USN | | | | | | | | | | |

10MAT41

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

Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***
2. ***Use of statistical tables is permitted.***

PART – A

1 a. Using the Taylor's series method, solve the initial value problem $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$ at $x = 0.1$ and $x_2 = 0.2$. **(06 Marks)**

b. Obtain an approximate 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, using Euler's modified method. Perform two modifications at each step. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.04$ and $y(0.3) = 2.09$, find $y(0.4)$ correct to five decimal places by employing the Milne's predictor-correct method. Use corrector formula twice. **(07 Marks)**

2 a. Find an approximate value of y and z corresponding to $x = 0.1$ given that $y(0) = 2$, $z(0) = 1$ and $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$. Using Picard's method. **(06 Marks)**

b. Solve, $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for $x = 0.2$, correct to four decimal places, with initial conditions $x = 0$, $y = 1$, $\frac{dy}{dx} = 0$, using Runge-Kutta method. **(07 Marks)**

c. Obtain an approximate solution at the point $x = 0.4$ of the initial value problem, $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, $y(0) = 1$, $y'(0) = 0.1$ using Milner's method. Given $y(0) = 1$, $y(0.1) = 1.03995$, $y(0.2) = 1.138036$, $y(0.3) = 1.29865$, $y'(0) = 0.1$, $y'(0.1) = 0.6955$, $y'(0.2) = 1.258$, $y'(0.3) = 1.873$. **(07 Marks)**

3 a. If $f(z) = u + iv$ is an analytic function, then prove that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$. **(06 Marks)**

b. Find an analytic function $f(z) = u + iv$, given that $u + v = \frac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$. **(07 Marks)**

c. Find an analytic function $f(z) = u + iv$ given the imaginary part $v = r^2\cos 2\theta - r\cos\theta + 2$. **(07 Marks)**

4 a. Find the bilinear transformation that transforms the points $z_1 = i$, $z_2 = 1$, $z_3 = -1$ onto the points $w_1 = 1$, $w_2 = 0$, $w_3 = \infty$ respectively. **(06 Marks)**

b. Evaluate $I = \int_{z=0}^{2+i} (\bar{z})^2 dz$ along the following curves:

i) The straight line $y = \frac{x}{2}$ from the origin θ to the point B(2 + i).

ii) The real axis from 0 to 2 and then vertically to 2 + i. **(07 Marks)**

c. State and prove Cauchy's integral formula. **(07 Marks)**

PART – B

5 a. Obtain the series solution Bessel's differential equation leading to Bessel's function of first kind. **(08 Marks)**

b. If α and β are distinct roots of the equation $J_n(ax) = 0$, then prove that $\int_0^a x J_n(\alpha x).J_n(\beta x)dx = 0$. **(07 Marks)**

c. Evaluate $p_0(x)$, $p_1(x)$, $p_2(x)$, $p_3(x)$ by using the Rodrigue's formula. **(05 Marks)**

6 a. A husband and wife appear for two vacancies of a post. The probability of husband's selection is 1/7 and that of wife's selection is 1/5. What is the probability that (i) both of them will be selected? (ii)Only one of them is selected? (iii) Neither is selected? **(06 Marks)**

b. What are independent events? If A and B are independent prove that (i) A and $\bar{B}$ are independent, (ii) $\bar{A}$ and B are independent and (iii) $\bar{A}$ and $\bar{B}$ are independent. **(07 Marks)**

c. An author has four typists typing the manuscript of his latest book. Typist A does 30% of the typing; typist B 25%; typist C 20% and typist D, 25%. Errors occur on 5% of the pages typed by A, on 4% types by B, on 3% typed by C and on 2% typed by D. If a page is chosen at random what is the probability that it contains errors? If a page chosen contains errors, what is the probability that it was typed by typist A or typist B? **(07 Marks)**

7 a. A random variable x has the density function

$$f(x) = \begin{cases} kx^2, & -3 \le x \le 3 \\ 0, & \text{elsewhere} \end{cases}$$

Evaluate K, and find (i) $p(1 \le x \le 2)$ ii) $p(x \le 2)$ iii) $p(2 < x \le 3)$ and iv) $p(x > 1)$. **(06 Marks)**

b. Find the mean, variance and standard deviation for the binomial distribution. **(07 Marks)**

c. The life of a certain type of electrical lamps is normally distributed with mean of 2040 hrs and standard deviation 60 hours. In a consignment of 2000 lamps, find how many would be expected to burn for (i) more than 2150 hours (ii) less than 1950 hours, and (iii) between 1920 hours and 2160 hours given that A(1.5) = 0.4332, A(1.83) = 0.4664 and A(2) = 0.4772. **(07 Marks)**

8 a. The mean and standard deviation of marks scored by a sample of 100 students are 67.45 and 2.92. Find (i) 95% and (ii) 99% confidence intervals for estimating the mean marks of the student population. **(06 Marks)**

b. Consider the sample consisting of nine numbers 45, 47, 50, 52, 48, 47, 49, 53 and 51. The sample is drawn from a population whose mean is 47.5. Find whether the sample mean differs significantly from the population mean at 5% level of significance. **(07 Marks)**

c. Fit a binomial distribution to the following data:

x_i	0	1	2	3	4	5
f_i	2	14	20	34	22	8

Test the goodness of this fit at 5% level of significance. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV43

Fourth Semester B.E. Degree Examination, June/July 2018
Structural Analysis–I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define linear and non-linear structures, static and kinematic indeterminacies. **(04 Marks)**

b. Determine static and kinematic indeterminacies of structures shown in Fig.Q1(b). **(10 Marks)**

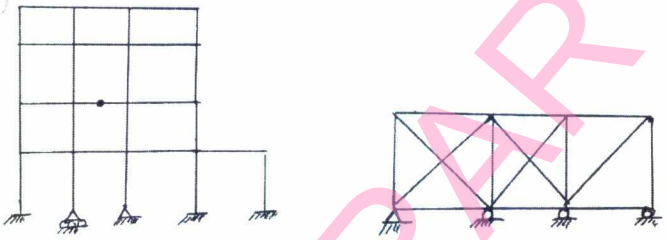

Fig.Q1(b)

c. Obtain an expression for strain energy stored in flexure for a cantilever with a concentrated load at the free end, with usual notations. **(06 Marks)**

2 a. Using moment–area method obtain maximum slope and maximum deflection for a simply supported beam of span 6m, subjected to a concentrated load of 30 kN, at a distance of 2m from the left support. Take $E = 204 \times 10^6$ kN/m^2 and $I = 50 \times 10^{-6}$ m^4. **(10 Marks)**

b. Determine slopes at the supports and deflection at the centre for the beam shown in Fig.Q2(b), using conjugate beam method. **(10 Marks)**

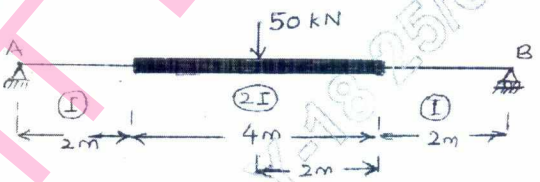

Fig.Q2(b)

3 a. State and prove Betti's law. **(06 Marks)**

b. Obtain vertical and horizontal deflections at the free end of the cantilever frame shown in Fig.Q3(b), using Castigliano's theorem. **(14 Marks)**

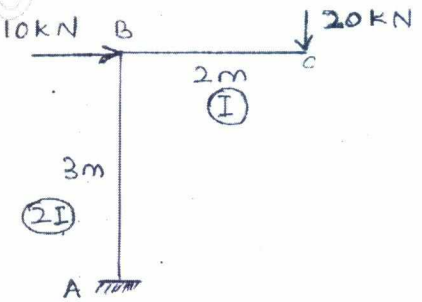

Fig.Q3(b)

4 a. Determine reaction at the propped end of a propped cantilever, loaded with a uniformly distributed load, throughout its span. Use strain–energy method. **(06 Marks)**

b. For the pin-jointed frame shown in Fig.Q4(b), determine vertical deflection under the load, using unit-load method. Cross–sectional area of each member is $500 \times 10^{-6} m^2$ and Young's modulus is 2×10^8 kN/m^2. **(14 Marks)**

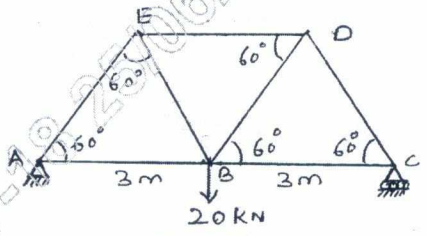

Fig.Q4(b)

PART – B

5 a. A three-hinged parabolic arch, hinged at the crown and at the supports has a span of 24m and a central rise of 4m. It carries a uniformly distributed load of 45kN/m over its left half portion and a concentrated load of 75kN at 6m from the right support. Determine bending moment, normal thrust and radial shear at a section 6m from the left support. **(10 Marks)**

b. A bridge cable is supported from the towers 80m apart and carries a uniformly distributed load of 45kN/m over the entire span. Determine maximum and minimum tensions in the cable, if the maximum sag is 8m. The cable is supported by saddles which are stayed by wires inclined at 30° to the horizontal. Determine forces developed in the towers. **(10 Marks)**

6 a. Analyse the propped cantilever shown in Fig.Q6(a) by consistent deformation method. Draw shear force diagram. **(08 Marks)**

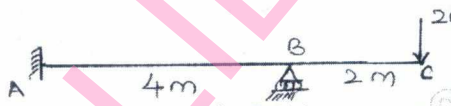

Fig.Q6(a)

b. Analyse the fixed beam shown in Fig.Q6(b) by consistent deformation method. Draw bending moment diagram. **(12 Marks)**

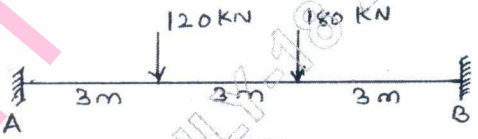

Fig.6Q(b)

7 Using Clapeyron's theorem of three–moments analyze the beam shown in Fig.Q7. Draw bending moment diagram. **(20 Marks)**

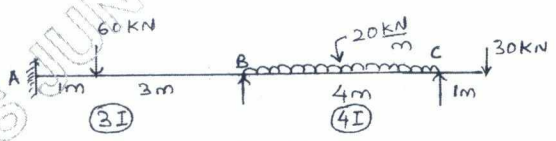

Fig.Q7

8 A two-hinged parabolic arch, with moment of inertia proportional to the secant of the slope of arch axis, span 20m and rise 4m is subjected to a concentrated load of 100kN, placed at 6m from the left support. Calculate the horizontal thrust; bending moment, normal thrust and radial shear at 5m from left support. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV/CT44

Fourth Semester B.E. Degree Examination, June/July 2018
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. Define the following terms:
(i) Transiting (ii) Swinging of telescope. **(04 Marks)**

b. Enumerate the applications of Theodolite. **(06 Marks)**

c. Explain the Repetetion method of measuring the horizontal angle and list the errors eliminated by that method. **(10 Marks)**

2 a. What are the fundamental lines of a Theodolite? State the desired relationship between them. **(10 Marks)**

b. A dumpy level was set up exactly midway between A and B, 50 m apart. The readings on the staff held at A and B were 1.0 m and 2.0 m respectively. The instrument was then shifted to a point C on the line BA produced and 10 m from 'A'. The readings as the staff held at A and B were 1.50 m and 2.60 m respectively. Determine the correct readings and the RL of B if that of A is 200.00 m. **(10 Marks)**

3 a. List the advantages of Total Station over conventional instruments. **(04 Marks)**

b. How would you determine the height of an object whose base is inaccessible by single plane method? **(06 Marks)**

c. Find the reduced level of a Church spire 'C' from the following observations taken from two stations A and B, 50 m apart. Angle BAC = 60° and angle ABC = 50°.
Angle of elevation from a to top of spire = 30°
Angle of elevation from B to top of spire = 29°
Staff reading on A on BM of RL 200.25 = 2.500 m
Staff reading on B to same BM = 0.500 m. **(10 Marks)**

4 a. Define the following:
(i) Anallactic lens (ii) Subtense bar. **(04 Marks)**

b. Explain the field procedure to determine the Tacheometric constants. **(06 Marks)**

c. A Tacheometer was set up at a station D and the following observations are taken. Calculate the gradient from A to B, if K = 100 and C = 0.

Instrument station	Staff Point	Bearing	Vertical angle	
D	A	340°30'	+5°30'	0.80, 1.85, 2.95
	B	70°30'	–4°40'	0.66, 2.20, 3.74

(10 Marks)

PART – B

5 a. Enumerate the different methods of designating a curve. Establish the relationship between them. **(04 Marks)**

b. Name the various elements of a simple curve with a diagram. Derive the relation to compute the same. **(06 Marks)**

c. The following data refers to a compound curve which bends to the right:
Total deflection angle = 59°45'
Degree of the first curve = 2°
Degree of the second curve = 5°
Chainage of point of intersection = 1500.450 m
Determine the chainage of tangent points, if length of both the curves is same 30 m chain is being used. **(10 Marks)**

6 a. Enumerate the importance of reconnaissance in a triangulation survey. **(04 Marks)**

b. What are the various points to be considered for selecting the site for a base line? **(06 Marks)**

c. A distance of 30 m is measured with a steel tape from one peg to another peg in a catenary under a pull of 100 N and a temperature of 70°F. There is a difference in vertical level of 0.25 m between the pegs. Calculate the horizontal distance between the two pegs if standard pull is 80 N and standard temperature is 60°F. Take density of tape as 7.86 g/cc. Cross section of tape = 0.08 cm^2, $\alpha = 6\times10^{-6}$ per 1°F, $E = 2\times10^7$ N/cm^2. **(10 Marks)**

7 a. What is a transition curve? Enumerate the functions and conditions to be fulfilled by a transition curve. **(10 Marks)**

b. A road which deflects 80° is to be designed for a maximum speed of 100 kmph, maximum centrifugal ratio is $\frac{1}{4}$ and max rate of change of radial acceleration is 0.3 m/s^2. The curve consists of circular arc combined with two cubic spirals. Calculate:
(i) Radius of circular arc.
(ii) Length of transition curve.
(iii) Length of total curve.
(iv) Chainage of tangent points and junction points if point of intersection is 42622 m.
(10 Marks)

8 a. Plot the cross staff survey data of a traverse ABCDEF and determine its area of the field. **(10 Marks)**

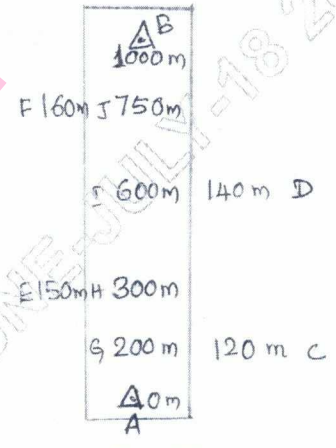

Fig. Q8 (a)

b. An embankment of width 10 m and side slope of 1 V : 1.5 H is required. The central heights at 40 m interval are as follows: 0.90, 1.25, 2.15, 2.50, 1.85, 1.35 and 0.85 m. Calculate the volume of earthwork by Trapezoidal and prismoidal rule. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV45

Fourth Semester B.E. Degree Examination, June/July 2018
Hydraulics & Hydraulic Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Distinguish between (i) Geometric and Kinematic similarity (ii) Reynolds and Froude number. (iii) Distorted and undistorted model. **(06 Marks)**

b. Prove that the discharge over a spill way is given by the relation, $Q = VD^2 f\left[\frac{\sqrt{gD}}{V}, \frac{H}{D}\right]$

where V = Velocity of flow; D = Depth at the Throat;
H = Head of water; g = acceleration due to gravity. **(08 Marks)**

c. A pipe of dia 15 mm is required to transmit an oil of specific gravity 0.9 and viscosity 3×10^{-2} poise at 3000 lps. Tests were conducted on 150 mm dia pipe using water at 20°C. Find velocity and rate of flow of model if 'μ' water at 20°C, if 0.01 poise. **(06 Marks)**

2 a. Bring out the difference between flow through pipes and flow through open channel. **(05 Marks)**

b. Derive the conditions for most economical trapezoidal section. Also show that the most economical trapezoidal section for an open channel is one which has three sides tangential to the semicircle described on the water line. **(07 Marks)**

c. A channel is 2 m width at bottom, the length of each sloping side is 1.95 m. The width of water surface is 5.5 m. The flow depth is 1.2 m and bed slope 1 in 5280. What is the discharge per minute? Take value of C = 34.6. **(08 Marks)**

3 a. Define the term hydraulic jump. Derive an expression for depth of hydraulic jump in terms of upstream Froud's number. **(10 Marks)**

b. The loss of energy head in a hydraulic jump is 4.25. The Froud number just before the jump is 7.50. Find (i) Discharge per meter width of channel (ii) The depths before and after the hydraulic jump. (iii) Froud number after the jump (iv) Percentage loss of energy head due to jump (v) Length of the jump. **(10 Marks)**

4 a. State the impulse momentum principle. Show that the efficiency of jet striking normally on series of slot plates mounted on the periphery of wheel is 50%. **(10 Marks)**

b. A 80 mm dia jet having a velocity of 40 m/sec strikes a flat plate the normal of which is inclined at 45°to the axis of the jet. Find the normal pressure on the plate (i) When the plate is stationary (ii) When the plate moving with a velocity of 20 m/sec and away from the jet. Also determine the power and efficiency of the jet when the plate is moving. **(10 Marks)**

PART – B

5 a. A jet of water strikes on unsymmetrical moving curved plate tangentially at one of the tips. Derive an expression for the force exerted by the jet in the horizontal direction of motion. Also describe the velocity triangles and obtain an expression for work done and efficiency. **(10 Marks)**

b. A jet of water having a velocity of 40 meters per second impinges without shock on a series of vanes moving at 12 m/sec. The jet is making an angle of 20° with the direction of motion of the vane. Relative velocity at exit is 0.9 times the relative velocity at entrance and the absolute velocity of water at exit if normal to the direction of the motion of the vanes. Find :

(i) Vane angle at entrance and exit.
(ii) Workdone on the vanes per N of water.
(iii) Efficiency. **(10 Marks)**

6 a. How will you classify the turbines? **(04 Marks)**

b. Derive an equation for efficiency of pelton wheel turbine. **(08 Marks)**

c. A Kaplan turbine develops 6500 kW under a head of 6 m. The velocity of flow through the runner is 6.50 m/sec. The diameters of the bolt is 0.35 times the external diameters. The vane tips have a velocity of 22 m/sec. The over all efficiency is 85%. Determine the dia and specific speed of the turbine. **(08 Marks)**

7 a. With a neat sketch, explain the general layout of a hydroelectric power plant. **(10 Marks)**

b. An inward flow water turbine has blades. The inner and outer radii of which are 30 cm and 50 cm respectively. Water enters the blades at the outer periphery with a velocity of 45 m/sec making an angle of 25° with the tangent to the wheel at the inlet tip. Water levels of the blade with a flow velocity of 8 m/sec. If the blade angles at inlet and outlet are 35° and 25° respectively. Determine (i) Speed of the turbine wheel (ii) Work done per Newton of water. **(10 Marks)**

8 a. With the help of neat sketches, explain the characteristic curves of the centrifugal pump. **(08 Marks)**

b. A multi stage centrifugal pump is required to lift 0.04 m^3/sec of water against a head of 700 m of water. If the speed of the pump is 2500 rpm find the minimum number of stages required. If the specific speed is not less than 25. **(06 Marks)**

c. A centrifugal pump runs at 1000 rpm and delivers water against a head of 15 m. The impeller diameter and width at the outlet are 0.3 m and 0.05 m respectively. The vanes are curved back at an angle of 30° with the periphery at the outlet $\eta_{mono} = 0.92$, find discharge. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP401

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

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Find the ratio in which the point C, (9, 8, -10) divides the line segment joining the points A(5, 4, -6) and B(3, 2, -4). **(06 Marks)**

b. If $\cos\alpha$, $\cos\beta$, $\cos\gamma$ are the direction cosines of a straight line, prove that (i) $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=2$ (ii) $\cos2\alpha+\cos2\beta+\cos2\gamma=-1$. **(07 Marks)**

c. Find the constant K such that the angle between the lines with direction ratios (-2, 1, -1) and (1, -K, 1) is 90°. **(07 Marks)**

2 a. Show that the angles between the diagonals of a cube is $\theta=\cos^{-1}(1/3)$. **(06 Marks)**

b. Find the equation of the plane through the points (1, 0, -1) and (3, 2, 2) and parallel to the line $\frac{x-1}{1}=\frac{1-y}{2}=\frac{z-2}{3}$. **(07 Marks)**

c. Show that the points A(-6, 3, 2), B(3, -2, 4), C(5, 7, 3) and D(-13, 17, -1) are coplanar. Also find the equation of the plane containing them. **(07 Marks)**

3 a. Find the angle between the vectors $\vec{a}=2i+6j+3k$, $\vec{b}=12i-4j+3k$. **(06 Marks)**

b. Find the area of a parallelogram whose adjacent sides are $i-2j+3k$ and $2i+j-4k$. **(07 Marks)**

c. Find a unit vector perpendicular to both vectors $\vec{a}=2i-3j+k$, $\vec{b}=7i-5j+k$. **(07 Marks)**

4 a. Show that the four points whose position vectors are $3i-2j+4k$, $6i+3j+k$, $5i+7j+3k$ and $2i+2j+6k$ are coplanar. **(06 Marks)**

b. A particle moves along the curve $x=t^3+1$, $y=t^2$, $z=2t+3$ where t is the time. Find the components of velocity and acceleration at $t=1$ in the direction of $i+j+3k$. **(07 Marks)**

c. Find the directional derivative of $f(x,y,z)=xy^2+yz^3$ at the point (2, -1, 1) in the direction of vector $i+2j+2k$. **(07 Marks)**

5 a. Find div F and curl F where $F=\text{grad}(x^3+y^3+z^3-3xyz)$. **(06 Marks)**

b. Show that $F=x(y-z)i+y(z-x)j+z(x-y)k$ is solenoidal. **(07 Marks)**

c. Find the constants a and b so that the vector $\vec{F}=(axy+z^3)\hat{i}+(3x^2-z)\hat{j}+(bxz^2-y)\hat{k}$ is irrotational. **(07 Marks)**

6 a. Find the Laplace transforms of $1+2t^3-4e^{3t}+5e^{-t}$. **(07 Marks)**

b. Find the Laplace transform of $t^2\sin^2 t$. **(07 Marks)**

c. Find the Laplace transform of $\frac{\sin at}{t}$. **(06 Marks)**

7 a. Find the inverse Laplace transform of $\frac{3s-4}{16-s^2}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{1}{s^2+4s+9}$. **(07 Marks)**

c. Evaluate $L^{-1}\left\{\frac{1}{(s+1)(s+2)}\right\}$. **(07 Marks)**

8 a. Obtain the Laplace transforms of $f'(t)$, $f''(t)$. **(08 Marks)**

b. Solve the differential equation using Laplace transforms $y''-3y'+2y=1-e^{2t}$ under the conditions $y(0) = 1$, $y'(0) = 0$. **(12 Marks)**

* * * * *