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15MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics–IV

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. Find by Taylor's series method the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ (upto 4th degree term). **(05 Marks)**

b. The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of y at x = 4.5 using Milne's predictor and corrector formulae. **(05 Marks)**

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

c. Using Euler's modified method. Obtain a solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$, with initial conditions y = 1 at x = 0, for the range $0 \le x \le 0.4$ in steps of 0.2. **(06 Marks)**

OR

2 a. Using modified Euler's method find y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 taking h = 0.2. **(05 Marks)**

b. Given $\frac{dy}{dx} = x^2(1+y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) =1.548, y(1.3) = 1.979. Evaluate y(1.4) by Adams-Bashforth method. **(05 Marks)**

c. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at x = 0.2 by taking h = 0.2 **(06 Marks)**

Module-2

3 a. Obtain the solution of the equation $2\frac{d^2y}{dx^2} = ux + \frac{dy}{dx}$ by computing the value of the dependent variable corresponding to the value 1.4 of the independent variable by applying Milne's method using the following data: **(05 Marks)**

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

b. Express $f(x) = 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(05 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ **(06 Marks)**

OR

4 a. By Runge-Kutta method solve $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for x = 0.2. Correct to four decimal places using the initial conditions y = 1 and $y' = 0$ at x = 0, h = 0.2. **(05 Marks)**

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

c. Prove the Rodrigues formula,

$$\rho_n(x) = \frac{1}{2^n n!} \frac{d^n (x^2 - 1)^n}{dx^n}$$ **(06 Marks)**

Module-3

5 a. State and prove Cauchy's-Riemann equation in polar form. **(05 Marks)**

b. Discuss the transformation $W = e^z$. **(05 Marks)**

c. Evaluate $\int_C \left\{ \frac{\sin(\pi z^2) + \cos(\pi z^2)}{(z-1)^2 (z-2)} \right\} dz$

using Cauchy's residue theorem where 'C' is the circle $|z| = 3$ **(06 Marks)**

OR

6 a. Find the analytic function whose real part is, $\frac{\sin 2x}{\cosh 2y - \cos 2x}$. **(05 Marks)**

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

c. Find the bilinear transformation which maps z = ∞, i, 0 into ω = -1, -i, 1. Also find the fixed points of the transformation. **(06 Marks)**

Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for,

(i) more than 2150 hours.
(ii) less than 1950 hours
(iii) more than 1920 hours and less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.
(ii) Covariance of x and y
(iii) Correlaiton of x and y. **(06 Marks)**

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OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

Horse A:	28	30	32	33	33	29	34
Horse B:	29	30	30	24	27	29	

Test whether you can discriminate between the two horses.($t_{0.05}$=2.2 and $t_{0.02}$=2.72 for 11 d.f) **(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. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B 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. **(06 Marks)**

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15ME42

Fourth Semester B.E. Degree Examination, June/July 2017
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer FIVE full questions, choosing one full question from each module.
2. In the sketches of mechanisms, clearly distinguish link & construction line.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. Define 'kinematic pair' and 'degree of freedom'. Sketch 'spherical pair' and state its degree of freedom. **(06 Marks)**

b. Name an exact straight line motion mechanism having only turning pairs. Draw a neat proportionate sketch of the same. State geometric relationships among its links. Indicate the point tracing straight line and prove that the point can trace straight line. **(10 Marks)**

OR

2 a. In a 4-bar mechanism, the lengths of driver crank, coupler and follower link are 150 mm, 250 mm and 300 mm respectively. The fixed link length is L_o. Find the range of values for L_o to make it a crank-rocker mechanism. **(06 Marks)**

b. Draw a neat proportionate sketch of 'Whitworth mechanism'. Indicate clearly the positions of driver crank corresponding to the extreme positions of shaper tool. **(06 Marks)**

c. State an application for the following:
i) Drag link mechanism ii) Oldham coupling
iii) Geneva wheel iv) Toggle mechanism **(04 Marks)**

Module-2

3 An IC engine mechanism has crank AB of 0.5m and connecting rod BC of 2m length. Crank AB rotates uniformly at 600 rpm in clockwise direction. When the crank has turned 45° from top dead centre (TDC), find the magnitude and direction of angular acceleration of connecting rod. **(16 Marks)**

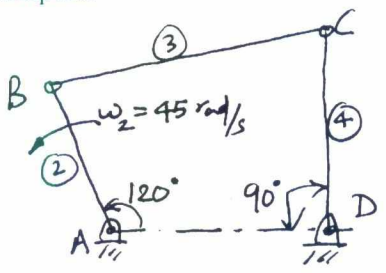
OR

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

b. A slider crank mechanism has crank of length 'r' and connecting rod 'ℓ'. Crank rotates uniformly at 'ω' rad/s in anticlockwise direction. Crank has moved θ from IDC. Assuming r, ℓ, ω and θ are known, state the procedure of 'Klein's construction' for:
i) Velocity analysis and ii) Acceleration analysis **(10 Marks)**

Module-3

5 A four bar mechanism ABCD is shown in Fig.Q5. Find the angular velocities of links 3 and 4 by complex algebra and vector algebra method, if ω_2 = 45 rad/s, counter clockwise, from first principles. **(16 Marks)**



AB = 100 mm
BC = r_3
CD = 300 mm
AD = 250 mm

Fig.Q5

OR

6 Obtain Freudenstein's equation for four bar mechanism. **(16 Marks)**

Module-4

7 a. State law of gearing and define:
i) Path of contact and
ii) Arc of contact. **(06 Marks)**

b. The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20° involute profile and the module is 6 mm. If the length of arc of contact is 1.75 times the circular pitch, find the addendum. **(10 Marks)**

OR

8 An epicyclic gear train has a fixed annular wheel C concentric with sun wheel A. A planet wheel B gears with A and C and can rotate freely on a pin carried by an arm D which rotates about an axis coaxial with that of A and C. If T_1 and T_2 are the numbers of teeth on A and C respectively, show that the ratio of the speeds of D to A is $\frac{T_1}{T_1 + T_2}$. **(16 Marks)**

Module-5

9 Draw the profile of a cam to raise a valve with SHM through 40 mm in $1/4^{th}$ revolution, keep it fully raised through $1/10^{th}$ revolution and to lower it with uniform acceleration and retardation in $1/6^{th}$ revolution. The valve remains closed during the rest of revolution. The diameter of roller is 20 mm and minimum radius of cam is 30 mm. The axis of valve rod passes through the axis of cam shaft. The cam rotates at 360 rpm, clockwise. Find maximum velocity and acceleration during raise and return of follower. **(16 Marks)**

OR

10 A symmetrical cam with convex flanks operates a flat-footed follower. The lift is 8 mm, base circle radius is 25 mm and the nose radius is 12 mm. If the total angle of cam action is 120°, find the radius of the convex flanks. Determine the maximum velocity and the maximum acceleration when the cam shaft rotates at 500 rpm. **(16 Marks)**

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15ME43

Fourth Semester B.E. Degree Examination, June/July 2017
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Obtain air standard efficiency expression for diesel cycle. **(08 Marks)**

b. The compression ratio of an air standard Otto cycle is 8. At the beginning of compression process the pressure is 1 bar and the temperature is 300 K. The heat transfer to the air per cycle is 1900 kJ/kg of air. Calculate:
i) Pressure and temperature at the end of each process of the cycle.
ii) Thermal efficiency. **(08 Marks)**

OR

2 a. With a neat sketch, explain the working of Ram jet. **(06 Marks)**

b. In a constant pressure open cycle gas turbine air enters at 1 bar and 20°C, leaves the compressor at 5 bar. Using the following data, temperature of gases entering the turbine = 680°C, pressure loss in the combustion chamber = 0.1 bar, compressor and turbine efficiency = 0.85 and 0.80, $\gamma = 1.4$, $C_p = 1.024$ kJ/kgK for air and gas, combustion chamber efficiency = 85%, find:
i) The quantity of air circulation if the plant develops 1065 kW.
ii) Heat supplied /kg of air circulation.
iii) The thermal efficiency of the cycle. Mass of the fuel may be neglected. **(10 Marks)**

Module-2

3 a. With a schematic diagram, explain the working of regenerative Rankine cycle. Show the process on T-S and H-S diagram. **(08 Marks)**

b. In a steam power plant operating on ideal Rankine cycle steam enters the turbine at 20 bar with an enthalpy of 3248 kJ/kg and an entropy of 7.127 kJ/kgK. The condenser pressure is 0.1 bar. Find the cycle efficiency and specific steam consumption in kg/kWh. Do not neglect pump work. **(08 Marks)**

OR

4 a. What are the advantages and disadvantages of binary vapour power cycle? **(06 Marks)**

b. In a reheat cycle, the initial steam pressure and the maximum temperature are 150 bar and 550°C, If the condenser pressure is 0.1 bar and the moisture at the condenser inlet is 5% and assuming ideal processes, determine: (i) Reheat pressure, (ii) Cycle efficiency, (iii) Steam rate, steal is reheated to 550°c. **(10 Marks)**

Module-3

5 a. Define the following:
i) Stochiometric air
ii) Enthalpy of formation
iii) Combustion efficiency. **(06 Marks)**

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b. During a test on a diesel engine the following observations were made. The power developed by the engine is used for driving a DC generator. The output of the generator was, 210 A at 200 V, the efficiency of generator being 82%. The quantity of fuel supplied to the engine was 11.2 kg/h. Calorific value of fuel being 42600 kJ/kg. The air fuel ratio was 18:1. The exhaust gases were passed through an exhaust gas calorimeter for which the observations were as follows, water circulated through exhaust gas calorimeter = 580 lit/h, temperature rise of water through calorimeter = 36°C. Temperature of exhaust gases at exit from calorimeter = 98°C, Ambient temperature = 20°C. Heat lost to jacket cooling water = 32% total heat supplied. Specific heat of exhaust gases = 1.05 kJ/kgK. Calculate BP of the engine, η_{bt} and draw up heat balance sheet on minute basis. **(10 Marks)**

OR

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

b. Benzene C_6H_6 is burnt in air and the analysis of the products of combustion yielded the following results:

$CO_2 = 10.96\%$, $CO = 0.5\%$, $O_2 = 7.5\%$, $N_2 = 81.04\%$.

Determine: i) Actual air-fuel ratio on mole basis ; ii) Actual air-fuel ratio on mass basis; iii) Percentage excess air. **(08 Marks)**

Module-4

7 a. With a schematic diagram, explain the working of vapour absorption refrigeration system. Show the processes on T-S diagram. **(08 Marks)**

b. An air conditioning plant is required to supply 60 m^3 of air/minute at a DBT of 21°C and 55% RH. The outside air is at DBT of 28°C and 60% RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then to cool the air. **(08 Marks)**

OR

8 a. With a neat sketch explain the working of winter air conditioning system. Show the processes on psychrometric chart. **(08 Marks)**

b. An air refrigeration system working on Bell-Coleman cycle with 15 TOR capacity has its pressure range 1 bar to 10 bar. Air enters the compressor at −5°C and enters the expander at 25°C. Assuming isentropic expansion and compression, find COP, air flow rate and power required. **(08 Marks)**

Module-5

9 a. Show that for perfect intercooling, stage pressure ratio remains the same in multistage air compressor and hence prove that $Z = \left(\frac{p_{x+1}}{p_1}\right)^{1/x}$ where z = stage pressure ratio, p_1 = initial pressure, x = number of stages. **(09 Marks)**

b. Steam expands from 17 bar and 284°C to 0.7 bar in a convergent-divergent nozzle. Assuming that the expansion is frictionless and the steam discharged is 0.25 kg/s, calculate the diameter of the nozzle, (i) at a point where the pressure is 9.5 bar, (ii) at exit, using H-S chart. **(07 Marks)**

OR

10 a. Briefly explain the different types of flows in a steam nozzle. **(09 Marks)**

b. Determine the size of the cylinder of a double acting air compressor of 45kW in which air is taken at 1 atmosphere and compressed to 16 atmospheric pressure according to the law $PV^{1.25} = C$. Assume speed of the crank as 300 rpm, piston speed = 180 m/min. **(07 Marks)**

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15ME44

Fourth Semester B.E. Degree Examination, June/July 2017
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-1

1 a. Define compressibility of a fluid. Derive an expression for compressibility of a fluid undergoing isentropic compression. **(04 Marks)**

b. A thin horizontal plate of area A is placed midway in a gap of height 'h' between two horizontal plane surfaces. The gap is filled with a liquid of viscosity μ_1. The plate requires a force F to move with a constant velocity V. The gap is now filled with another liquid of viscosity μ_2 and the same plate is placed at a distance of h/4 from one wall and parallel to it. Experiments indicate that for the same velocity V, the force required was same. Prove that $\mu_1 = \frac{4}{3}\mu_2$. **(07 Marks)**

c. A U-tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100 mm below the level of mercury in the right limb. If the difference of mercury level in the two limbs is 160 mm, determine the absolute pressure of oil in the pipe. Take atmospheric pressure = 100 kPa. **(05 Marks)**

OR

2 a. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. **(08 Marks)**

b. A wooden cylinder of specific gravity 0.6 and circular in cross section is required to float in oil of specific gravity 0.9. Find the L/D ratio for the cylinder to float with its longitudinal axis vertical in oil, where L is the height of the cylinder and D is its diameter. **(08 Marks)**

Module-2

3 a. Derive the continuity equation in three dimensional Cartesian coordinates for a steady incompressible flow. **(06 Marks)**

b. Write the expressions for acceleration of a fluid in x, y and z directions. Differentiate between local and convective acceleration. **(05 Marks)**

c. The velocity potential function ϕ is given by an expression $\phi = -2\ell n(x^2 + y^2)$. Show that it represents a possible case of fluid flow. **(05 Marks)**

OR

4 a. Derive an expression for discharge through a triangular notch. **(06 Marks)**

b. A pump has tapering pipe running full of water. The pipe is placed vertically with the diameter at the base and top being 1.2m and 0.6m respectively. The pressure at the upper end is 240 mm of Hg vacuum, while the pressure at the lower end is 15 kN/m^2. Assume the head loss to be 20% of the difference in the velocity head. Calculate the discharge. The flow is vertically upwards. The difference of elevation is 3.95 m. **(10 Marks)**

Module-3

5 a. Prove that the velocity distribution across a cross section of a circular pipe during viscous fluid flow is parabolic in nature. Also show that the maximum velocity is in the centre of the pipe and is equal to twice the average velocity. **(10 Marks)**

b. Water at 15°C flows between two parallel plates at a distance of 1.6 mm apart. Determine:
i) Maximum velocity
ii) Pressure loss per unit length
iii) Shear stress at the plate if the average velocity is 0.2 m/s. Viscosity of water at 15°C is 0.01 poise. Take unit width of the plate. **(06 Marks)**

OR

6 a. Derive Darcy-Weisbach equation for determining loss of head due to friction in a pipe. **(08 Marks)**

b. An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/s. Find the head loss due to friction and power required to maintain the flow for a length of 1000 m. Take kinematic viscosity of oil = 0.29 stokes. **(08 Marks)**

Module-4

7 a. What is the meaning of boundary layer separation? What is the effect of pressure gradient on boundary layer separation? **(08 Marks)**

b. Using Rayleigh's method, show that the power P developed by a hydraulic turbine is given by $P = \rho N^3 D^5 \phi\left[\frac{N^2D^2}{gH}\right]$, where ρ = density of liquid, N = rotational speed of turbine in rpm, D = diameter of the runner, H = working head, g = gravitational acceleration. **(08 Marks)**

OR

8 a. The rate of discharge Q of a centrifugal pump is dependent upon density of the fluid ρ, pump speed N in rpm, diameter of the impeller D, pressure P, viscosity of the fluid μ. Using Bucking Ham's π - theorem method, show that $Q = ND^3\phi\left[\frac{P}{\rho N^2D^2}, \frac{\mu}{\rho ND^2}\right]$. **(08 Marks)**

b. A kite 0.8m × 0.8m weighing 3.924N assumes an angle of 12° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. The pull on the string is 24.525 N when the wind is flowing at a speed of 30 km/hr. find the corresponding coefficient of drag and lift. Take density of air = 1.25 kg/m^3. **(08 Marks)**

Module-5

9 a. Show that the velocity of a sound wave in a compressible fluid medium is given by $c = \sqrt{\frac{k}{\rho}}$ where k and ρ are bulk modules of elasticity and density of the fluid respectively. **(08 Marks)**

b. Calculate the velocity and mach number of a supersonic aircraft flying at an altitude of 1000 m where the temperature is 280 K. Sound of the aircraft is heard 2.15 seconds after the passage of the aircraft on the head of an observer. Take γ = 1.41 and R = 287 J/kgK. **(08 Marks)**

OR

10 a. Define stagnation temperature of a fluid. Show that the stagnation temperature and static temperatures are related by $\frac{T_0}{T} = 1 + \left(\frac{r-1}{2}\right)m^2$ where r = ratio of specific heats, m = mach number. **(08 Marks)**

b. Mention the applications and limitations of computational fluid dynamics. **(08 Marks)**

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15ME45A

Fourth Semester B.E. Degree Examination, June/July 2017
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. List and briefly explain the steps involved in making sand casting. **(08 Marks)**

b. Explain in detail various allowance given to pattern and reasons to provide the allowance. **(08 Marks)**

OR

2 a. List the types of moulding sand. Briefly explain the properties of moulding sand. **(08 Marks)**

b. With a neat sketch, explain the working principle of Jolt and Squeeze machine. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain the different zones present in CUPOLA FURNACE. **(08 Marks)**

b. How do you classify the melting furnace? Draw a neat sketch and explain the working of gas fired pit furnace. **(08 Marks)**

OR

4 a. What is die casting? Draw a neat sketch and explain the Hot chamber die casting process. **(08 Marks)**

b. With a neat sketch, explain centrifugal casting process. Mention merits and demerits. **(08 Marks)**

Module-3

5 a. What is nucleation? Explain types of nucleation with neat sketches. **(08 Marks)**

b. What is degasification in liquid metals? Mention the methods explain any one. **(08 Marks)**

OR

6 a. What is Fettling? Mention the steps involved in Fettling. Explain with sketch of any two casting defects. **(08 Marks)**

b. With a neat sketch, explain the principle of lift-out crucible furnace. **(08 Marks)**

Module-4

7 a. Sketch and explain TIG welding process. Mention its advantages and disadvantages. **(08 Marks)**

b. Explain with a neat sketch, atomic hydrogen welding. **(08 Marks)**

OR

8 a. With a neat sketch, explain LASER beam welding and mention its advantages, disadvantages and limitations. **(08 Marks)**

b. Sketch and explain seam welding. Mention advantages, disadvantages and applications. **(08 Marks)**

Module-5

9 a. What is heat affected zone (HAZ)? Explain the parameters affecting HAZ. **(08 Marks)**

b. Write short notes on: i) Welding defects, ii) Residual stresses. **(08 Marks)**

OR

10 a. With neat sketch, explain Oxy-acetylene welding process. **(08 Marks)**

b. What are different non-destructive testing (NDT) methods and explain with a neat sketch ultrasonic inspection method. **(08 Marks)**

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15ME45B/15MA45

Fourth Semester B.E. Degree Examination, June/July 2017
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

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

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2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

1 a. Define machine tool. Give classification of machine tool. **(06 Marks)**

b. With neat sketch, explain various parts of lathe machine. **(10 Marks)**

OR

2 a. Explain with neat sketch working principle of drilling machine. **(04 Marks)**

b. Sketch and label principle parts of shaper. **(06 Marks)**

c. Explain briefly constructional features of milling machine with neat sketch. (Column and knee type) **(06 Marks)**

Module-2

3 a. What is machining? Give classification of machining processes. **(06 Marks)**

b. With neat sketches, explain working and auxiliary motions in machine tools. **(10 Marks)**

OR

4 a. List the operations performed on a lathe and explain any four operations with neat sketches. **(08 Marks)**

b. Explain briefly with neat sketches of any five drilling machine operations. **(08 Marks)**

Module-3

5 a. Describe properties and characteristics of cutting tool materials. **(04 Marks)**

b. With neat sketch, explain principal angles of a single point cutting tool. **(06 Marks)**

c. Explain briefly Twist drill nomenclature with neat sketch. **(06 Marks)**

OR

6 a. Mention the basic requirements of cutting fluids. **(04 Marks)**

b. Discuss briefly about types of cutting fluids used in metal cutting process. **(06 Marks)**

c. List the parameters affecting the surface finish and explain them briefly. **(06 Marks)**

Module-4

7 a. A workpiece of 80 mm diameter and 120 mm length is held between centres and turned in 2 passes. If the approach length is 10 mm and over travel is 6 mm find machining time. Assume cutting speed as 0.4 m/sec and feed 0.4 mm/rev. **(08 Marks)**

b. Calculate the machining time required to reduce 60 mm diameter shaft to 50 mm diameter for a length of 1500 mm with depth of cut of 2 mm for rough cut and 1 mm for finish cut. The following details are given:

i) Cutting speed = 30 m/min
ii) Feed = 0.5 mm/rev
iii) Approach length = 5 mm
iv) Overrun length = 5 mm
v) Number of passes = 3 (2 rough cut + 1 finish cut) **(08 Marks)**

OR

8 a. A 63.5 mm diameter plain milling cutter having 6 teeth is used for face milling a block of aluminium 18 cm long and 3 cm wide. The spindle speed is 1500 rpm and the feed is 0.125 mm/tooth. Determine:
   i) Table feed in mm/min
   ii) Cutting time. **(08 Marks)**

   b. Evaluate cutting speed and machining time for the plain (slab) milling operation for the following data:
   Diameter of milling cutter = 100 mm
   Cutting speed = 500 rpm
   Depth of cut = 5 mm
   Table feed = 100 mm/min
   Length of workpiece = 50 cm
   Number of teeth in the cutter = 8. **(08 Marks)**

Module-5

9 a. Explain briefly causes for the tool failure/wear with sketches. **(08 Marks)**

   b. Discuss about tool wear mechanisms which are responsible for causing wear. **(08 Marks)**

OR

10 a. Mention the factors affecting tool life and explain them briefly. **(08 Marks)**

   b. A tool life of 80 minute is obtained at a speed of 30 mpm (m per min) and 8 minute at 60 m per min. Determine the following:
   i) Tool life equation
   ii) Cutting speed for 4 minute tool life. **(08 Marks)**

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15ME46B

Fourth Semester B.E. Degree Examination, June/July 2017
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain with a sketch, the international prototype meter. **(08 Marks)**

b. Briefly explain: i) Wringing procedure ii) Principle of sine bar. **(08 Marks)**

OR

2 a. Explain the principle of Auto-collimeter with a neat sketch and list advantages of wavelength standards. **(08 Marks)**

b. Show the arrangement of minimum angle gauges required to obtain the following angles.
i) 32°36′24″ ii) 122°30′0″ **(08 Marks)**

Module-2

3 a. Define the terms : i) Limits ii) Fits iii) Tolerance. **(06 Marks)**

b. Illustrate the following types of gauges
i) Snap gauge ii) Ring gauge iii) Plain plug gauge. **(10 Marks)**

OR

4 a. Explain with a neat sketch, the working of SOLEX COMPARATOR. **(08 Marks)**

b. Differentiate measuring instruments, gauges and comparators. **(08 Marks)**

Module-3

5 a. With the setup, explain how effective diameter of a screw thread is measured using 3 wire method. **(08 Marks)**

b. Describe constant chord method to find tooth thickness. **(08 Marks)**

OR

6 a. List the advantages of Lasers and explain in detail any one laser interferometer. **(08 Marks)**

b. Sketch and explain a CMM. What are the various applications of CMM? **(08 Marks)**

Module-4

7 a. Briefly explain the following terms:
i) System response and time delay ii) Accuracy and error iii) Repeatability **(08 Marks)**

b. What is the necessity of modifying devices? Enlist the advantages of electrical modifying devices. **(08 Marks)**

OR

8 a. Explain with a neat sketch Ballast circuit. **(06 Marks)**

b. What are terminating devices? Explain in detail oscillograph. **(10 Marks)**

Module-5

9 a. Explain the working of Pirani gauge with a neat sketch. **(08 Marks)**

b. Explain with neat sketch Analytical Balance to measure unknown faces. **(08 Marks)**

OR

10 a. What is a thermocouple? Explain the Law's of thermocouple. **(08 Marks)**

b. Sketch and explain total Radiation pyrometers. **(08 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2017
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-1

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

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

c. Find all the eigen values and eigen vector corresponding to largest eigen value of the matrix :
$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$. **(05 Marks)**

OR

2 a. Solve the following system of equations by Gauss elimination method :
$x + y + z = 9$
$2x + y - z = 0$
$2x + 5y + 7z = 52.$ **(06 Marks)**

b. Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ into its echelon form and hence find its rank. **(05 Marks)**

c. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley – Hamilton theorem. **(05 Marks)**

Module-2

3 a. Solve $(D^2 - 4D + 13)y = \cos 2x$ by the method of undetermined coefficients. **(06 Marks)**
b. Solve $(D^2 + 2D + 1)y = x^2 + 2x$. **(05 Marks)**
c. Solve $(D^2 - 6D + 25)y = \sin x$. **(05 Marks)**

OR

4 a. Solve $(D^2 + 1)y = \tan x$ by the method of variation of parameters. **(06 Marks)**
b. Solve $(D^3 + 8)y = x^4 + 2x + 1$. **(05 Marks)**
c. Solve $(D^2 + 2D + 5)y = e^{-x} \cos 2x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of :

i) $e^{-t}\cos^2 3t$ ii) $\frac{\cos 2t - \cos 3t}{t}$. **(06 Marks)**

b. Find:

i) $L\left[t^{-5/2} + t^{5/2}\right]$ ii) $L[\sin 5t \cdot \cos 2t]$. **(05 Marks)**

c. Find the Laplace transform of the function : $f(t) = E\sin\left(\frac{\pi t}{\omega}\right)$, $0 < t < \omega$, given that $f(t+\omega) = f(t)$. **(05 Marks)**

OR

6 a. Find :

i) $L[t^2 \sin t]$ ii) $L\left[\frac{\sin 2t}{t}\right]$. **(06 Marks)**

b. Evaluate : $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\,dt$ using Laplace transform. **(05 Marks)**

c. Express $f(t) = \begin{cases} \sin 2t, & 0 < t < \pi \\ 0, & t > \pi \end{cases}$, in terms of unit step function and hence find L[f(t)]. **(05 Marks)**

Module-4

7 a. Solve the initial value problem $\frac{d^2y}{dx^2} + \frac{5dy}{dx} + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transforms : i) $\frac{3(s^2-1)^2}{2s^2}$ ii) $\frac{s+1}{s^2+6s+9}$. **(05 Marks)**

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

OR

8 a. Solve the initial value problem :

$\frac{d^2y}{dt^2} + \frac{4dy}{dt} + 3y = e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transform : i) $\frac{1}{s\sqrt{5}} + \frac{3}{s^2\sqrt{5}} - \frac{8}{\sqrt{5}}$ ii) $\frac{3s+1}{(s-1)(s^2+1)}$. **(05 Marks)**

c. Find the inverse Laplace transform : $\frac{2s-1}{s^2+4s+29}$. **(05 Marks)**

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Module-5

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

b. A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. They fire a volley. What is the probability that i) two shots hit ii) atleast two shots hit? **(05 Marks)**

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

OR

10 a. Prove that $P(A \cup B) = P(A) + (B) - P(A \cap B)$, for any two events A and B. **(06 Marks)**

b. Show that the events $\overline{A}$ and $\overline{B}$ are independent, if A and B are independent events. **(05 Marks)**

c. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine C. **(05 Marks)**

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