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10MAT41

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

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Using Taylor series method, solve $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ at the point $x = 0.2, 0.3$ consider up to 4^{th} degree term. **(06 Marks)**

b. Using Runge Kutta method of order 4, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$ by taking step length h0.2. **(07 Marks)**

c. Given $\frac{dy}{dx} = \frac{1}{2}xy$, $y(0) = 1$, $y(0.1) = 1.0025$, $y(0.2) = 1.0101$, $y(0.3) = 1.0228$. Compute y at $x = 0.4$ by Adams – Bash forth predictor – corrector method use corrector formula twice. **(07 Marks)**

2 a. Evaluate y and z at $x = 0.1$ from the Picard's second approximation to the solution of the following system of equations given by $y = 2$ and $z = 1$ at $x = 0$ initially $\frac{dy}{dx} = x + z$ $\frac{dz}{dx} = x - y^2$. **(06 Marks)**

b. Given $y'' = x^3(y + y')$ with the initial condition $y(0) = 1$ $y'(0) = 0.5$ compute $y(0.1)$ by taking $h = 0.1$ and using 4^{th} order Runge Kutta method. **(07 Marks)**

c. Applying Milne's method compute $y(0.4)$ Given that y satisfies the equation $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$ and y and y′ are governed by the following values

$y(0) = 1$, $y(0.1) = 1.03995$, $y(0.2) = 1.138036$
$y(0.3) = 1.29865$, $y'(0) = 0.1$, $y'(0.1) = 0.6955$
$y'(0.2) = 1.258$, $y'(0.3) = 1.873$. **(07 Marks)**

3 a. Derive Cauchy Riemann Equation in Cartesian form. **(06 Marks)**

b. Prove that for every analytic function $f(z) = u + iv$ the two families of curves $u(x,y) = C_1$ and $v(x,y) = C_2$ form an orthogonal system. **(07 Marks)**

c. If $u - v = (x - y)(x^2 + 4xy + y^2)$ and $f(z) = u + iv$ is analytic function of $z = x + iy$ find f(z) interms of f(z). **(07 Marks)**

4 a. Find the bilinear transformation that maps the points $z = 0, i, \infty$ onto the points $w = 1, -i, -1$ respectively, find the invariant points. **(06 Marks)**

b. Discuss the transformation $w = e^z$. **(07 Marks)**

c. Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$, where c is the circle $|z| = 3$. **(07 Marks)**

PART – B

5 a. Starting from Laplace differential equation. Obtain Bessel's differential equation as $xy'' + xy' + (x^2 - n^2)y = 0$ **(08 Marks)**

b. If $x^3 + 2x^2 - x + 1 = a\,P_0(x) + b\,P_1(x) + c\,P_2(x) + d\,P_3(x)$ find the value of a, b, c, d. **(06 Marks)**

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

6 a. Define axioms of probability. Prove that,
$P(A \cup B \cup C) = P(A) + P(B) + P(C) + P(A \cap B \cap C) - P(A \cap B) - P(B \cap C) - P(C \cap A)$ **(06 Marks)**

b. A solar water heater manufactured by a company consists of two parts the heating panel and the insulated tank. It is found that 6% of the heaters produced by the company have defective heating panels and 8% have defective tank. Find the percentage of non defective heaters produced by the company. **(07 Marks)**

c. A box contains 500 IC chips of which 100 are manufactured by company X and the rest by company Y. It is estimated that 10% of the chips made by company X and 5% made by company Y are defective. If a randomly selected ohip is found to be defective find the probability that it came from company X. **(07 Marks)**

7 a. A random variables X takes the values $-3, -1, 2$ and 5 with respective probabilities $\frac{2k-3}{10}, \frac{k-2}{10}, \frac{k-1}{10}, \frac{k+1}{10}$. Find the value of k and i) $p(-3 < x < 4)$ ii) $p(x \le 2)$. **(06 Marks)**

b. Find the mean and variance of binomial distribution. **(07 Marks)**

c. In an examination 7% of students scores less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation of the marks are normally distribute, it is given that $P(0 < z < 1.2263) = 0.39$ and $P(0 < z < 1.4757) = 0.43$. **(07 Marks)**

8 a. Explain the following terms :
i) Null hypothesis
ii) Type I and Type II error
iii) Confidence limits. **(06 Marks)**

b. A coin is tossed 1000 times and it turn up head 540 times decide on the hypothesis that the coin is unbiased. **(07 Marks)**

c. A certain stimulus administered to each of the 12 patients resulted is the following change is blood pressure 5, 2, 8, −1, 3, 0, 6, −2, 1, 5, 0, 4 can it be calculated that the stimulus will increase the blood pressure ($t_{0.05}$ for 11 df 2.201.) **(07 Marks)**

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

Structural Analysis – I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data may be suitably assumed.***

PART – A

1 a. Explain degree of freedom with examples. **(06 Marks)**

b. Distinguish between statically determinate and indeterminate structures with examples. **(08 Marks)**

c. Derive an expression for strain energy due to bending. **(06 Marks)**

2 a. Determine the rotation and deflection at the free end of a cantilever beam shown in Fig.Q2(a) by moment area method.

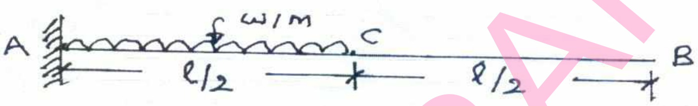

Fig.Q2(a) **(10 Marks)**

b. A horizontal girder of steel having a uniform section is 14m long and is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at sections 3m and 4.5 m from the left end and right end respectively. Find the slope and deflection under the loads by conjugate beam method. **(10 Marks)**

3 a. Using strain energy method, determine the deflection at the free end of a cantilever beam subjected to a concentrated load p at the free end. Take length of beam $= \ell$. **(08 Marks)**

b. Determine the vertical deflection of point 'C' in the frame shown in Fig.Q3(b) by strain energy method. Given $E = 200$ kN/mm^2 and $I = 30 \times 10^6$ mm^4.

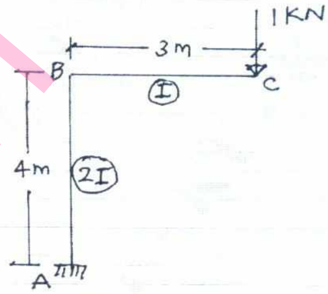

Fig.Q3(b) **(12 Marks)**

4 a. Determine the reaction at prop. for propped cantilever beam carrying udl of w/m run throughout its span using strain energy method. Take EI constant. **(08 Marks)**

b. Analyze the fixed beam shown in Fig.Q4(b) by strain energy method and draw SFD and BMD.

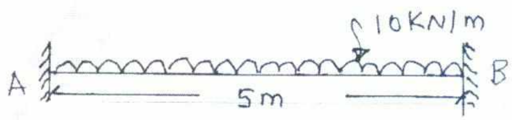

Fig.Q4(b) **(12 Marks)**

PART – B

5 a. A three hinged parabolic arch at the supports and at the crown has a span of 24 m and central rise of 4m. It carries a concentrated load of 50 kN at 18 m from the left support and udl of 30 kN over the left half span. Determine the bending moment, normal thrust and radial shear at a section 6m from the left support. **(12 Marks)**

b. A suspension cable having supports at same level has a span of 40 m and a maximum dip of 4m. The cable is loaded with udl of 10 kN/m throughout its length. Calculate minimum and maximum tension in the cable. Also find the length of cable. **(08 Marks)**

6 a. By consistent deformation method, analyse the cantilever beam shown in Fig.Q6(a). Draw SFD and BMD.

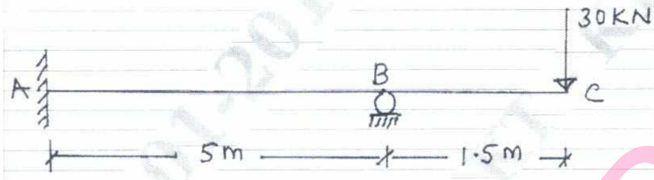

Fig.Q6(a) **(10 Marks)**

b. Find the fixed end moments for the beam shown in Fig.Q6(b) by consistent deformation method.

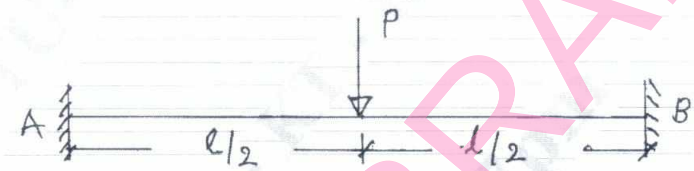

Fig.Q6(b) **(10 Marks)**

7 Determine the support moments in the continuous beam shown in Fig.Q7 by using three moment equation. Draw BMD.

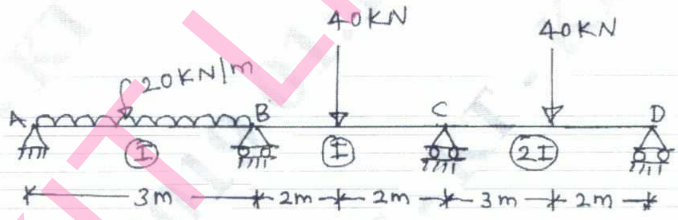

Fig.Q7 **(20 Marks)**

8 A parabolic two hinged arch has a span of 30 m and rise of 5 m. A concentrated load of 12 kN acts at 10 m from left hinge. The second moment of area varies as the secant of slope of rib axis. Calculate the horizontal thrust and normal thrust and radial shear at left hinge. **(20 Marks)**

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10CV/CT44

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

Surveying – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Describe the procedure for measuring the horizontal angle by repetition method. **(10 Marks)**

b. Explain the procedure for the prolongation of a straight line using theodolite:
   i) Which is in adjustment?
   ii) Which is in poor adjustment? **(10 Marks)**

2 a. What are the permanent adjustments of a theodolite? Explain the spire test. **(10 Marks)**

b. Explain with a neat sketch 'two-peg method' adopted in the permanent adjustments of a level. **(10 Marks)**

3 a. Explain the method of determining the distance and the elevation of an object using trigonometric leveling, when the base in inaccessible and the instrument stations are in the same plane as that of the object. Derive the required equations. **(10 Marks)**

b. Determine the height of the pole above the ground on the basis of the following angles of elevation from two instrument stations A and B, in line with the pole.
Angle of elevation from A to the top and bottom of the pole : 30° and 25°
Angle of elevation from B to the top and bottom of the pole : 35° and 29°
Horizontal distance AB = 30 m
The readings obtained on the staff at the BM with the two instrument settings are 1.48 m and 1.32 m respectively. What is the horizontal distance of the pole from A? **(10 Marks)**

4 a. Explain the method of determining the constants of tacheometer in the field. **(10 Marks)**

b. Determine the gradient from the point P to another point Q from the following observations made with a tacheometer fitted with an anallactic lens. The constants of the instrument were 100 and 0 and the staff was held vertical.

Instrument station	Staff station	Bearing	Vertical angle	Staff Readings (m)
R	P	130°	+10°32′	1.255, 1.810, 2.365
	Q	220°	+5°06′	1.300, 2.120, 2.940

(10 Marks)

PART – B

5 a. Explain the method of setting out of a simple curve by off-sets from chord produced method with a neat sketch. **(10 Marks)**

b. A simple circular curve of radius 450 m and deflection angle 70° was to be set out. The chainage of the point of the curve was 1022 m. Due to inaccessibility problem it was required to rotate the forward tangent by 12° about the point of tangency. Find the new radius and the chainage of the tangent points and that of the point of intersection. **(10 Marks)**

6 a. What is transition curve? State the various types of transition curves with the help of neat sketch. Explain briefly its necessity. **(10 Marks)**

b. A reverse curve is to join two straight having a very acute angle of intersection. The common tangent (140 m) makes an angle of intersection of 120° and 130° with the main straights. Calculate the suitable common radius. **(10 Marks)**

7 a. Define a compound curve. Describe briefly the setting out of a compound curve. **(10 Marks)**

b. A compound curve is made up of two arcs of radii 320 m and 510 m. The deflection angle of the combined curve is 100° and that of the first arc of radius 320 m is 54°. The chainage of the first tangent point is 920 m. find the chainage of the point of intersection; common tangent point, and forward tangent point. **(10 Marks)**

8 a. Derive an expression for trapezoidal formula for volume calculations. **(10 Marks)**

b. A railway embankment is 12 m wide. The ground is level in a direction transverse to the central line. Calculate the volume contained in 100 m length by trapezoidal and prismoidal rule, if the side slope is 1.5:1. The central height at 20 m interval are 3.70 m, 2.60 m, 4.0 m, 3.4 m, 2.8 m, 3.0 m and 2.2 m. **(10 Marks)**

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10CV45

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Hydraulics and Hydraulic Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

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.

PART – A

1 a. Assuming that rate of discharge Q of a centrifugal pump is dependent upon the mass density ρ of fluid, pump speed N(rpm), the diameter of impeller D, the pressure P and viscosity of fluid μ, show using the Buckingham's π-theorem that it can be represented by :

$Q = (ND^3)\phi\left[\left(\frac{gH}{N^2D^2}\right), \left(\frac{\upsilon}{ND^2}\right)\right]$ where υ = kinematic viscosity, H = Head. **(08 Marks)**

b. Name different types of models. Where are their applications? **(04 Marks)**

c. The ratio of lengths of a submarine and its model is 30:1. The speed of submarine is 10m/sec. The model is tested in a wind tunnel. Find the speed air in wind tunnel. Also determine the ratio of the drag (resistance) between the model and its prototype. Take the value of kinematic viscosities for seawater and air as 0.012 Stokes and 0.016 stokes respectively. The density for seawater and air is given as 1030 kg/m^3 and 1.24 kg/m^3 respectively. **(08 Marks)**

2 a. Find the slope of the bed of a rectangular channel of width 5m when depth of water is 2m and rate of flow given as 20m^3/sec. Take Chezy's constant C = 50. **(04 Marks)**

b. Define most economical channel section. Derive the conditions for most economical channel section for maximum discharge through a circular channel section. **(08 Marks)**

c. A trapezoidal channel section to carry 142 m^3/ minute of water is designed to have a minimum cross-section. Find the bottom width and depth if the bed slope is 1in 2000, the side slope as 45° and Chezy's constant C = 55. **(08 Marks)**

3 a. Draw a neat diagram of specific energy diagram for a channel section and mark its salient points. **(06 Marks)**

b. A rectangular channel carries a discharge of 2m^3/sec per metre width. If the loss of energy in the hydraulic jump is found to be 2.75m determine the conjugate depths before and after the jump. **(08 Marks)**

c. State the relationship between water surface slopes and channel bottom slope for non uniform flow in channels. Give the classification of channel bottom slopes and state the conditions. **(06 Marks)**

4 a. State and explain Impulse-momentum equation. What are its applications? **(06 Marks)**

b. Derive an expression for force exerted by a jet on a series of moving flat plates fixed on a wheel. Find the maximum efficiency, with usual notations. **(08 Marks)**

c. A jet of water of diameter 25mm strikes a 20cm × 20cm square plate of uniform thickness with a velocity of 10m/sec at the centre of the plate which is suspended vertically by a hinge on its top horizontal edge. The weight of the plate is 98.1N. The jet strikes normal to the plate. What force must be applied at the lower edge of the plate so that the plate is kept vertical? If the plate is allowed to deflect freely, what will be the inclination of the plate with vertical due to the force exerted by the jet of water? **(06 Marks)**

PART – B

5 a. Derive expressions for force on the curved plate and also workdone by the jet on the plate/sec, when the plate is moving in the direction of jet, with usual notations. **(06 Marks)**

b. A jet of water having a velocity of 15m/sec, strikes a curved vane which is moving with a velocity of 5m/sec. The vane is symmetrical and it is so shaped that the jet is deflected through 120°. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth. **(14 Marks)**

6 a. List various classification of turbines. **(06 Marks)**

b. Draw a neat diagram of Pelton turbine and explain function of its various components. **(06 Marks)**

c. A Pelton wheel has a mean bucket speed of 10 metre/sec with a jet of water flowing at the rate of 700 litre/sec under a head of 30metres. The buckets deflect the jet through an angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. **(08 Marks)**

7 a. Define a draft tube. What are the functions of draft tube? Mention different types of draft tubes. **(06 Marks)**

b. What is cavitation in turbines? List the effects of cavitation and precautions for protection against cavitation. **(06 Marks)**

c. The hub diameter of a Kaplan turbine, working under a head of 12m, is 0.35 times the diameter of the runner. The turbine is running at 100rpm. If the vane angle of the extreme edge of the runner at outlet is 15° and flow ratio is 0.6, find:

i) Diameter of the runner
ii) Diameter of the boss
iii) Discharge through the runner.

The velocity of whirl of outlet is given as zero. **(08 Marks)**

8 a. Define suction head, delivery head, maometric efficiency and overall efficiency of a centrifugal pump. **(06 Marks)**

b. Derive an expression for minimum starting speed of a centrifugal pump. **(06 Marks)**

c. A centrifugal pump is running at 1000rpm. The outlet vane angle of the impeller is 45° and velocity of flow at outlet is 2.5m/sec. The discharge through the pump is 200 litres/sec, when the pump is working against a total head of 20m. If the manometric efficiency of the pump is 80%, determine:

i) Diameter of the impeller ii) Width of the impeller at outlet. **(08 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Prove that the angle between two lines whose direction cosines are (l_1, m_1, n_1) and (l_2, m_2, n_2) is $\cos\theta = l_1 l_2 + m_1 m_2 + n_1 n_2$ **(07 Marks)**

b. Find the value of K if the angle between the lines with direction ratios $-2, 1, -1$ and $1, -K, -1$ is $\frac{2\pi}{3}$. **(07 Marks)**

c. Find the projection of the line segment AB on CD where A = (3, 4, 5), B = (4, 6, 3), C = (−1, 2, 4), D = (1, 0, 5) **(06 Marks)**

2 a. Derive the equation of the plane in the intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(07 Marks)**

b. Find the image of the point (2, −1, 3) in the plane $2x+4y+z-24=0$. **(07 Marks)**

c. Find the equation of the plane containing the line $\frac{x+1}{2}=\frac{y+2}{3}=\frac{z+3}{4}$ and is perpendicular to the line $x-2y+3z=4$. **(06 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $2i-j+k$, $i-3j-5k$ and $3i-4j-4k$ form a right angled triangle. **(07 Marks)**

b. Find the cosine and sine of the angle between the vectors $2i-j+3k$ and $i-2j+2k$. **(07 Marks)**

c. Find the value of λ such that the vectors $\vec{a}=\lambda i-5j-2k$, $\vec{b}=-7i+14j-3k$ and $\vec{c}=11i+4j+k$ are coplanar. **(06 Marks)**

4 a. A particle moves along a curve $x=t^3-4t$, $y=t^2+4t$, $z=8t^2-3t^3$. Determine its velocity and acceleration and also the magnitude of velocity and acceleration at t = 2. **(07 Marks)**

b. Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point (2, −1, 2). **(07 Marks)**

c. Find the directional derivative of the function $\phi = xyz$ along the direction of the normal to the surface $xy^2+yz^2+zx^2=3$ at the point (1, 1, 1) **(06 Marks)**

5 a. If $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$ find div $\vec{F}$ and curl $\vec{F}$. **(07 Marks)**

b. Show that curl(gradϕ) = 0. **(06 Marks)**

c. Show that $\vec{F}=\frac{xi+yj}{x^2+y^2}$ is both solenoidal and irrotational. **(07 Marks)**

6 a. Find the Laplace transform of t^n, where n is a positive integer. **(05 Marks)**
b. Find $L(\sin 5t \cos 2t)$. **(05 Marks)**
c. Find $L(t \cos at)$. **(05 Marks)**
d. Find $L\left(\dfrac{\cos at - \cos bt}{t}\right)$. **(05 Marks)**

7 a. Find $L^{-1}\left[\dfrac{s+5}{s^2 - 6s + 13}\right]$. **(07 Marks)**
b. Find $L^{-1}\left[\dfrac{1}{s(s+1)(s+2)(s+3)}\right]$. **(07 Marks)**
c. Find $L^{-1}\left[\log\left(\dfrac{s+a}{s+b}\right)\right]$. **(06 Marks)**

8 a. Using Laplace transform solve $\dfrac{d^2y}{dt^2} + 4\dfrac{dy}{dt} + 4y = e^{-t}$, $y(0) = 0 = y'(0)$ **(10 Marks)**
b. Using Laplace transform solve $\dfrac{dx}{dt} + y = \sin t$, $\dfrac{dy}{dt} + x = \cos t$ given $x(0) = 1$, $y(0) = 0$ **(10 Marks)**

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