CBCS Scheme

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15MAT41

Fourth Semester B.E. Degree Examination, June/July 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. Use Taylor's series method to find y at x = 1.1, considering terms upto third degree given that $\frac{dy}{dx} = x + y$ and y(1) = 0. **(05 Marks)**

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

c. Given $\frac{dy}{dx} = x^2 - y$, y(0) = 1 and the values y(0.1) = 0.90516, y(0.2) = 0.82127, y(0.3) = 0.74918, evaluate y(0.4), using Adams-Bashforth method. **(06 Marks)**

OR

2 a. Using Euler's modified method, find y(0.1) given $\frac{dy}{dx} = x - y^2$, y(0) = 1, taking h = 0.1. **(05 Marks)**

b. Solve $\frac{dy}{dx} = xy$; y(1) = 2, find the approximate solution at x = 1.2, using Runge-Kutta method. **(05 Marks)**

c. Solve $\frac{dy}{dx} = x - y^2$ with the following data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762, compute y at x = 0.8, using Milne's method. **(06 Marks)**

Module-2

3 a. Using Runge-Kutta method of order four, solve $y'' = y + xy'$, y(0) = 1, y'(0) = 0 to find y(0.2). **(05 Marks)**

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

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

OR

4 a. Given $y'' = 1 + y'$; y(0) = 1, y'(0) = 1, compute y(0.4) for the following data, using Milne's predictor-corrector method.

y(0.1) = 1.1103 y(0.2) = 1.2427 y(0.3) = 1.399
y'(0.1) = 1.2103 y'(0.2) = 1.4427 y'(0.3) = 1.699. **(05 Marks)**

b. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(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. Derive Cauchy-Riemann equations in polar form. **(05 Marks)**

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

c. Find the bilinear transformation which maps $z = \infty, i, 0$ on to $w = 0, i, \infty$. **(06 Marks)**

OR

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

b. If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$, find the corresponding analytic function $f(z) = u + iv$. **(05 Marks)**

c. Discuss the transformation $w = z^2$. **(06 Marks)**

Module-4

7 a. Derive mean and standard deviation of the binomial distribution. **(05 Marks)**

b. If the probability that an individual will suffer a bad reaction from an injection of a given serum is 0.001, determine the probability that out of 2000 individual (i) exactly 3 (ii) more than 2 individuals will suffer a bad reaction. **(05 Marks)**

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

X \ Y	-3	-2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Determine: i) Marginal distribution of X and Y ii) Covariance of X and Y
iii) Correlation of X and Y **(06 Marks)**

OR

8 a. Derive mean and standard deviation of exponential distribution. **(05 Marks)**

b. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed. Given $P(0 < z < 1.2263) = 0.39$ and $P(0 < z < 1.14757) = 0.43$. **(05 Marks)**

c. The joint probability distribution of two random variables X and Y is as follows:

Y \ X	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Compute: i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y) iv) $\rho(X, Y)$ **(06 Marks)**

Module-5

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

b. The nine items of a sample have the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5? **(05 Marks)**

c. Given the matrix $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$ then show that A is a regular stochastic matrix. **(06 Marks)**

OR

10 a. A die was thrown 9000 times and of these 3220 yielded a 3 or 4, can the die be regarded as unbiased? **(05 Marks)**

b. Explain: i) Transient state ii) Absorbing state iii) Recurrent state **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand, if he does not study one night, he is 60% sure not to study the next night. In the long run, how often does he study? **(06 Marks)**

CBCS Scheme

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 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 $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ by reducing to echelon form. **(06 Marks)**

b. Use Cayley-Hamilton theorem to find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. **(05 Marks)**

c. Apply Gauss elimination method to solve the equations $x+4y-z=-5$; $x+y-6z=-12$; $3x-y-z=4$ **(05 Marks)**

OR

2 a. Find all the eigen values and eigen vector corresponding to the largest eigen value of $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. **(06 Marks)**

b. Find the rank of the matrix by elementary row transformations $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$. **(05 Marks)**

c. Solve the system of linear equations $x+y+z=6$; $2x-3y+4z=8$; $x-y+2z=5$ by Gauss elimination method. **(05 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2}+4y=\tan 2x$ by the method of variation of parameters. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2}+5\frac{dx}{dt}+6x=0$, given $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(05 Marks)**

c. Solve $(D^2+5D+6)y=e^x$. **(05 Marks)**

OR

4 a. Solve by the method of undetermined coefficients $(D^2-2D+5)y=25x^2+12$. **(06 Marks)**

b. Solve $(D^2+3D+2)y=\sin 2x$. **(05 Marks)**

c. Solve $(D^2-2D-1)y=e^x\cos x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of, (i) $t\cos^2 t$ (ii) $\frac{1-e^{-t}}{t}$ **(06 Marks)**

b. Find the Laplace transforms of, (i) $e^{-2t}(2\cos 5t-\sin 5t)$ (ii) $3\sqrt{t}+\frac{4}{\sqrt{t}}$. **(05 Marks)**

c. Express the function, $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

OR

6 a. Find the Laplace transform of the periodic function defined by $f(t) = E\sin\omega t$, $0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. **(06 Marks)**

b. Find the Laplace transform of $2^t + t\sin t$. **(05 Marks)**

c. Find the Laplace transform of $\frac{2\sin t \sin 5t}{t}$. **(05 Marks)**

Module-4

7 a. Using laplace transforms method, solve $y'' - 6y' + 9 = t^2e^{3t}$, $y(0) = 2$, $y'(0) = 6$. **(06 Marks)**

b. Find the inverse Laplace transforms of, (i) $\frac{s^2 - 3s + 4}{s^3}$ (ii) $\frac{s+3}{s^2 - 4s + 13}$ **(05 Marks)**

c. Find the inverse Laplace transforms of, (i) $\log\left(\frac{s+1}{s-1}\right)$ (ii) $\frac{s^2}{(s-2)^3}$ **(05 Marks)**

OR

8 a. Solve the simultaneous equations $\frac{dx}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$ being given $x = y = 0$ when $t = 0$. **(06 Marks)**

b. Find the inverse Laplace transforms of $\cot^{-1}\left(\frac{s}{2}\right)$. **(05 Marks)**

c. Find the inverse Laplace transforms of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$. **(05 Marks)**

Module-5

9 a. For any three arbitrary events A, B, C prove that,
$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$ **(04 Marks)**

b. A class has 10 boys and 5 girls. Three students are selected at random, one after the other. Find probability that, (i) first two are boys and third is girl (ii) first and third boys and second is girl. (iii) first and third of same sex and the second is of opposite sex. **(06 Marks)**

c. In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body. (i) what is the probability that mathematics is being studied ? (ii) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? (iii) a boy? **(06 Marks)**

OR

10 a. State and prove Bayes theorem. **(04 Marks)**

b. A problem in mathematics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved? **(06 Marks)**

c. A pair of dice is tossed twice. Find the probability of scoring 7 points. (i) Once, (ii) at least once (iii) twice. **(06 Marks)**

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15ME42

Fourth Semester B.E. Degree Examination, June/July 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. Define the following:
i) Link ii) Kinematic pairs iii) Kinematic chain
iv) Mechanism v) Structure vi) Degree of freedom **(06 Marks)**

b. Explain with neat sketch crank and slotted lever mechanism. **(05 Marks)**

c. Explain with neat sketch peaucellier mechanism. **(05 Marks)**

OR

2 a. Explain with neat sketch Ackerman steering mechanism. Mention condition for correct steering. **(08 Marks)**

b. Explain with neat sketch: i) Oldham's coupling ii) Pantograph. **(08 Marks)**

Module-2

3 The crank and connecting rod of a theoretical steam engine are 0.5 m and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
i) Velocity of piston
ii) Angular velocity of connecting rod
iii) Velocity of point E on the connecting rod 0.5 m from the crank end
iv) Velocities of rubbing at the pins of the crank shaft, crank and cross head when the diameter of their pins are 50 mm, 60 mm and 30 mm respectively
v) Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. **(16 Marks)**

OR

4 a. State and prove Aronhold Kennedy's theorem. **(04 Marks)**

b. In a slider crank mechanism, the length of crank and connecting rod are 125 mm and 500 mm respectively. The centre of gravity 'G' of the connecting rod is 275 mm from the slider. The crank speed is 600 rpm clockwise. The crank makes 45° from inner dead centre. Locate all the instantaneous centers and find velocity of slider, velocity of slider, velocity of point G and angular velocity of connecting rod. By Klein's construction, determine the acceleration of the slider and the point G. **(12 Marks)**

Module-3

5 The crank of an engine is 200 mm long and the ratio of connecting rod length to crank radius is 4. Determine the acceleration of piston when the crank has turned through 45° from the inner dead centre position and moving towards center at 240 rpm by complex algebra analysis. **(16 Marks)**

OR

6 a. Derive the expression for Freudenstein's equation for slider crank mechanism. **(12 Marks)**

b. Explain function generation for four bar mechanism. **(04 Marks)**

Module-4

7 a. Derive the equation for length of path of contact. **(08 Marks)**

b. A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided:
i) The addenda on pinion and gear wheel
ii) Length of path of contact
iii) The maximum velocity of sliding of teeth on either side of the pitch point. **(08 Marks)**

OR

8 a. Explain with neat sketch:
i) Simple gear train
ii) Compound gear train
iii) Reverted gear train
iv) Epicyclic gear train **(08 Marks)**

b. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm of the gear train rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of the gear B. If the gear A instead of using fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B. Arrangement is shown in Fig.Q8(b).

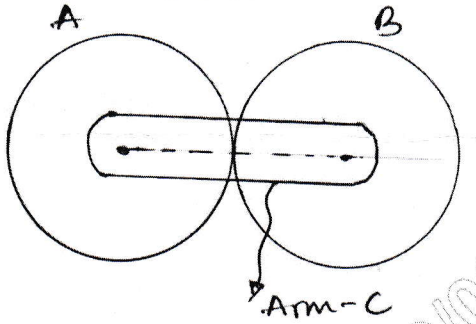

Fig.Q8(b) **(08 Marks)**

Module-5

9 A cam is to be designed for a knife edge follower with the following data, cam lift = 40 mm during 90° for cam rotation with simple harmonic motion, dwell for the next 30°, during the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion, dwell during the remaining 180°. Draw the profile of the cam when the line of stroke of the follower passes through the axis of cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm. Assume the direction of cam rotation is clockwise. **(16 Marks)**

OR

10 In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate:
i) The principal dimensions of the cam.
ii) The accelerations of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(16 Marks)**

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Fourth Semester B.E. Degree Examination, June/July 2018
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive an expression for mean effective pressure in an air standard Otto cycle. **(08 Marks)**

b. Compression ratio of an air standard dual cycle is 8. Air is at 100 kPa, 300 K at the beginning of the compression process. The temperature of air at the end of constant pressure heat addition process is 1300 K. The net heat transfer to the cycle is 480 kJ/kg. Determine:
i) Heat added during constant volume per kg of air
ii) Air standard cycle efficiency and
iii) m.e.p. **(08 Marks)**

OR

2 a. For a simple gas turbine cycle, the optimum pressure ratio for maximum work output of cycle is given by

$$r_p = \left\{ \eta_C \eta_T \frac{T_3}{T_1} \right\}^{\frac{\gamma}{2(\gamma-1)}}$$

where η_C and η_T are the isentropic efficiency of compressor and turbine respectively, T_3 and T_1 = maximum and minimum temperature of the cycle respectively. $\gamma = C_p/C_v$ **(08 Marks)**

b. Determine the network output and thermal efficiency of an ideal gas turbine cycle having two stages of compression with perfect intercooling, two stages of expansion with perfect reheating between the stages and an ideal regenerator. The overall pressure ratio of the cycle is 4 and the maximum temperature of the cycle is 900°C. Assume that the atmospheric temperature is 15°C and the cycle is designed for maximum work output. Draw the schematic and T-S diagrams for the cycle. **(08 Marks)**

Module-2

3 a. Why is Carnot cycle not practicable for steam power plant? Explain briefly with the help of T-S diagram. **(06 Marks)**

b. Discuss the effect of (i) Boiler pressure and (ii) Superheat on the performance of a Rankine cycle. **(06 Marks)**

c. A steam power plant operates on a theoretical reheat cycle. Steam at boiler with 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw h-s diagram and find:
i) Quality of steam at turbine exit
ii) Cycle efficiency
iii) Steam rate in kg/KW.h **(04 Marks)**

OR

4 a. With the help of flow and h-s diagram, derive an expression for cycle efficiency and also for mass of steam bled in a practical regenerative steam cycle with one open feed water heater. **(08 Marks)**

b. Steam at 30 bar, 350°C is supplied to a steam turbine in a practical regenerative cycle and the steam is bled at 4 bar. The bled steam comes out as dry saturated steam and heats the feed water in an direct contact type feed water heater to its saturated liquid state. The rest of the steam in the turbine expands to condenser pressure of 0.1 bar. Assuming the turbine efficiency to be same before and after bleeding; determine:

i) The turbine efficiency
ii) Steam quality at the condenser inlet
iii) Mass of steam bled per kg of boiler steam
iv) Cycle efficiency. **(08 Marks)**

Module-3

5 a. With neat sketch, explain the Orsat's apparatus used for exhaust gas analysis. **(06 Marks)**

b. The products of combustion of an unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat apparatus: CO_2 = 8.0%, CO = 0.9%, O_2 = 8.8% and rest is N_2. Determine:

i) Composition of the fuel
ii) The air-fuel ratio
iii) Percentage of excess air
iv) Dew point temperature of the products if the total pressure is 1.0 bar. **(10 Marks)**

OR

6 a. Explain the principle of conducting Morse test on IC engines for determining frictional power. **(04 Marks)**

b. List the factors affecting the detonation. **(02 Marks)**

c. A 4-cylinder 2-stroke petrol engine has a bore of 57 mm and stroke of 90 mm. Its rated speed is 2800 rpm and is tested at this speed against a brake, which has a torque arm of 0.356 m. The net brake load is 155 N and the fuel consumption is 6.74 lit/h. The specific gravity of the petrol is 0.735 and it has a calorific value of 44200 kJ/kg. A Morse test is carried out and the cylinders are cut-out in order 1, 2, 3, 4 with corresponding brake loads 111, 106.5, 104.2 and 111.3 N respectively. Calculate for this speed :

i) The engine torque ii) Brake mean effective pressure
iii) Brake thermal efficiency iv) BSFC
v) Mechanical efficiency vi) Indicated thermal efficiency. **(10 Marks)**

Module-4

7 a. A vapour compression plant uses R-12 and is to develop 5 tonnes of refrigeration. The condenser and evaporator temperatures are to be 40°C and –10°C respectively. Determine:

i) The refrigerant flow rate in kg/s
ii) Heat rejected in the condenser in KW
iii) COP
iv) Power required to drive the compressor **(06 Marks)**

b. An air refrigeration system working on Reversed Brayton Cycle with 15 tonnes 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 the isentropic efficiency of expander and compressor each has 85%, find: i) COP ii) Air flow rate and iii) Power required. **(06 Marks)**

c. What are the desirable properties of good refrigerant? **(04 Marks)**

OR

8 a. With a neat sketch explain the working of air conditioning system for hot and dry summer condition. Show the processes on psychrometric chart. **(08 Marks)**

b. It is required to design an air conditioning plant for a office room with the following conditions:
Outdoor conditions: 14°C DBT and 10°C WBT
Required conditions: 20°C DBT and 60% RH
Amount of air circulation = 0.3 m^3/min/person
Seating capacity of office = 60
The required condition is achieved first by heating and then by adiabatic humidifying. Determine:
i) Heating capacity of the coil in KW and surface temperature required if the by-pass factor of the coil is 0.4.
ii) The capacity of the humidifier. **(08 Marks)**

Module-5

9 a. Derive the condition for minimum work required by a two stage air compressor with perfect intercooling between stages. Assume the compression follows the law $PV^n = C$ for stage-1 and for the stage-2 follows $PV^m = C$. Reduce this equation when n = m. **(08 Marks)**

b. A single stage, double acting air compressor, required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bar and speed is 300 rpm. Take the clearance volume as 5% of swept volume with the compression and expansion index, n = 1.3. Calculate:
i) the bore and stroke of the cylinder assuming L = 1.2 D
ii) Delivery temperature
iii) Indicated power required. **(08 Marks)**

OR

10 a. Prove that maximum flow rate of steam per unit area through a nozzle occurs when the ratio of pressure at throat to the inlet pressure is equal to $\left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$ where n = isentropic index of expansion. **(08 Marks)**

b. An adiabatic steam nozzle is to be designed for a discharge rate of 10 kg/s of steam from 10 bar and 400°C to a back pressure of 1 bar. The nozzle efficiency is 0.92 and the frictional loss is assumed to take place in the diverging portion of the nozzle only. Calculate: i) Velocity of steam at throat and exit of the nozzle, ii) Throat and exit area. Assume index of expansion = 1.3. **(08 Marks)**

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CBCS SCHEME

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15ME44

Fourth Semester B.E. Degree Examination, June/July 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 following terms with SI units : i) Mass density ii) Kinematic viscosity iii) Capillarity iv) Compressibility. **(08 Marks)**

b. A circular shaft of diameter 30mm is rotating in a journal bearing of length 20cm. Speed of shaft is 360 rpm. The clearance between shaft and bearing is 0.6mm and dynamic viscosity is 0.2 N-S/m^2. Determine Torque and Power required to rotate the shaft at given speed. **(08 Marks)**

OR

2 a. State and prove Hydrostatic law. **(04 Marks)**

b. Define Meta centre and explain its importance in stability of floating bodies. **(04 Marks)**

c. Determine the total hydrostatic force and its location on a circular plate immersed in a tank containing oil. The circular plate is inclined at 30^0 to free surface of oil and nearest point of it circumference is 1.2m below free surface. Diameter of circular plat is 5m and specific gravity of oil is 0.90. **(08 Marks)**

Module-2

3 a. Derive continuity equation in Cartesian co-ordinates for a fluid flow in 3 – Dimensions. **(06 Marks)**

b. Differentiate between : i) Steady flow and Unsteady flow ii) Viscous flow and Turbulent flow iii) Uniform and Non – Uniform flow. **(06 Marks)**

c. Define and explain stream function and velocity potential function. **(04 Marks)**

OR

4 a. State assumptions in Bernoulli's equation and derive the relation. **(06 Marks)**

b. Differentiate between Venturi meter and Orifice meter. **(04 Marks)**

c. A 30cm × 15cm venturimeter is inserted in a vertical pipeline carrying oil of specific gravity 0.85, the flow of oil is upwards. Throat section is 50cms above inlet section of venturimeter. The oil mercury differential manometer gives a reading of 30cms of mercury. Find the rate of oil flow in lts/sec and pressure difference between inlet and throat section. Assume $C_d = 0.96$. Neglect all losses. **(06 Marks)**

Module-3

5 a. Derive Hagen Poiseuille equation for laminar flow through a circular pipe. **(08 Marks)**

b. Oil of viscosity 10 Poise flows between two parallel plates are kept at a distance of 50mm apart. Find the rate of oil flow between the plates if the pressure drop per meter length is 0.3N/cm^2. Width of plate is 200mm and length of plate is 1.8m. Specific gravity is 0.85. **(08 Marks)**

OR

6 a. Derive Darcy – Weisbach relation for a fluid flow through a pipe. **(08 Marks)**

b. Determine rate of water flow through a pipe of diameter 20cm and length 50m, with one end connected to a tank and other end of pipe is open to the atmosphere. The pipe is horizontal and height of water level in the tank is 7.5m above pipe axis. Consider all losses and assume f = 0.01. Draw HGL. **(08 Marks)**

Module-4

7 a. Explain the term : i) Lift ii) Drag iii) Displacement thickness iv) Momentum thickness. **(08 Marks)**

b. A thin plate is moving in air at a velocity of 5m/s. The length of plate is 0.6m and width 0.5m. Find the thickness of boundary layer at the end of the plate and drag force on one side of the plate. Take density of air as 1.24 kg/m^3 and the kinematic viscosity 0.15 stokes. **(08 Marks)**

OR

8 a. Explain importance of dimensional analysis in the model similitude. Explain Rayleigh method of the dimensional analysis. **(06 Marks)**

b. The frictional torque T of a disc of diameter D depends on speed N, in a fluid of dynamic viscosity μ and density of fluid ρ in a turbulent fluid flow. By Bukingham Pi method, develop a relation for frictional torque T. **(10 Marks)**

Module-5

9 a. Derive an expression for velocity of sound in a fluid. **(08 Marks)**

b. An Aeroplane is flying at an height of 15km where the temperature is -50^{0}C. The speed of the plan is corresponding to Mach number 2.0. Assume K = 1.4 , R = 287 J/kg ^{0}K. Find the speed of the plane. **(08 Marks)**

OR

10 a. Define the following terms : i) Mach number ii) Mach cone iii) Zone of action iv) Subsonic flow v) Supersonic flow. **(10 Marks)**

b. Explain the meaning o CFD and its applications. **(06 Marks)**

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CBCS SCHEME

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15MEA405

Fourth Semester B.E. Degree Examination, June/July 2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Briefly explain the steps involved in manufacturing of product by casting process. **(08 Marks)**

b. What is pattern? Explain different pattern allowances. **(08 Marks)**

OR

2 a. With a neat sketch explain the working principle of "Sand Slinger". **(08 Marks)**

b. Explain with neat sketch carbon dioxide (CO_2) moulding process. **(08 Marks)**

Module-2

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

b. What are the zones in "CUPOLA"? With neat sketch explain Cupola furnace. **(08 Marks)**

OR

4 a. With neat sketch, explain continuous casting process. **(08 Marks)**

b. With neat sketch, explain Hot chamber pressure die casting process. **(08 Marks)**

Module-3

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

b. What is degasification in liquid metals? Explain with neat sketch flushing degasification method. **(08 Marks)**

OR

6 a. With neat sketch, explain Stri casting set-up. **(08 Marks)**

b. What is fettling? What are the steps involved in fettling? Explain briefly sans casting defects. **(08 Marks)**

Module-4

7 a. Sketch and explain "MIG" [Metal Inert Gas welding] welding process. Mention its advantages and disadvantages. **(08 Marks)**

b. Explain with a neat sketch, "SAW" [Submerged Arc Welding] process. **(08 Marks)**

OR

8 a. Explain with neat sketch:
(i) Seam welding process (ii) Explosive welding process. **(08 Marks)**

b. Explain with neat sketch, "LASER" beam welding and mention its advantages and disadvantages. **(08 Marks)**

Module-5

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

b. Explain with neat sketch, Oxy-Acetylene welding process. **(08 Marks)**

OR

10 a. Differentiate between Soldering and Brazing. Mention their advantages and disadvantages. **(08 Marks)**

b. With neat sketch and explain Ultrasonic inspection of casting process. **(08 Marks)**

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CBCS SCHEME

USN | 1 | K | S | 1 | 6 | M | E | 0 | 7 | 2 | **15MEB406**

Fourth Semester B.E. Degree Examination, June/July 2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is a material standard? List out the advantages of wavelength standard **(06 Marks)**

b. Explain about subdivisions of standards. **(04 Marks)**

c. A calibrated meter bar has an actual length of 1000.0008mm. It is to be used in the calibration of two bars A and B each having a length of 500mm when compared with meter bar $L_A + L_B$ was found to be shorter by 0.0004mm. In comparing A with B it was found that A was 0.0006mm longer than B. Find the actual length of A and B. **(06 Marks)**

OR

2 a. How do you specify sine bar and explain why it is not preferred to measure greater than 45°. **(05 Marks)**

b. What are slip gauges? Explain about wringing of slip gauge and care of slip gauge. **(05 Marks)**

c. Using M112 set, of slip gauges build the following dimension with protector blocks at both ends of 2mm blocks individually i) 29.758 ii) 57.895. **(06 Marks)**

Module-2

3 a. Define:
- i) Basic hole
- ii) Selective assembly
- iii) Allowance
- iv) Tolerance
- v) Fundamental deviation **(05 Marks)**

b. Why shaft basis system is not preferred? **(03 Marks)**

c. Design the gauges to check $50C_7$ the F.D. for $C = 0.52D^{0.2}$. The diameter falls in the step of 30-50mm. The quality for grade 7 is 16i where $i = 0.45\sqrt[3]{D} + 0.001D$. **(08 Marks)**

OR

4 a. Illustrate with a neat sketch, the working of Zeiss optimeter. **(06 Marks)**

b. Classify the different comparator and explain the functional requirements. **(04 Marks)**

c. Differentiate measuring instruments, gauges and comparators. **(06 Marks)**

Module-3

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

b. List out the various methods of measuring the gear tooth thickness explain any one of it. **(08 Marks)**

c. What do you mean by pressure angle of a Gears? **(02 Marks)**

OR

6 a. List the various coordinates measuring machines. Sketch, and explain coordinate measuring machine. **(06 Marks)**

b. With a neat sketch explain about laser interferometer. **(06 Marks)**

c. List out applications of tool makers microscope. **(04 Marks)**

Module-4

7 a. Define: i) Accuracy ii) Precision iii) Loading effect iv) Calibration v) Error. **(05 Marks)**

b. Explain the working of generalized measurement system with block diagram taking one of the examples. **(06 Marks)**

c. Discuss briefly about LVDT. **(05 Marks)**

OR

8 a. Discuss briefly about electronic amplifiers. **(08 Marks)**

b. What are terminating devices? Explain in detail CRO. **(08 Marks)**

Module-5

9 a. Sketch a proving ring and explain how it is used for force measurement. **(05 Marks)**

b. How are dynamometers classified? Explain with a sketch rope brake dynamometer. **(05 Marks)**

c. With a neat sketch explain Mcleod gauge used for pressure measurement. **(06 Marks)**

OR

10 a. Discuss about temperature compensation in strain gauges. **(06 Marks)**

b. List out materials used for thermocouples. **(04 Marks)**

c. Explain the working principle of optical pyrometer. **(06 Marks)**

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