **(06 Marks)**

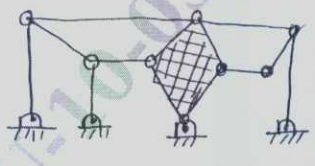

Fig. Q1(c)(i)

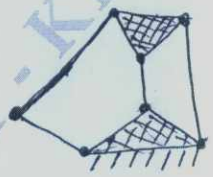

Fig. Q1(c)(ii)

OR

2 a. Derive the expression for the condition of correct steering. **(05 Marks)**

b. Explain with sketch Pantograph Mechanism and Geneva Wheel Mechanism. **(10 Marks)**

c. With a neat sketch, explain Peaucellier Straight line mechanism. **(05 Marks)**

Module-2

3 a. Define the following :
i) Linear and Angular velocity ii) Linear and Angular Acceleration. **(04 Marks)**

b. A four bar mechanism ABCD is pin jointed at ends and the link AD is fixed of length 600mm. The links AB BC and CD are 300mm , 360mm and 360mm respectively. At certain instant the link AB makes an angle of 60^0 with link AD. If the link AB rotates at an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec^2 both clockwise. Determine angular velocity and angular acceleration of links BC and CD by graphical methods. **(16 Marks)**

OR

4 a. What is Instantaneous centre of rotation of a body? Discuss different types of instantaneous centres. **(04 Marks)**

b. Explain Klein's construction for slider crank mechanism. **(08 Marks)**

c. In a slider crank mechanism the crank OA = 300mm and connecting rod AB = 1200mm. The crank OA is turbed 30^0 from I.D.C. Locate all instantaneous centre if the crank rotates at 15 rad/sec clockwise , find i) Velocity of slider B ii) Angular velocity of connecting rod AB. **(08 Marks)**

Module-3

5 Using Complex Algebra derive expression for Velocity , Angular velocity , Acceleration and Angular acceleration of Coupler link and output link of a four bar mechanism. **(20 Marks)**

OR

6 a. Derive Freudenstein's equation for slider crank mechanism. **(08 Marks)**

b. In a reciprocating engine length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at a uniform speed of 300 rpm CW. Crank is at 30^0 from I D.C. Determine

i) Velocity of piston and angular velocity of connecting rod.

ii) Acceleration of piston and angular acceleration of connecting rod by Complex Algebra method from first principle. **(12 Marks)**

Module-4

7 a. State and prove that the Law of Gear tooth action for constant velocity ratio. **(08 Marks)**

b. The following are particulars of pair of spur gears. Number of teeth on pinion = 19 , Number of teeth on gear = 47 , Pressure angle = 20^0 , Module = 6.5mm , Addendum = 6.5mm, determine i) Number of pairs of teeth of contact.

ii) Angle turned thrush by pinion and gear when one pair of teeth is in contact.

iii) Ratio of velocity of sliding to rolling velocity at the instant the engagements begins, the engagement terminates and at pitch point. **(12 Marks)**

OR

8 a. Sketch and explain i) Reverted gear train ii) Epicyclic gear train. **(06 Marks)**

b. An Epicyclic gear train as shown in fig. Q8(b) below, has a sunwheel S of 30 teeth and two planet wheels P of 50 teeth. The planet wheels mesh with the internal teeth of a fixed annulus A. The driving shaft carrying the sunwheel transmits 4 KW at 300 rpm. The driven shaft is connected to an arm which carries the planet wheels. Determine the speed of the driven shaft and the torque transmitted if the overall efficiency is 95%.

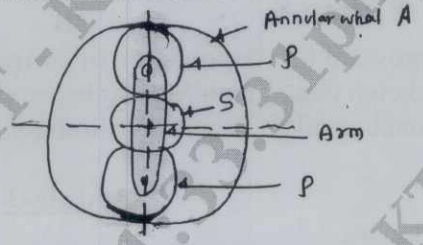

Fig.Q8(b)

(14 Marks)

Module-5

9 Draw to a full size, the profile of the cam which will give a lift of 38mm to a follower carrying a roller of 25mm diameter. The axis of follower is off-set by 18mm to the right of the axis of the cam. Ascent of follower takes place with SHM in 0.05sec followed by a period of rest 0.0125 sec. The follower by thin descent with VARM during 0.125 sec, the acceleration being 3/5 times retardation. The cam rotates in clockwise direction at a constant speed of 240 rpm and the base circle radius is 50mm. **(20 Marks)**

OR

10 a. Explain the following : i) Disc cam with Translating follower ii) Wedge cam with translating follower iii) Cylindrical cam with oscillating follower. **(06 Marks)**

b. In a four stroke petrol engine the crank angle is 4^0 after I.D.C when the suction valve opens and 50^0 after B.D.C when the suction valve closes. The lift is 10 mm the nose radius is 2.5mm and the least radius of cam is 20mm. The shaft rotates at 600 rpm. The cam is of circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity , maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertial of moving parts weighing 250gm. **(14 Marks)**

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17ME43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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 Steam Tables / Mollier chart / Psychrometric chart is permitted.*

Module-1

1 a. Derive an expression for an air standard efficiency of diesel cycle with neat sketch of PV and TS diagram. State the assumptions made to formulate this expression. **(10 Marks)**

b. In an air standard dual cycle, the air is at a pressure of 100 kPa and a temperature of 27°C before the isentropic compression begins. In this process, the volume of air is reduced from 0.07 m^3 to 0.004 m^3. During the process of heat addition at constant pressure, the temperature of the air is increased from 1160°C to 1600°C. Determine:
(i) Compression ratio (ii) Cutoff ratio
(iii) Thermal efficiency (iv) Mean effective pressure **(10 Marks)**

OR

2 a. Explain in detail with TS diagram, how the following methods are employed to improve the performance of gas turbine. (i) Regeneration (ii) Reheating **(10 Marks)**

b. A gas turbine has a minimum and maximum temperature of 60°C and 900°C. The compressor and the turbine efficiencies are 0.80 and 0.85 respectively. Estimate the condition for maximum net work done. Also, calculate the net work done and the thermal efficiency. The pressure at the inlet of the compressor is 1 bar. **(10 Marks)**

Module-2

3 a. A steam power plant is working on simple ideal Rankine cycle with fixed inlet temperature and condenser pressure. Explain with TS diagram, the effect of following factors on the turbine work output, heat supplied, cycle efficiency and the steam quality at the turbine exit.
(i) Boiler pressure (ii) Super heating the steam **(10 Marks)**

b. A steam power plant operates on a Rankine cycle between the pressure limits of 17500 kPa and 10 kPa. The peak temperature is 500°C. If the adiabatic efficiency of the turbine is 80% and the adiabatic pump efficiency is 85%. Determine the thermal efficiency and the specific steam consumption. **(10 Marks)**

OR

4 a. With a neat schematic layout and TS diagram, explain how the performance of steam power plant change, when a simple Rankine cycle is modified with Reheater. **(10 Marks)**

b. Consider a steam power plant operating on an ideal Reheat Rankine cycle. Steam enters the high pressure turbine at 15 MPa and 600°C and is condensed in the condenser at a pressure of 10 kPa. If the moisture content of the steam at the exit of low pressure turbine is not to exceed 10.4%, determine: (i) Pressure at which the steam should be reheated (ii) Thermal efficiency of the cycle. Assume the steam is reheated to the inlet temperature of the high pressure turbine. **(10 Marks)**

Module-3

5 a. Define and briefly explain the following terms related to combustion thermodynamics:
(i) Excess air
(ii) Enthalpy of formation
(iii) Internal energy of combustion
(iv) Combustion efficiency
(v) Adiabatic flame temperature **(10 Marks)**

b. The products of combustion of an unknown hydrocarbon C_xH_y have the following composition measured by Orsat apparatus.
$CO_2 = 8\%$, $CO = 0.9\%$, $O_2 = 8.8\%$, $N_2 = 82.3\%$
Determine:
(i) The composition of fuel
(ii) Air fuel ratio
(iii) The percentage of excess air
(iv) Dew point temperature of the products if the total pressure is 1.01325 bar. **(10 Marks)**

OR

6 a. Explain the following methods of determining frictional power of an engine:
(i) Motoring test
(ii) Morse test **(10 Marks)**

b. The following observations are recorded in a test of one hour duration on a single cylinder, 4 stroke SI engine; Bore = 220 mm, stroke = 300 mm, fuel used = 4 kg, calorific value of fuel = 42000 kJ/kg, speed = 300 rpm, MEP = 5 bar, load on brake = 600 N, spring balance reading = 30 N, diameter of the brake drum = 1.4 m, quantity of cooling water = 500 kg/hr, temperature rise of cooling water = 20°C, air fuel ratio = 16, C_p of gases = 1.1 kJ/kgK, ambient temperature = 30°C, exhaust gas temperature = 410°C. Calculate the following:
(i) Brake thermal efficiency
(ii) SFC
Also draw heat balance sheet in kJ/min. **(10 Marks)**

Module-4

7 a. With a schematic diagram, explain the working of a vapour absorption refrigeration system. **(08 Marks)**

b. A 10 TR Ammonia ice plant operates between an evaporator temperature of –15°C and condenser temperature of 35°C. The ammonia enters the compressor as dry saturated vapour. Assuming isentropic compression. Determine:
(i) Mass flow rate of ammonia
(ii) COP of plant
(iii) Power input
(iv) Tonnes of ice at –10°C produced from water at 25°C in a day.
Take C_P of ammonia vapour = 4.81 kJ/kgK, $h_{fg(ice)}$ = 335 kJ/kg, $C_{P(ice)}$ = 2.1 kJ/kgK, $C_{P(water)}$ = 4.2 kJ/kgK. **(12 Marks)**

OR

8 a. With a neat sketch, explain the working of a summer air conditioning system for hot and dry weather. Represent the various processes of the system on a psychrometric chart. **(10 Marks)**

b. For a hall to be air conditioned, the following conditions are given:
Outdoor conditions = 40°C DBT, 20°C WBT
Required comfort conditions = 20°C DBT, 60% RH
Seating capacity of the hall = 1500
Amount of outdoor air supplied = 0.3 m^3/min/person.
If the required condition is achieved first by adiabatic humidification and then by cooling, estimate:
(i) Capacity of cooling coil in TR
(ii) Capacity of the humidifier in kg/hr
(iii) Condition of air after adiabatic humidification. **(10 Marks)**

Module-5

9 a. Derive the condition for minimum work in a 2 stage reciprocating air compressor. Using this condition obtain the expression for minimum work in a two stage compression. **(12 Marks)**

b. A single stage single acting compressor delivers 0.6 kg of air/minute at 6 bar pressure. The temperature and pressure at the end of suction stroke are 30°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of swept volume. Assuming the index of compression and expansion to be 1.3, find:
(i) Volumetric efficiency of the compressor
(ii) Power required if the mechanical efficiency is 0.85
(iii) Speed of the compressor **(08 Marks)**

OR

10 a. Explain the following types of flows in a steam nozzle:
(i) Isentropic flow
(ii) Flow with friction
(iii) Super saturated flow **(10 Marks)**

b. A convergent divergent nozzle is required to discharge 360 kg/hr of steam. The nozzle is supplied with steam at 10 bar and 0.97 dryness and discharges against a back pressure of 0.5 bar. Neglecting the effect of friction, find the throat and the exit diameter. Assume the condition for maximum discharge. **(10 Marks)**

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CBCS SCHEME

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17ME44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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 following terms with SI units:
i) Capillarity
ii) Surface tension
iii) Kinematic viscosity
iv) Specific volume. **(06 Marks)**

b. Derive relation for pressure intensity and surface tension;
i) Liquid droplet ii) Soap bubble. **(06 Marks)**

c. A cube of 250mm sides, 300N weight slides down an inclined plane at 30° to horizontal. An oil film of thickness 0.5mm is between inclined plane and cube surface. Uniform velocity of slide is 3 m/sec. Determine the dynamic viscosity and kinematic viscosity if specific density of oil is 900 kg/m^3. **(08 Marks)**

OR

2 a. State and prove Hydrostatic law. **(06 Marks)**

b. Explain working of U-tube differential manometer, with neat sketch. **(06 Marks)**

c. A circular plate of 3m in diameter is submerged in oil of specific gravity 0.9, such that its greatest and least depths below the free surface are 3.5m and 2m respectively. Determine total pressure on one face and the depth of centre of pressure. **(08 Marks)**

Module-2

3 a. Derive continuity equation in 3-dimensional co-ordinates. **(06 Marks)**

b. Explain different types of fluid flows. **(06 Marks)**

c. A 2-dimensional flow is given by velocity potential $\phi = x(2y - 1)$. Determine the velocity at point P(2, 3). Find also the stream function. **(08 Marks)**

OR

4 a. Derive Bernoulli's equation for a fluid flow. List the assumptions made. **(08 Marks)**

b. Differentiate between venturimeter and orificemeter. **(04 Marks)**

c. A venturimeter with a throat diameter 10cm and area ratio 4 is provided in a vertical pipeline carrying oil of specific gravity 0.90. The difference in elevation of throat section and entry of venturimeter is 40cm. The differential u-tube mercury manometer shows a deflection of 30cm. Find: i) Discharge of oil ii) Pressure difference. Assume $C_d = 0.98$. **(08 Marks)**

Module-3

5 a. Derive relation for viscous flow through circular flow and obtain relation for head loss. **(10 Marks)**

b. A lubricating oil of viscosity 1.0 poise and specific gravity 0.9 is pumped through 30mm diameter pipe. The pressure drop per metre length is 20kN/m^2. Determine: i) Mass flow rate ii) Reynold's iii) Shear stress at pipe wall iv) Power required per 50m length of pipe to maintain the viscous flow. **(10 Marks)**

OR

6 a. Derive Darcy's equation for fluid flow through circular pipe. **(06 Marks)**

b. Define HGL and TEL, with sketch. **(04 Marks)**

c. Determine flow rate of water through a pipe of diameter 20cm and length 50m, when one end of pipe is connected to tank and the other end of pipe is open to the atmosphere. The pipe is horizontal and height of water in tank is 10mts above pipe axis. Consider all losses and assume f = 0.01. **(10 Marks)**

Module-4

7 a. Define lift and drag force. Derive relations with neat sketch. **(10 Marks)**

b. Experiments were conducted in a wind tunnel with a speed of 50km/hour on a flat plate of size 2m long and 1m wide. Density of air is 1.15kg/m^3. Coefficients of lift and drag are 0.75 and 0.15 respective. Determine Drag and lift force. **(10 Marks)**

OR

8 a. Define model similitude and explain. List the applications. **(08 Marks)**

b. The force 'F' acting on a screw propeller is given by, $F = \rho D^2 V^2 \phi\left(\frac{\rho D^3 V^2}{T}, \frac{ND}{V}, \frac{\rho VD}{\mu}\right)$

where T is Torque, 'D' diameter, V is velocity, N is RPM, ρ is density and viscosity of fluid 'μ'. Use Buckingham π method. **(12 Marks)**

Module-5

9 a. Derive relation for velocity of sound in terms of Bulk Modulus. **(08 Marks)**

b. Explain the terms: i) Mach Cone ii) Mach Number. **(04 Marks)**

c. An aero plane is flying at a height of 12km where the temperature is -53°C. Find the speed of the plane, if Mach Number is M = 2. Assume K = 1.4 and R = 287J/kg K. **(08 Marks)**

OR

10 a. Explain the importance of CFD. Mentions the applications of CFD. **(10 Marks)**

b. Explain types of sonicflows with neat sketch. **(06 Marks)**

c. Explain normal shock and oblique shock. **(04 Marks)**

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CBCS SCHEME

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17ME45B/MEB405

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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 classification of drilling machines. **(04 Marks)**
b. Briefly explain various parts of Radial drilling machine. **(08 Marks)**
c. With a neat sketch, explain principal parts of horizontal boring machine. **(08 Marks)**

OR

2 a. Define Milling. With a neat sketch, explain Horizontal milling machine. **(10 Marks)**
b. With a neat sketch, explain Vertical Broaching machine. **(06 Marks)**
c. Differentiate between Shaper and Planer. **(04 Marks)**

Module-2

3 a. What is Machining? With a neat sketch, explain relative motion of tool and work piece in milling. **(08 Marks)**
b. Explain briefly, with neat sketches of any Four drilling operations. **(06 Marks)**
c. List the operations performed on grinding machine. Explain any two operations with neat sketches. **(06 Marks)**

OR

4 a. List and explain different machining parameters and related quantities on a shaping machine. **(06 Marks)**
b. Explain Centreless grinding operation, with a neat sketch. **(07 Marks)**
c. Explain Slotting Operation on Slotting Machine. **(07 Marks)**

Module-3

5 a. Explain the geometry of a Single Point Cutting tool, with a neat sketch. **(08 Marks)**
b. Illustrate the desirable properties of cutting tool material. **(05 Marks)**
c. A shaping machine is used to machine a rectangular piece of 18cm long and 35cm width, with a cutting speed of 26 mpm. Feed is 0.8mm per cycle. Cutting stroke is adjusted 20cm. Time for cutting to return stroke is 3:2. Find the time required for machining the whole surface. **(07 Marks)**

OR

6 a. Define Cutting fluid and explain essential properties of cutting fluid. **(07 Marks)**
b. Explain different types of cutting fluids with their application. **(06 Marks)**
c. Find the time required for drilling a 18mm hole in a work piece having – thickness of 50mm. Assume cutting speed of 12 meters per minute and feed 0.2mm/revolution. Neglect the length of approach. **(07 Marks)**

Module-4

7 a. Explain the concept of oblique and Orthogonal cutting. **(08 Marks)**
b. Explain different types of chips, with neat sketches. **(05 Marks)**

c. In an experiment, a pipe is turned on end in Orthogonal cutting conditions with a tool of 20^0 rake angle. A chip – length of 85mm is obtained from an uncut chip length of 202mm while cutting with a depth of cut of 0.5mm. Determine the shear plane angle and chip thickness. **(07 Marks)**

OR

8 a. Draw Merchant circle diagram using usual notations and state the assumptions. **(06 Marks)**

b. Derive an expression for horizontal cutting force in terms of shear force, rake angle, friction angle and shear plane angle in an orthogonal cutting process. **(05 Marks)**

c. A seamless tubing 35mm outside diameter is turned orthogonally on a lathe. The following data is available. Rake angle = 35^0, Cutting speed = 15m/min, Feed = 0.10mm/rev. Length of continuous chip in one revolution = 50.72mm, Cutting force = 200N, Feed force = 80N. Calculate the Coefficient friction, Shear plane angle, Velocity of chip along tool face and Chip thickness. **(09 Marks)**

Module-5

9 a. Define Tool Life. List out the wear mechanism. Explain any one. **(08 Marks)**

b. Define Machinability. List out the various parameters affecting the machinability. **(06 Marks)**

c. A cast iron bar stock was turned at 50m/min for which, the tool life was 3 hours. For the same material, at 40m/min, the tool life was 5 hours. Find the value of constant C and n in the Taylor's tool life equation. **(06 Marks)**

OR

10 a. Explain various criteria for determining machinability. **(06 Marks)**

b. Explain effect of variations in cutting speed on various cost factors. **(08 Marks)**

c. Determine the optimum cutting speed for an operation carried on a lathe using the following data : Tool change time 4 min, tool regrind time 3 min, machine running cost 20 paise per minute, depreciation tool grind one rupee. Assume values of C and n of Taylor's tool equation as 60 and 1/5 respectively. **(06 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
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 $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 16 & 8 & -6 & -2 \end{bmatrix}$ by elementary applying row transformation. **(06 Marks)**

b. Solve the following system of linear equation by Gauss Elimination method $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$ **(07 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

OR

2 a. Reduce the matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ into its echelon form and hence find its rank. **(06 Marks)**

b. Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **(07 Marks)**

c. Solve the following system of linear equation by Gauss Elimination method $x + y + z = 9$, $x - 2y + 3z = 8$, $2x + y - z = 3$. **(07 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x}$ **(06 Marks)**

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

c. Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters. **(07 Marks)**

OR

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

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

c. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4e^{3x}$ by the method of undetermined coefficients. **(07 Marks)**

Module-3

5 a. Prove that $L[\text{Cosh at}] = \frac{s}{s^2 - a^2}$ **(06 Marks)**

b. Find the Laplace transform of cost cos2t cos3t **(07 Marks)**

c. Find the Laplace transform of $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a < t \le 2a \end{cases}$ where $f(t + 2a) = f(t)$ **(07 Marks)**

OR

6 a. Find the Laplace transform of sint sin2t sin3t. **(06 Marks)**

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

c. Express $f(t) = \begin{cases} t^2 & 1 < t \le 2 \\ 4t & t > 2 \end{cases}$ interms of unit step function and hence find $L\{f(t)\}$. **(07 Marks)**

Module-4

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

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

c. Using Laplace transform, solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$ under the initial condition $y(0) = 1$ $y'(0) = 0$. **(07 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 $\frac{5s+3}{(s-1)(s^2+2s+5)}$. **(07 Marks)**

c. Solve by using Laplace transform $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ under the initial condition $y(0) = 0$, $y'(0) = 0$. **(07 Marks)**

Module-5

9 a. Prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

b. Find the probability that a leap year selected at random will contain 53 Sundays. **(07 Marks)**

c. An office has 4 secretaries handling 20%, 60%, 15%, 5% respectively of the files of certain reports. The probabilities that they misfile such reports are respectively 0.05, 0.1, 0.1 and 0.05. Find the probability that a misfiled report is caused by the first secretary. **(07 Marks)**

OR

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

b. A problem is given to four students A, B, C, D whose chances of solving it are 1/2, 1/3, 1/4, 1/5 respectively. Find the probability that the problem is solved. **(07 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? **(07 Marks)**

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