CBCS SCHEME

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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Using Taylor's series method solve $\frac{dy}{dx} = x^2 + y^2$ with y(0) = 1 and hence find y(0.1) and consider upto 3rd degree. **(06 Marks)**

b. Using modified Euler's method solve $\frac{dy}{dx} = 1 + \frac{y}{x}$ with y(1) = 2 then find y(1.2) in two steps. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{x+y}{2}$, give that y(0) = 2, y(0.5) = 2.636, y(1) = 3.595 and y(1.5) = 4.968 then find value of y at x = 2 using Milne's predictor and corrector formulae. **(05 Marks)**

OR

2 a. Using modified Euler's method solve $\frac{dy}{dx} = x + \sqrt{y}$, with y(0) = 1 then find y(0.2) with h = 0.2. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, with y(0) = 1 and hence find y(0.1) by taking one steps using Runge-Kutta method of fourth order. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{(1+x^2)y^2}{2}$, given that y(0) = 1, y(0.1) = 1.06. y(0.2) = 1.12 and y(0.3) = 1.21 then evaluate y(0.4) using Adam's – Bash forth method. **(05 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = \frac{2dy}{dx} - y$, y(0) = 1, y'(0) = 2, evaluate y(0.1) and y'(0.1) using Runge-Kutta method of fourth order. **(06 Marks)**

b. Solve the Bessel's differential equation : $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$ leading to $J_n(x)$. **(05 Marks)**

c. Express $x^3 + 2x^2 - 4x + 5$ in terms of Legendre polynomials. **(05 Marks)**

OR

4 a. Using Milne's method. obtain an approximate solution at the point x = 0.8 of the problem $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ using the following data :

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

(06 Marks)

b. If α and β are two distinct roots of $J_n(x) = 0$ then P-T $\int_0^1 x\, J_n(\alpha x)\, J_n(\beta x)\, dx = \{0$ if $\alpha \neq \beta$.

(05 Marks)

c. With usual notation, prove that $J_{+\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(05 Marks)**

Module-3

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

b. Find analytic function f(z) whose imaginary part is $v = \left(r - \frac{1}{r}\right)\sin\theta$. **(05 Marks)**

c. Discuss the transformation of $\omega = e^z$. **(05 Marks)**

OR

6 a. State and prove Cauchy's integral formula. **(06 Marks)**

b. Emulate $\oint_c \frac{e^{2z}}{(z+1)(z-2)} dz$ where c is $|z| = 3$ using Cauchy's residue theorem. **(05 Marks)**

c. Find the bilinear transformation which maps z = –1, 0, 1 into $\omega = 0$, i, 3i. **(05 Marks)**

Module-4

7 a. Derive mean and variance of the binomial distribution. **(06 Marks)**

b. A random variable x has the following probability mass function.

x	0	1	2	3	4	5
P(x)	k	3k	5k	7k	9k	11k

i) find k ii) find $p(x < 3)$ iii) find $p(3 < x \leq 5)$. **(05 Marks)**

c. The joint distribution of two random variable x and y as follows :

x \ y	–4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Compute : i) E(x) and E(y) ii) E(xy) iii) cov(xy). **(05 Marks)**

OR

8 a. 2% of the fuses manufactured by a firm are found defective. Find the probability that a box containing 200 fuses contains. i) no defective fuses ii) 3 or more defective fuses. **(06 Marks)**

b. In a test on 2000 electric bulbs. It was found that the life of a particular brand was distributed normally with an average life of 2040 hours and S.D 60 hours. Estimate the number of bulbs likely to burn ($P(0 < z < 1.83) = 0.4664$ $P(1.33) = 0.4082$, $P(2) = 0.4772$) i) more than 2150 ii) less than 1960 iii) more than 1920 but less than 2160 hours. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y given by the following table:

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

Find marginal distribution of X and Y and evaluate cov(XY).

(05 Marks)

Module-5

9 a. Define: i) Null hypothesis ii) significance level iii) Type–I and Type–II error. **(06 Marks)**

b. Ten individual are chosen at random from a population and their height in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that mean height of the universe is 66 inches. Given that ($t_{0.05} = 2.262$ for 9d.f) **(05 Marks)**

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

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}.$$ **(05 Marks)**

OR

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(06 Marks)**

b. Four coins are tossed 100 times and following results were obtained :

No. of heads	0	1	2	3	4
Frequency	5	29	36	25	5

Fit a binomial distribution for the data and test the goodness of fit $\left(\chi^2_{0.05} = 9.49\right)$. **(05 Marks)**

c. A student's study habit 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? **(05 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ **(05 Marks)**

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

c. Find all the eigen values of the matrix
$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(06 Marks)**

OR

2 a. Find the values of K, such that the matrix A may have the rank equal to 3:
$A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 4 & K \\ 1 & 4 & 10 & K^2 \end{bmatrix}$ **(05 Marks)**

b. Solve by Gauss elimination method
$x_1 - 2x_2 + 3x_3 = 2 \quad 3x_1 - x_2 + 4x_3 = 4 \quad 2x_1 + x_2 - 2x_3 = 5$ **(05 Marks)**

c. Find all the eigen values and corresponding eigen vectors of the matrix
$A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$ **(06 Marks)**

Module-2

3 a. Find C.F of $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(05 Marks)**

b. Solve the initial value problem $\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 29x = 0$

Subject to the conditions $x(0) = 0, \frac{dx}{dt}(0) = 15$. **(05 Marks)**

c. Using the method of undetermined coefficients, solve $(D^2 - 4D + 3)y = 20\cos x$ **(06 Marks)**

OR

4 a. Solve $(D^2 - 2D + 4)y = e^x \cos x$. **(05 Marks)**

b. Solve $(D^2 + 4)y = x^2 + 2^{-x}$. **(05 Marks)**

c. Using the method of variation of parameters, find the solution of $(D^2 - 2D + 1)y = e^x / x$. **(06 Marks)**

Module-3

5 a. Find the Laplace transform of $\frac{\cos 3t - \cos 4t}{t}$. **(05 Marks)**

b. Find $L\{t\sin^2 t\}$ **(05 Marks)**

c. Express the following function interms of Heaviside unit step function and hence find the Laplace transform where

$$f(t) = \begin{cases} t^2 & 0 < t \le 2 \\ 4t & t > 2 \end{cases}$$ **(06 Marks)**

OR

6 a. Find $L\left[\frac{e^{-t}.\sin t}{t}\right]$. **(05 Marks)**

b. Using Laplace transform evaluate $\int_0^\infty e^{-t} t\sin^2 3t\,dt$. **(05 Marks)**

c. If $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a \le t \le 2a \end{cases}$ $f(t+2a) = f(t)$, show that $L[f(t)] = \frac{1}{s^2}\tan h\left(\frac{as}{2}\right)$. **(06 Marks)**

Module-4

7 a. Find inverse Laplace transform of $\frac{s+5}{s^2 - 6s + 13}$. **(05 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 transform method $y''(t) + 4y(t) = 0$, given that $y(0) = 2$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find $L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4)}\right]$. **(05 Marks)**

b. Find $L^{-1}\left[\frac{(s+2)e^{-s}}{(s+1)^4}\right]$ **(05 Marks)**

c. Solve by using Laplace transform method $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. **(06 Marks)**

Module-5

9 a. There are 10 students of which three are graduates. If a committee of five is to be formed, what is the probability that there are (i) only 2 graduates (ii) atleast 2 graduates? **(05 Marks)**

b. In a school 25% of the students failed in the first language, 15% of the students failed in second language and 10% of the students failed in both. If a student is selected at random find the probability that :

i) He failed in first language if he had failed in the second language.

ii) He failed in second language if he had failed in the first language. **(05 Marks)**

c. In a bolt factory there are four machines A, B, C and D manufacturing respectively 20%, 15%, 25%, 40% of the total production. Out of these 5%, 4%, 3% and 2% are defective. If a bolt drawn at random was found defective what is the probability that it was manufactured by A or D. **(06 Marks)**

OR

10 a. From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. What is the probability that the product is a positive number? **(05 Marks)**

b. Three students A, B, C write an entrance examination. Their chances of passing are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that (i) atleast one of them passes (ii) all of them passes. **(05 Marks)**

c. Three major parties A, B, C are contending for power in the elections of a state and the chance of their winning the election is in the ratio 1:3:5. The parties A, B, C respectively have probability of banning the online lottery $\frac{2}{3}, \frac{1}{3}, \frac{3}{5}$. What is the probability that there will be a ban on the online lottery in the state? What is the probability that the ban is from the party 'C'? **(06 Marks)**

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15ME42

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 with neat sketch the mechanism required to convert rotary motion to reciprocating motion [which should have only one turning pair] (08 Marks)

b. State and explain the suitable mechanism which can be used in Forming machines/sheet metal punching. (08 Marks)

OR

2 a. Some of the 4 bar linkages are shown in Fig Q2(a) where the number indicate the respective link in Lengths in 'cm'. Identify the nature of each mechanism whether

(i) double crank
(ii) crank rocker
(iii) Double Rocker. Give Reason in brief (12 Marks)

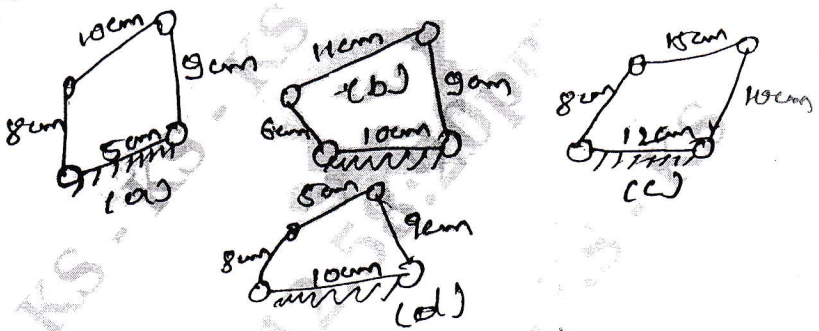

Fig Q2(a)

b. Differentiate between

i) Machine and mechanism
ii) Binary joints and binary links (04 Marks)

Module-2

3 In the mechanism shown in Fig Q3 crank 2 rotates out 300 rpm. Find the acceleration of point C in magnitude, direction and sense. Find also the angular acceleration of link 3.

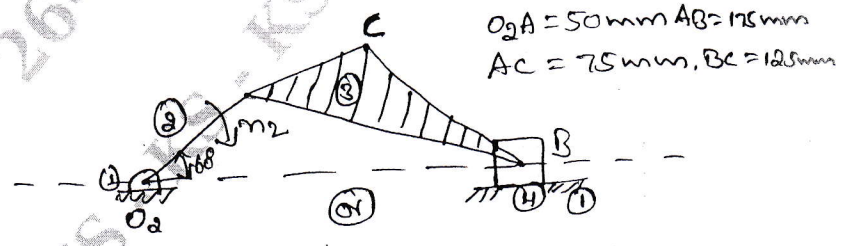

Fig Q3 (16 Marks)

OR

4 A pin jointed 4 bar mechanism ABCD show Fig Q4. Link AB = 150mm, BC = 180mm, CD = 180mm and fixed link AD = 300mm. Link AB makes 60° with link AD, and rotates uniformly at 100 rpm. Locate all the instantaneous centres and find the angular velocity of link BC and linear velocity of link CD.

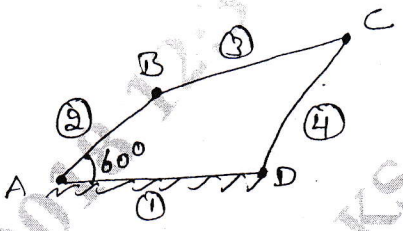

Fig Q4 **(16 Marks)**

Module-3

5 Develop an equation for the relationship between the Angular velocities of the input crank and output crank of 4 bar linkage shown in Fig Q5. Using loop closure equation.

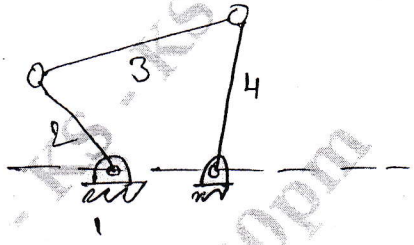

Fig Q5 **(16 Marks)**

OR

6 Design a four bar mechanism when the motions of the input and output links are governed by a function $y = 2x^2$ and x various 2 to 4 with an interval of 1. Assume θ to vary from 40° to 120° and ϕ from 60° to 132°. **(16 Marks)**

Module-4

7 a. A pair of gears 40 and 30 teeth respectively are of 25°involute form. Addendum = 5mm, Module = 2.5mm. If the smaller wheel is the driver and rotate at 1500rpm, find the velocity of sliding at the point of engagement, out pitch point and the point of disengagement, length of path of contact and length of Arc of contact. **(10 Marks)**

b. Explain minimum of teeth an a Gear to avoid interference and minimum number of teeth on a pinion to avoid interference. **(06 Marks)**

OR

8 In an epicyclic gear train, the internal wheels A, B and compound wheel C and D rotate independently about the axis 'O'. The wheels E and F rotate on a pin fixed to the Arm G. E gears with A and C, and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C = 28, D = 26

i) Sketch the arrangement
ii) Find the number of teeth on A and B
iii) If the Arm G makes 15rpm CW and A is fixed, find speed of B
iv) If the Arm G makes 150rpm CW and wheel A makes 15rpm CCW, find speed of B.

(16 Marks)

Module-5

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

i) Outward during 150° with U.AR.M

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, Follower axis passes through the cam axis. **(16 Marks)**

OR

10 A symmetrical tangent cam operating a roller follower has the following particulars Radius of base circle of cam = 40mm, Roller radius = 20mm, Angle of ascent = 75°, total lift = 20mm, N = 300rpm. Determine :

a. Principle Dimensions of the cam

b. The equation of the displacement curve when follower is in contact with straight flank.

c. Acceleration of the follower, when it is in contact with the straight flank where it merges into circular nose. **(16 Marks)**

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15ME43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. Use of steam table/Mollier chart/Psychrometric chart is permitted.

Module-1

1 a. Derive an expression of Air-standard efficiency of otto cycle with neat sketch of P-V and T-S diagrams. **(06 Marks)**

b. With a neat sketch, explain the working of Ram jet. **(05 Marks)**

c. Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 14 if the fuel cut-off is delayed from 5% to 8%. **(05 Marks)**

OR

2 a. With a neat block diagram and T-S diagram, explain how 'regeneration' increases thermal efficiency of gas turbine plant. **(06 Marks)**

b. Define Air-standard efficiency. **(02 Marks)**

c. A Gas turbine unit has a pressure ratio 6 : 1 and maximum cycle temperature of 610°C. The isentropic efficiencies of the compressor and turbine are 0.80 and 0.82 respectively. Calculate the power output when the air enters the compressor at 15°C at the rate of 16 kg/s. Take C_p = 1.005 KJ/kgK and γ = 1.4 for compression and C_P = 1.11 kJ/kgK and γ = 1.333 for expansion processes. **(08 Marks)**

Module-2

3 a. With the help of corresponding flow and T-S diagrams explain briefly the working of a practicle regenerative Rankine cycle with one open feed water heater. Derive also an expression for its thermal efficiency. **(08 Marks)**

b. A simple Rankine cycle works between the boiler pressure of 3 MPa and condenser pressure of 4 KPa. The steam is dry saturated before the throttling in the turbine. Determine (i) Rankine cycle efficiency (ii) Work ratio (iii) Specific steam consumption. **(08 Marks)**

OR

4 a. Discuss the effect of, (i) Boiler pressure (ii) Condenser pressure (iii) Super heat on the performance of a Rankine cycle. **(08 Marks)**

b. A steam power plant operates on a theoretical reheat cycle. Steam at boiler at 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. Find (i) Quality of steam at turbine exhaust (ii) Cycle efficiency (iii) Steam rate in $\frac{kg}{hr.KW}$ **(08 Marks)**

Module-3

5 a. Explain the following: (i) Stoichiometric air (ii) Enthalpy of formation. **(04 Marks)**

b. Explain the method of finding friction power using Morse test. **(04 Marks)**

c. A Solid fuel contains by weight, carbon 71%, hydrogen 4%, oxygen 9%, Sulphur 3%, Nitrogen 1% and the remainder is ash. Determine the minimum quantity of air required for complete combustion of 1 kg of fuel. If the actual air supplied is 1.3 times the minimum required for complete combustion, estimate the percentage gravimetric composition of dry gases. **(08 Marks)**

OR

6 a. Classify the IC engines. **(04 Marks)**

b. Define : (i) BSFC (ii) Indicated thermal efficiency. **(04 Marks)**

c. In a trial of a single cylinder oil engine working on dual cycle, the following observations were made:
Oil consumption = 10.2 kg/h ; Calorific value of fuel = 43890 kJ/kg
Air consumption = 3.8 kg/min; Speed = 1900 rpm
Torque on the brake drum = 186 N-m; Quantity of cooling water used = 15.5 kg/min
Temperature rise = 36°C; Exhaust gas temperature = 410°C
Room temperature = 20°C; 'C_P' of exhaust gases = 1.17 kJ/kgK
Calculate Brake thermal efficiency and draw heat balance sheet on minute basis. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the working of Bell – Coleman air refrigeration cycle. **(06 Marks)**

b. Show the following processes on psychometric chart: (i) Sensible heating and cooling (ii) Cooling and dehumidification **(04 Marks)**

c. In a simple vapour compression cycle, following are the properties of the refrigerant R-12 at various points;
Compressor inlet : $h_2 = 183.2$ KJ/kg; $V_2 = 0.0767$ m^3/kg
Compressor discharge : $h_3 = 222.6$ KJ/kg; $V_3 = 0.0164$ m^3/kg
Compressor exit : $h_4 = 84.9$ KJ/kg; $V_4 = 0.00083$ m^3/kg
The piston displacement volume for compressor is 1.5 litres per stroke and its volumetric efficiency is 80%. The speed of the compressor is 1600 rpm. Find (i) Power rating of the compressor (KW) (ii) Refrigerating effect (KW) **(06 Marks)**

OR

8 a. Define (i) Dry bulb temperature (ii) Wet bulb temperature (iii) Dew point temperature (iv) Relative humidity. **(04 Marks)**

b. State the properties of good refrigerant. **(04 Marks)**

c. An air conditioning system is designed under the following conditions:
Outdoor conditions = 30°C DBT and 75% RH
Required indoor conditions = 22°C DBT and 70% RH
Amount of free air circulated = 3 m^3/sec
Coil dew point temperature = 14°C
The required condition is achieved first by cooling and dehumidification and then by heating. Calculate (i) the capacity of the cooling coil in tones.
(ii) the capacity of the heating coil in KW.
(iii) the amount of water vapour removed in kg/s. **(08 Marks)**

Module-5

9 a. What are the advantages of multistage compression? **(04 Marks)**

b. What do you mean by a supersaturated flow? Explain with the help of h-s diagram. **(06 Marks)**

c. A single stage double-acting air compressor is required to deliver 14 m^3 of air per minute at 1.013 bar and 15°C. The delivery pressure is 7 bar and the speed 300 rpm. Take the clearance volume as 5% of the swept volume with the compression and expansion index n = 1.3, calculate (i) Swept volume of cylinder (ii) Indicated power. **(06 Marks)**

OR

10 a. Derive an expression for the condition for minimum work input required for two stage compressor with perfect intercooling. **(08 Marks)**

b. A multistage compressor is to be designed to elevate the pressure from 1 bar to 120 bar, such that the stage pressure ratio will not exceed 4. Determine (i) Number of stages (ii) Minimum power required (iii) Intermediate pressures (iv) Exact pressure ratio. It is required to compress 15 m^3/min of free air. Take n = 1.2 **(08 Marks)**

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15ME44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following properties of fluids with their units:
(i) Weight density.
(ii) Dynamic viscosity.
(iii) Bulk modulus **(06 Marks)**

b. An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9m × 0.9m slides down an inclined plane having an inclination of 20° with the horizontal. The weight of square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the kinematic viscosity of oil. specific gravity of the oil is 0.7 **(05 Marks)**

c. A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of Sp.gravity 0.8 and having vacuum pressure is flowing. The other end of manometer is open to atmosphere. Find the vacuum pressure in pipe, if difference of mercury level in two limbs is 40 cm and height of fluid in the left from the centre of pipe is 15 cm below. **(05 Marks)**

OR

2 a. State and prove Pascal's law. **(06 Marks)**

b. Derive expression for total pressure and centre of pressure for a plane surface immersed vertically in a static mass of fluid. **(06 Marks)**

c. A uniform body of size 3m long × 2m wide × 1 m deep floats in water. What is the weight of the body if depth of immersion is 0.8 m? Determine the meta centric height also. **(04 Marks)**

Module-2

3 a. Explain different types of fluid flow. **(06 Marks)**

b. The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point P(2, 3). Find the velocity potential ϕ. **(04 Marks)**

c. Obtain the Euler's equation of motion along a stream line and hence derive Bernoulli's equation for a steady incompressible fluid flow. State the assumptions made. **(06 Marks)**

OR

4 a. Derive an expression for discharge through a triangular notch. **(05 Marks)**

b. A jet of water of diameter 50 mm having velocity 40 m/s, strikes a curved fixed symmetrical plate at its centre. The jet is deflected through an angle 120° at the outlet of the curved plate. Calculate the force exerted by jet of water in the direction of jet and perpendicular to jet. **(05 Marks)**

c. Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of specific gravity 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe. **(06 Marks)**

Module-3

5 a. Prove that the ratio of maximum velocity to average velocity for laminar flow between two stationary parallel plates is 1.5. **(10 Marks)**

b. A fluid of viscosity 0.7 NS/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find (i) the pressure gradient (ii) Average velocity (iii) Reynold's number of the flow. **(06 Marks)**

OR

6 a. What are the energy losses that occur in pipes? Give the expressions for different minor energy losses. **(04 Marks)**

b. An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 lit/sec. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow. **(06 Marks)**

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

Module-4

7 a. Define the terms:
(i) Boundary layer thickness.
(ii) Energy thickness
(iii) Lift
(iv) Drag **(04 Marks)**

b. Write a short note on boundary layer separation and methods to control it. **(06 Marks)**

c. A long plate of size $5m \times 2m$ is moving in air with velocity of 9 km/hr parallel to its length. Calculate the drag force on both sides of plate if, (i) Boundary layer is laminar over the complete plate. (ii) Boundary layer is turbulent over the complete plate.
Take $\rho_{air} = 1.2$ kg/m^3 and $\mu = 1.8 \times 10^{-4}$ poise **(06 Marks)**

OR

8 a. The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π-theorem. Obtain an expression for $\Delta\phi$. **(10 Marks)**

b. Explain (i) Geometric similarity (ii) Kinematic similarity (iii) Dynamic similarity **(06 Marks)**

Module-5

9 a. Define stagnation properties. Obtain an expression for stagnation pressure of a compressible fluid in terms of Mach number and pressure. **(10 Marks)**

b. A projectile travels in air of pressure 15 N/cm^2 at 10°C at a speed of 1500 km/hr. Find the Mach number and Mach angle. Assume r = 1.4 and R = 287 J/kgK **(04 Marks)**

c. What are normal and oblique shocks? **(02 Marks)**

OR

10 a. Show that velocity of propogation of elastic wave in an adiabatic medium is given by $C = \sqrt{rRT}$ starting from fundamentals. **(08 Marks)**

b. Calculate the stagnation temperature on nose of plane which is flying at 800 km/hr through still air having a pressure 8 N/cm^2 and temperature -10°C. Take R = 287 J/kgK and r = 1.4 **(02 Marks)**

c. Define computional fluid dynamics. Mention the applications of CFD. **(06 Marks)**

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CBCS SCHEME

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15MEA405

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Explain the steps involved in making a sand casting. **(06 Marks)**
b. Explain with neat sketches the various steps involved in shell moulding. **(10 Marks)**

OR

2 a. Explain the various allowances provided on the pattern. **(08 Marks)**
b. Explain with neat sketches, the open riser blind riser. **(08 Marks)**

Module-2

3 a. Explain with a neat sketch, the working principle of direct arc electric furnace. **(08 Marks)**
b. Explain with a neat sketch, the continuous casting process. **(08 Marks)**

OR

4 a. Explain with a neat sketch, the working of Cupola. **(10 Marks)**
b. Explain with a neat sketch, the true centrifugal casting process. **(06 Marks)**

Module-3

5 a. Explain with neat sketches, any two types of vacuum degasification methods. **(08 Marks)**
b. Discuss the advantages and limitations of Aluminium castings. **(08 Marks)**

OR

6 a. Explain with neat sketches, different types of defects that occur during casting. **(08 Marks)**
b. Explain with a neat sketch, the working principle of Stir casting process. **(08 Marks)**

Module-4

7 a. Explain with a neat sketch, metal inert gas welding process. **(08 Marks)**
b. Explain with a neat sketch, projection welding process and mention its advantages and limitations. **(08 Marks)**

OR

8 a. Explain with a neat sketch, atomic hydrogen welding process. **(08 Marks)**
b. Explain laser beam welding process with a neat sketch. Mention its advantages. **(08 Marks)**

Module-5

9 a. Explain different zones of welded joint with a neat sketch. **(06 Marks)**
b. Explain with a neat sketch, holography inspection method. Mention its advantages and limitations. **(10 Marks)**

OR

10 a. Define soldering and brazing. Mention the advantages and limitations of soldering and brazing process. **(08 Marks)**
b. Explain with neat sketches, fluorescent penetrant inspection method. **(08 Marks)**

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15ME46B

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Explain the characteristics of line and end standards. **(05 Marks)**

b. With a neat sketch, explain Imperial Standard Yard. **(05 Marks)**

c. Four length bars of basic length 100mm are to be calibrated using a calibrated length bar of 400mm, whose actual length is 399.9992mm. It was also found that length of bars B, C, D in comparison to A are + 0.0002 , + 0.0004 and – 0.0001mm respectively and the length of all four bars put together in comparison to standard calibrated bar is + 0.0003mm longer. Determine the actual dimensions of all the four end bars. **(06 Marks)**

OR

2 a. Explain with a neat sketch, Wringing phenomenon of slip gauges. **(08 Marks)**

b. With a neat sketch, explain the uses of sine bar. **(08 Marks)**

Module-2

3 a. Explain with a neat sketch, different types of fits. **(08 Marks)**

b. Explain briefly Selective assembly and Interchangeability. **(08 Marks)**

OR

4 a. With a neat sketch, explain plug gauges and snap gauges. **(10 Marks)**

b. With a neat sketch, describe the construction and working of Jahansson – Mikro Kator. **(06 Marks)**

Module-3

5 a. Explain the 3 – wire method of finding effective diameter of screw threads. **(08 Marks)**

b. With a sketch, define the following terms with respect to a screw thread i) Major diameter ii) Effective diameter iii) Pitch iv) Angle of thread. **(08 Marks)**

OR

6 a. Explain with a neat sketch, 'Tool Maker's microscope. **(08 Marks)**

b. With a neat sketch, explain laser interferometer. **(08 Marks)**

Module-4

7 a. Briefly explain the generalized measurement system, with block diagram. **(08 Marks)**

b. List and explain the different types of errors. **(08 Marks)**

OR

8 a. Explain the inherent problems present in mechanical modifying system. **(08 Marks)**

b. Explain the working of "Cathode Ray Oscilloscope". **(08 Marks)**

Module-5

9 a. Explain briefly i) Proving ring ii) Prony brake dynamometer. **(08 Marks)**

b. Explain with neat sketch, the working of Bridgemann gauge. **(08 Marks)**

OR

10 a. Explain the wheat stone bridge arrangement for strain measurement. **(08 Marks)**

b. What is Thermocouple? State and explain the laws of thermo couple. **(08 Marks)**

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