IV ME, CV (S)

CBCS Scheme

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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of statistical tables is permitted.

Module-1

1 a. Employ Taylor's series method to find y at x = 0.1. Correct to four decimal places given $\frac{dy}{dx} = 2y + 3e^x$; $y(0) = 0$. **(05 Marks)**

b. Using Runge Kutta method of order 4, find y(0.2) for $\frac{dy}{dx} = \frac{y-x}{y+x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. If $y' = 2e^x - y$; y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090. Find y(0.4) using Milne's predictor corrector formula. Apply corrector formula twice. **(06 Marks)**

OR

2 a. Use Taylor's series method to find y(4.1) given that $(x^2 + y)y' = 1$ and y(4) = 4. **(05 Marks)**

b. Using modified Euler's method find y at x = 0.1, given $y' = 3x + \frac{y}{2}$ with y(0) = 1, h = 0.1. Perform two iterations. **(05 Marks)**

c. Find y at x = 0.4 given $y' + y + xy^2 = 0$ and $y_0 = 1$, $y_1 = 0.9008$, $y_2 = 0.8066$, $y_3 = 0.722$ taking h = 0.1 using Adams-Bashforth method. Apply corrector formula twice. **(06 Marks)**

Module-2

3 a. Given $y'' = xy'^2 - y^2$ find y at x = 0.2 correct to four decimal places, given y = 1 and y′ = 0 when x = 0, using R-K method. **(05 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(05 Marks)**

c. If $x^3 + 2x^2 - x + 1 = ap_0(x) + bp_1(x) + cp_2(x) + dp_3(x)$ then, find the values of a, b, c, d. **(06 Marks)**

OR

4 a. Apply Milne's method to compute y(0.8) given that $y'' = 1 - 2yy'$ and the table.

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

Apply corrector formula twice. **(05 Marks)**

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

c. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n}\left[(x^2 - 1)^n\right]$. **(06 Marks)**

Module-3

5 a. Define analytic function and obtain Cauchy Riemann equation in Cartesian form. **(05 Marks)**

b. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$; c is the circle $|z| = 3$ by using theorem Cauchy's residue. **(05 Marks)**

c. Discuss the transformation $w = e^z$ with respect to straight line parallel to x and y axis. **(06 Marks)**

OR

6 a. Find the analytic function whose real part is $u = \frac{x^4y^4 - 2x}{x^2 + y^2}$. **(05 Marks)**

b. State and prove Cauchy's integral formula. **(05 Marks)**

c. Find the bilinear transformation which maps the points $z = 1, i, -1$ into $w = 2, i, -2$. **(06 Marks)**

Module-4

7 a. Find the constant c, such that the function $f(x) = \begin{cases} cx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is a p.d.f. Also compute $p(1 < x < 2)$, $p(x \leq 1)$, $p(x > 1)$. **(05 Marks)**

b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. **(05 Marks)**

c. x and y are independent random variables, x take the values 1, 2 with probability 0.7; 0.3 and y take the values -2, 5, 8 with probabilities 0.3, 0.5, 0.2. Find the joint distribution of x and y hence find cov(x, y). **(06 Marks)**

OR

8 a. Obtain mean and variance of binomial distribution. **(05 Marks)**

b. The length of telephone conservation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes, (ii) between 5 and 10 minutes. **(05 Marks)**

c. The joint distribution of two discrete variables x and y is $f(x, y) = k(2x + y)$ where x and y are integers such that $0 \leq x \leq 2$; $0 \leq y \leq 3$. Find: (i) The value of k; (ii) Marginal distributions of x and y; (iii) Are x and y independent? **(06 Marks)**

Module-5

9 a. Explain the terms: (i) Null hypothesis; (ii) Type I and type II errors; (iii) Significance level. **(05 Marks)**

b. A die thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Is it reasonable to think that the die is an unbiased one? **(05 Marks)**

c. Find the unique fixed probability vector for the regular Stochastic matrix:

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(06 Marks)**

OR

10 a. 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) **(05 Marks)**

b. It has been found that the mean breaking strength of a particular brand of thread is 275.6 gms with $\sigma = 39.7$ gms. A sample of 36 pieces of thread showed a mean breaking strength of 253.2 gms. Test the claim at 1+.. and 5–*l*. level of significance. **(05 Marks)**

c. A man's smoking habits are as follows. If he smokes filter cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. One the other hand, if he smokes non filter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? **(06 Marks)**

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15ME42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain:
i) kinematic pair,
ii) Types of links,
iii) Grashof's criterion. **(06 Marks)**

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

OR

2 a. What is quick return motion? Explain with neat sketch crank and slotted lever mechanism. **(08 Marks)**

b. Draw a neat sketch of Peacellier straight line mechanism. Explain with proof how the tracing point describes a straight line path. **(08 Marks)**

Module-2

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

OR

4 a. Define Coriol's component of acceleration. Derive an expression for the same. **(08 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction for a steam engine to the following specifications:
Stroke of piston = 300 mm
Ratio of length of connecting rod to crank radius = 4
Speed of engine = 300 rpm
Clockwise position of crank = 45° with inner dead centre. **(08 Marks)**

Module-3

5 a. Derive analytical expressions for the determination of velocity and acceleration of piston of a reciprocating engine. **(12 Marks)**

b. If the crank and connecting rod are 150 mm and 600 mm long respectively and the crank rotates at a constant speed of 100 rpm, determine the velocity and acceleration of piston. The angle which the crank makes with the inner dead centre is 30°. **(04 Marks)**

OR

6 a. Derive Freudenstein's equation for slider crank mechanism. **(10 Marks)**

b. Explain function generation for four bar mechanism. **(06 Marks)**

Module-4

7 a. State and prove the law of gear tooth action for constant velocity ratio. **(08 Marks)**

b. Two mating spur gears with module of 6.5 mm have 19 and 47 teeth of 20° pressure angle, and 6.5 mm addendum. Determine the number of pairs of teeth in contact. Also determine the sliding velocity at the instant (i) engagement commences, (ii) engagement terminates. The pitch line velocity is 1.2 m/s. **(08 Marks)**

OR

8 a. Define: (i) Interference in gears, (ii) Epicyclic gear train. **(04 Marks)**

b. Fig.Q8(b) shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel D. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel), gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed, and carries the compound wheel B, C. If the motor runs at 1000 rpm, find the speed of the machine shaft. Find the torque exerted on the machine shaft if the motor develops a torque of 100 Nm.

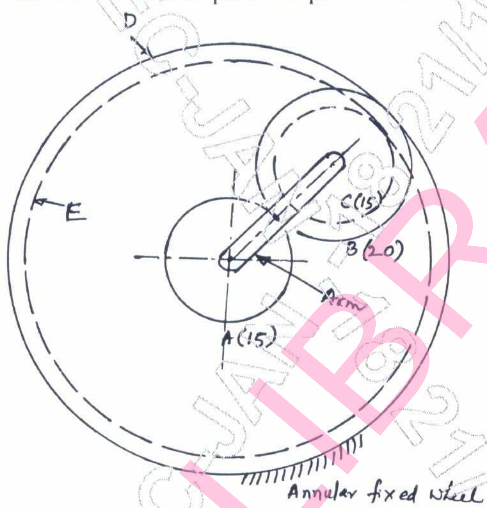

Fig.Q8(b) **(12 Marks)**

Module-5

9 A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:

i) Outward during 150° with UARM.
ii) Dwell for next 30°.
iii) Return during next 120° with SHM.
iv) Dwell for the remaining period.

Stroke of the follower is 3 cm. Minimum radius of the cam is 3 cm. Draw the cam profile, when the follower axis passes through the cam axis. Find the maximum velocity and acceleration during outstroke. **(16 Marks)**

OR

10 a. Define the terms:

i) Cam profile
ii) Base circle
iii) Prime circle
iv) Pitch curve **(04 Marks)**

b. Derive expressions for displacement, velocity and acceleration of the follower when the flat faced follower is in contact with any point on the circular flank. **(12 Marks)**

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15ME43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use thermodynamic data hand book and steam tables is permitted.*

Module-1

1 a. Compare the otto, diesel and dual cycles on P-V diagram and T-S diagrams, when heat is supplied to each cycle is same. **(08 Marks)**

b. Derive air standard efficiency expression for dual combustion cycle. **(08 Marks)**

OR

2 a. With a schematic diagram, explain a closed cycle gas turbine. **(04 Marks)**

b. With the help of neat diagram, explain a Rocket engine. **(04 Marks)**

c. The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature 20°C. The pressure of the air after the compression is 4 bar. The isentropic efficiencies of the compressor and turbine are 80% and 85% respectively. The air fuel ratio is 90 : 1. If flow rate of air is 3 kg/sec. Find (i) Power developed (ii) Thermal efficiency of the cycle.
Assume C_P = 1.0 kJ/kgK and γ = 1.4 for air and gases. Take calorific value of the fuel as 41800 KJ/kg. **(08 Marks)**

Module-2

3 a. List out the factors affecting the efficiency of the Rankine cycle. **(04 Marks)**

b. Compare the Rankine and the Carnot cycles of steam power plants. **(04 Marks)**

c. In a steam power cycle, the steam supply is at 15 bar and dry saturated. The condenser pressure is 0.4 bar. Calculate Carnot and Rankine efficiency of the cycle neglect the pump work. **(08 Marks)**

OR

4 a. What do you mean by Regenerative cycle? With help of neat diagram, explain the working of a regenerative Rankine cycle and derive the efficiency of the cycle. **(08 Marks)**

b. Consider a regenerative vapour power cycle with open feed water heater. Steam enters the turbine at 9 MPa and 350°C and expands to 0.9 MPa where some of the steam is extracted and passed to the open feed water heater operating at 0.9 MPa. The remaining steam expands through the remaining part of the turbine to the condenser pressure of 0.01 MPa. Saturated liquid exits the open feed water heater at 0.9 MPa. If the net power output of the cycle is 120 MW. Determine
(i) Thermal efficiency (ii) Mass flow rate of steam entering the turbine. **(08 Marks)**

Module-3

5 a. Explain the following terms with reference to a combustion process:
(i) Enthalpy of formation (ii) Adiabatic flame temperature
(iii) Enthalpy of combustion (iv) Heat of reaction **(08 Marks)**

b. Methane is burned with atmospheric air. The analysis of the products on a dry basis is as follows:
CO_2 = 10%, O_2 = 2.37%, CO = 0.53%, N_2 = 87.10%
(i) Determine the combustion equation.
(ii) Calculate the air fuel ratio on mass basis.
(iii) Percent theoretical air. **(08 Marks)**

OR

6 a. Explain the combustion phenomenon in C.I. engine. **(08 Marks)**

b. A single cylinder 4 stroke diesel engine gave the following results while running on full load. Area of indicator card = 300 mm^2, Spring constant = 1 bar/mm, Length of the diagram = 40 mm, Speed of the engine = 450 rpm, Load on the brake = 370 N, Spring balance reading = 50 N, Diameter of the brake drum = 1.2 m, Diameter of the cylinder = 160 mm, Stroke of the piston = 200 m, C.V of the fuel = 41800 KJ/kg.
Calculate (i) IMEP
(ii) BP and brake mean effective pressure
(iii) BSFC (Brake Specific Fuel Consumption)
(iv) Brake thermal and indicated thermal efficiency. **(08 Marks)**

Module-4

7 a. With the help of a neat sketch, explain a simple vapour absorption cycle. **(05 Marks)**

b. Explain the various factors affecting the performance of a vapour compression system. **(04 Marks)**

c. A vapour compression refrigerator uses methyl chloride (R-40) and operates between temperature limits of $-10^{\circ}C$ and $45^{\circ}C$. At the entry to the compressor, the refrigerant is dry and after compression it acquires a temperature of $60^{\circ}C$. Find the C.O.P of the refrigerator. **(07 Marks)**

OR

8 a. Define the following terms:
(i) Dry bulb temperature (DBT).
(ii) Wet bulb temperature (WBT)
(iii) Specific humidity.
(iv) Relative humidity. **(08 Marks)**

b. Atmospheric air at 101.325 KPa has $30^{\circ}C$ DBT and $15^{\circ}C$ DPT. Without using the psychromatic chart, using the property values from the tables. Calculate
(i) Partial pressure of air and water vapour.
(ii) Specific humidity
(iii) Relative humidity.
(iv) Vapour density and enthalpy of moist air. **(08 Marks)**

Module-5

9 a. Obtain expression for volumetric efficiency of a single stage air compressor in terms of pressure ratio, clearance and 'n' the polytropic index. **(06 Marks)**

b. What are disadvantages of a single stage air compressor? **(02 Marks)**

c. A two stage air compressor with perfect intercooling takes in air at 1 bar $27^{\circ}C$. The law of compression in both the stages is $PV^{1.3}$ = constant. The compressed air is delivered at 9 bar. Calculate for unit mass flow rate of air the minimum workdone and the heat rejected to the intercooler. Compare the values if the compression is carried out in single stage compressor with after cooler. **(08 Marks)**

OR

10 a. Mention the types of nozzles. Explain any one. **(04 Marks)**

b. Derive an expression for steam velocity coming out from a nozzle. **(04 Marks)**

c. Dry saturated steam at a pressure of 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine
(i) The exit velocity of steam.
(ii) Ratio of cross section at exit and that at throat. **(08 Marks)**
Assume the index of adiabatic expansion is 1.135.

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15ME44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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) Mass density ii) Dynamic viscosity iii) Surface tension **(06 Marks)**

b. Determine the specific gravity of a fluid having a kinematic viscosity of the 0.04 stoke and dynamic viscosity of 0.05 poise. **(04 Marks)**

c. An oil film of thickness 115mm is used for used for lubricating between a square plate of size 0.8m × 0.8m and an inclined plane having an exclinition of 30° with the horizontal. The weight of the square plate is 300N and slides down the plane with a uniform velocity of 0.3m/s. Find the dynamic viscosity of oil. **(06 Marks)**

OR

2 a. Define : i) Bouyancy ii) Meta centre. **(02 Marks)**

b. Derive an expression for total pressure force and depth of centre of pressure for a vertical surface submerged in water. **(08 Marks)**

c. A solid cylinder of diameter 4m has a height of 3m. Find the meta centre height when it is floating in water with its axis vertical. The Specific gravity of cylinder is 0.6. **(06 Marks)**

Module-2

3 a. Explain the two different fluid flow analysis method with suitable example. **(06 Marks)**

b. The velocity potential for 0 is given by $0 = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$

Calculate the velocity components in the X and Y direction. Check the possibility of such a flow. **(10 Marks)**

OR

4 a. Derive Euler's equation of motion for a steady flow and deduce Bernoullis equation. **(10 Marks)**

b. A horizontal venturimeter with inlet dia. 20cm and throat diameter 10cms is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and Vaccum pressure at the throat is 30cms of mercury. Find the discharge of water through venture meter $C_d = 0.9$. **(06 Marks)**

Module-3

5 a. Define Reynolds number. What is its significance? List the characteristic of laminar flow. **(08 Marks)**

b. A crude oil of viscosity 0.97 per sec and specific gravity 0.9 is flowing through a horizontal circular pipe of diameter of 0.1m and length 10m. Calculate the difference of pressure at two ends of the pipe if 100kg is collected in a tank in 0.5 minutes. Assume laminar flow. **(08 Marks)**

OR

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

b. A 10cm diameter pipe takes off abruptly from a large tank and run 5m, then expands to 20cm diameter abruptly and runs 50m and next discharge directly to open air with a velocity of 25m/s. Calculate the height of water surface above point of discharge. Take Darcy's coefficients 0.0065. **(08 Marks)**

Module-4

7 a. Define :
   i) Displacement thickness
   ii) Momentum thickness
   iii) Energy thickness
   iv) Shape factor as with respect to boundary layer. **(08 Marks)**

b. A man descends the ground from an airoplane with help of a parachute, which is hemispherical having a diameter of 5m against the resist of air with a uniform velocity of 25m/s. Find the weight of the man if the weight of parachute is 9.81, CD = 0.6. **(08 Marks)**

OR

8 a. Explain the different types of similitude. **(08 Marks)**

b. Assume the viscous force F exerted by a fluid on sphere of diameter D, depends on viscosity μ of mass density ρ and velocity of motion of the sphere, obtain the expression for shear force F, using Buckingham's π – theorem method. **(08 Marks)**

Module-5

9 a. Define: i) Mach line ii) Mach angle iii) Subsonic and supersonic flow. **(08 Marks)**

b. Calculate the velocity and Mach number of a supersonic aircraft flying at an altitude of 1200m when temperature is 300K. Sound of aircraft is heard 2 seconds after passage of aircraft over the head of an observer. Take r = 1.41, R = 287 J/kg/k. **(08 Marks)**

OR

10 a. Write short essay on the engineering application of CFD, brining the advantages and the limitations. **(08 Marks)**

b. Define the following terms and write the relevant equations for the same : -
   i) Stagnation Temperature
   ii) Stagnation Pressure. **(08 Marks)**

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15MEA405/15ME45A

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Briefly discuss the steps involved in making a sand casting with block diagram. **(08 Marks)**

b. List the pattern allowance and explain shrinkage allowance. Draft allowance and machining allowance. **(08 Marks)**

OR

2 a. What are the requirements of base sand? **(04 Marks)**

b. Explain with neat sketch, cope and drag pattern. **(04 Marks)**

c. Explain with neat sketch, jolt type moulding machine. **(08 Marks)**

Module-2

3 a. Explain the construction features of cupola furnace, with neat sketch. **(08 Marks)**

b. Explain with neat sketch, Electric Arc Furnace. **(08 Marks)**

OR

4 a. Explain with neat sketch, low pressure die casting. **(08 Marks)**

b. Explain with neat sketch, squeeze casting process. **(08 Marks)**

Module-3

5 a. What is Solidification? Briefly discuss the solidification variables. **(08 Marks)**

b. Explain the basic steps involved in cleaning of casting, with simple sketch. **(08 Marks)**

OR

6 a. What are the causes and remedies for the following sand casting defects : i) Shrinkage cavity ii) Inclusions? **(08 Marks)**

b. What are the advantages and limitations of Aluminum castings? **(08 Marks)**

Module-4

7 a. Sketch and explain TIG welding. **(08 Marks)**

b. Define Welding and Classify. **(04 Marks)**

c. What are the advantages and disadvantages of welding? **(04 Marks)**

OR

8 a. Explain the principle of Resistance welding and list its major applications. **(08 Marks)**

b. With neat sketch, explain Butt welding and Seam welding. **(08 Marks)**

Module-5

9 a. Explain the formation of different zones during welding. **(10 Marks)**

b. Explain Shrinkage and Residual stresses in welding. **(06 Marks)**

OR

10 a. Compare soldering and brazing. Mention advantages and application of joining process. **(10 Marks)**

b. Explain : i) Oxy – acetylene welding ii) Oxy – Hydrogen welding iii) Air – acetylene welding. **(06 Marks)**

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15MEB405/15ME45B/15MA45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain with a neat sketch, the main parts of an Engine or Center Lathe. **(08 Marks)**

b. Write important specifications of : i) Milling machine ii) Shaping machine. **(08 Marks)**

OR

2 a. Explain with a neat sketch, a Horizontal shaping machine. **(08 Marks)**

b. Sketch and label a Center less Grinding machine. **(08 Marks)**

Module-2

3 a. Explain briefly the motions involved in a machining process. **(08 Marks)**

b. Discuss with a neat sketch, any Four machining process in :
i) Lathe ii) Milling. **(08 Marks)**

OR

4 a. Briefly explain the following machining parameters with respect to turning operation :
i) Cutting speed ii) Machine time iii) Metal Removal Rate. **(08 Marks)**

b. Explain with a neat sketch, the following operations :
i) Broaching ii) Reaming iii) Grinding iv) Counter sinking. **(08 Marks)**

Module-3

5 a. List and briefly explain the properties of a cutting tool material. **(08 Marks)**

b. With a neat sketch of a single point cutting tool, explain tool geometry. **(08 Marks)**

OR

6 a. Explain the different types of cutting fluids. **(08 Marks)**

b. Write a brief note on : i) Surface finish ii) Effect of Machining parameters on surface finish. **(08 Marks)**

Module-4

7 a. Derive the equation for the coefficient of friction between chip and tool face. (Ernst – Merchants solution). **(12 Marks)**

b. Compare Orthogonal and Oblique cutting. **(04 Marks)**

OR

8 a. Explain the different types of chips formation. **(06 Marks)**

b. In an Orthogonal cutting operation following observations were made :
Cutting speed = 25m/min , Width of cut = 2.5mm , Feed = 0.24mm/rev ,
Chip thickness = 0.4mm , Cutting force = 1400N , Thrust force = 400N ,
Tool rake angle = 5^0. Calculate
i) Shear angle (ϕ) ii) Friction angle (τ) iii) Chip flow velocity (V_f)
iv) Shear strain (γ) v) Power consumed at tool in KW (P). **(10 Marks)**

Module-5

9 a. Explain the common mechanism of tool wear. **(08 Marks)**

b. In a turning operation, it was observed that the tool life was 150min, when the cutting speed was 20m/min. As the speed was increased to 25m/min, the tool life dropped to 25.2min. If the time required to change the tool was 2min and if the cost of regrinding the tool was 10 times the cost of turning per minute, calculate

i) The most economical cutting speed ii) Tool life for maximum production. **(08 Marks)**

OR

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

b. Write short notes on :

i) Choice of feed.

ii) Taylor's tool life equation. **(08 Marks)**

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15MEB406/15ME46B

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State the objectives of Metrology. **(04 Marks)**

b. Explain with a neat sketch International Prototype meter. **(06 Marks)**

c. Using M112 set of slip gauges, build the following dimensions :
i) 48.3275 ii) 68.208. **(06 Marks)**

OR

2 a. Four length bars A, B, C & D of approximately 250mm each are to be calibrated with standard calibrated metre bar which is actually 0.0008mm less than a metre. It is also found that bar B is 0.0002mm longer than bar 'A' bar 'C' is 0.0004mm longer than 'A' and bar 'D' is 0.0001mm shorter than bar 'A'. The length of all four bars put together is 0.0003mm longer than the calibrated standard metre. Determine the actual dimension of each bar. **(10 Marks)**

b. Explain with a neat sketch the method of measuring taper angles using sine centre. **(06 Marks)**

Module-2

3 a. Differentiate : i) Clearance fit and Interference fit ii) Unilateral and Bilateral tolerance. **(08 Marks)**

b. Explain Hole basis system and Shaft basis system. **(08 Marks)**

OR

4 a. Illustrate with a neat sketch, the working of a sigma comparator. **(08 Marks)**

b. With a neat sketch, explain the construction and principle of Solex Pneumatic Comparator. **(08 Marks)**

Module-3

5 a. Explain the two wire method to find the effective diameter of screw thread. **(06 Marks)**

b. With a sketch, explain the construction of a tool maker's microscope. What are its applications? **(08 Marks)**

c. What is Best Wire Size? **(02 Marks)**

OR

6 a. Sketch and explain co-ordinate measuring machine. **(06 Marks)**

b. What are Tactile sensors? Explain different types of tactile sensors. **(06 Marks)**

c. Explain the principle of Inferometry. **(04 Marks)**

Module-4

7 a. Explain the working of generalized measurement system with block diagram taking the example. **(06 Marks)**

b. Define the following terms, with reference to measuring systems :
i) Threshold ii) Hysteresis. **(04 Marks)**

c. Distinguish between :
i) Primary & Secondary transducer ii) Active & Passive transducer. **(06 Marks)**

OR

8 a. State and explain any four Inherent problems associated in mechanical systems. **(08 Marks)**
b. State any four terminating devices. Explain any two. **(08 Marks)**

Module-5

9 a. With a neat sketch, describe the Bridgeman gauge used for pressure measurement. **(08 Marks)**
b. How are dynamometers classified? Explain with a neat sketch, Prony brake dynamometer. **(08 Marks)**

OR

10 a. Explain the working principle of radiation pyrometer. **(06 Marks)**
b. Illustrate the working of Electrical resistance strain gauge. **(04 Marks)**
c. Briefly explain the laws of Thermocouple. **(06 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 $A=\begin{bmatrix}2 & 3 & -1 & -1\\ 1 & -1 & -2 & -4\\ 3 & 1 & 3 & -2\\ 6 & 3 & 0 & -7\end{bmatrix}$ by applying elimentary row transformations. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $x-2y+3z=8$ and $2x+y-z=3$. **(05 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix}5 & -2\\ 3 & 1\end{bmatrix}$ using Cayley-Hamilton theorem. **(05 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix}1 & 3 & -1 & 2\\ 0 & 11 & -5 & 3\\ 2 & -5 & 3 & 1\\ 4 & 1 & 1 & 5\end{bmatrix}$ by reducing it to echelon form. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $2x-3y+4z=13$ and $3x+4y+5z=40$. **(05 Marks)**

c. Find the eigen values of $A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$. **(05 Marks)**

Module-2

3 a. Solve $(D^4-2D^3+5D^2-8D+4)y=0$. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2}-4y=\cosh(2x-1)+3^x$. **(05 Marks)**

c. Solve by the method of variation of parameters $y''+a^2y=\sec ax$. **(06 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+4\frac{dy}{dx}-2y=e^x$. **(05 Marks)**

b. Solve $(D^2+5D+6)y=\sin x$. **(05 Marks)**

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

Module-3

5 a. Find the Laplace transform of $\cos t.\cos 2t.\cos 3t$. **(06 Marks)**

b. Find the Laplace transform $f(t)=\frac{Kt}{T}$, $0<t<\pi$, $f(t+T)=f(t)$. **(05 Marks)**

c. Express $f(t)=\begin{cases}\cos t, & 0<t<\pi\\ \sin t, & t>\pi\end{cases}$ in terms of unit step function, and hence find L[f(t)]. **(05 Marks)**

OR

6 a. Find the Laplace transform of (i) $t\cos at$, (ii) $\frac{1-e^{-at}}{t}$. **(06 Marks)**

b. Find the Laplace transform of a periodic function a period 2a, given that $f(t)=\begin{cases}t, & 0\le t<a\\ 2a-t, & a\le t<2a\end{cases}$ $f(t+2a)=f(t)$. **(05 Marks)**

c. Express $f(t)=\begin{cases}1, & 0<t<1\\ t, & 1<t\le 2\\ t^2, & t>2\end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

Module-4

7 a. Find the inverse Laplace transform of (i) $\frac{(s+2)^3}{s^6}$, (ii) $\frac{s+5}{s^2-6s+13}$. **(06 Marks)**

b. Find inverse Laplace transform of $\log\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$. **(05 Marks)**

c. Solve by using Laplace transforms $\frac{d^2y}{dt^2}+k^2y=0$, given that $y(0)=2$, $y'(0)=0$. **(05 Marks)**

OR

8 a. Find the inverse Laplace transform of $\frac{4s+5}{(s+1)^2(s+2)}$. **(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 $y''+4y'+3y=e^{-t}$ with $y(0)=1$, $y'(0)=1$. **(05 Marks)**

Module-5

9 a. If A and B are any two events of S, which are not mutually exclusive then $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. **(05 Marks)**

b. The probability that 3 students A, B, C, solve a problem are ½, ⅓, ¼ respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? **(05 Marks)**

c. In a class 70% are boys and 30% are girls. 5% of boys, 3% of girls are irregular to the classes. What is the probability of a student selected at random is irregular to the classes and what is the probability that the irregular student is a girl? **(06 Marks)**

OR

10 a. If A and B are independent events then prove that $\overline{A}$ and $\overline{B}$ are also independent events. **(05 Marks)**

b. State and prove Baye's theorem. **(05 Marks)**

c. A Shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out or 3 shoots. Find the probability that the target is being hit:
(i) when both of them try (ii) by only one shooter. **(06 Marks)**

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