Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2018
BECM 2201
(Engineering Construction Management)

Full Marks: 210 Time: 3 hrs.

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What is project management? Describe different levels of project management. (10)
   (b) List fourteen principles for a successful management and discuss any five of them. (15)
   (c) What are the roles of a construction project manager? Write down the consequences of bad project management. (10)

2. (a) The first cost of a small dam is expected to be $3 million. The annual maintenance cost is estimated to be $10,000 per year a $35,000 outlay will be required for every 5 years. In addition an expenditure of $5,000 in year 10 will be required, increased by $1,000 per year through year 20, after which it will remain constant. If the dam is expected to last forever, what will be the capitalized cost at an interest rate of 15% per year? (15)
   (b) A design-build-operate engineering company in Texas that owns a sizeable amount of land plans to lease the drilling rights (oil and gas only) to a mining and exploration company. The contract calls for the mining company to pay $20,000 per year for 20 years beginning 3 years from now (i.e. beginning at the end of year 3 and continuing through year 22) plus $10,000 six years from now and $15,000 sixteen years from now. Utilize engineering economy relations by hand to determine the four equivalent values listed below at 16% per year. (1) Total present worth P_T in year 0, (2) Future worth F in year 22, (3) Annual series over all 22 years and (4) Annual series over the first 10 years. (20)

3. (a) Select the better of two proposals on the basis of conventional and modified B/C Analysis. (15)

	Proposal A	Proposal B
First cost, Tk.	320,000	540,000
Annual O & M Cost, Tk.	45,000	35,000
Annual benefits, Tk.	110,000	150,000
Annual dis benefits, Tk.	20,000	45,000
Salvage value	0	0
Life, years	10	20

   (b) Compare the alternatives below on the basis of present worth analysis, assuming I, interest rate = 15% per year. (20)

	Project A	Project B
First cost, Tk.	40,000	90,000
Annual operating Cost, Tk.	15,000	8,000
Annual repair cost, Tk.	5,000	2,000
Annual increase in cost, Tk.	1,000	1,500
Salvage value, Tk.	8,000	1,2000
Life, years	10	20

4. (a) Define MARR. Compare the alternatives on the basis of rate of return analysis where MARR = 12% per years. (17)

	Option A	Option B
Initial cost, $	8,000	13,000
Annual Cost, $ per year	3,500	1,600

Salvage value, $	0	2,000
Life, years	10	5

(b) A company adopted new system. The system has an installed cost of $150,000 and an additional cost of $50,000 after 10 years. The annual software maintenance contract cost is $5,000 for the first 5 years and $10,000 thereafter. In addition, there is expected to be a recurring major upgrade cost of $15,000 in every 13 years. Again another recurring cost is expected for every 8 years. The new system will be used for the indefinite future, find the capitalized cost for the new system. (18)

Section – B

5. (a) What are the advantages and limitations of linear programming? (05)
   (b) A manufacturer of leather belts makes three types of bets A, B and C which are processed on three machines M_1, M_2 and M_3. Belt A requires 2 hours on machine M_1 and 3 hours on machine M_3. Belt B requires 3 hours on machine M_1, 2 hours on machine M_2 and 2 hours on machine M_3 and belt C requires 5 hours on machine M_2 and 4 hours on machine M_3. There are 8 hours of time per day available on machine M_1, 10 hours of time per day available on machine M_2 and 15 hours of time per day available on machine M_3. The profit gained from belt A is Tk. 3.00 per unit, from belt B is Tk. 5.00 per unit and from belt C is Tk. 4.00 per unit. Solve this LPP using simplex method so that the profit is maximum. (30)

6. (a) What is inventory? Derive an expression of E.O.Q. (10)
   (b) The demand for an item in a company is 25,000 units per year and the company can produce the item at a rate of 6000 per month. The cost of one setup is Tk. 600.00 and the holding cost of 1 unit per month is 75 paisa. The shortage cost of one unit is Tk. 30.00 per month. Determine the optimum manufacturing time and the time between set ups. (15)
   (c) A contractor has to supply 120,000 units per 6 days. He can produce 30,000 units per day. The cost of holding a unit in stock is Tk. 3.00 per day and the setup cost is Tk. 50 per run. How frequently and of what size, the production runs be made? (10)

7. (a) What is tender? Write down the qualifications of a tender. (10)
   (b) Write short notes: (i) Tender security, (ii) Performance security, (iii) Liquid assets and (iv) Annual construction turnover. (12)
   (c) Describe the functions of store management in engineering point of view. (13)

8. (a) Define forecasting. Write down the application of demand forecasting. What are the limitations of moving average method of demand forecasting? (08)
   (b) Use exponential smoothing technique to compute the forecasts for the following series data under two situations when smoothing constant $\alpha = 0,3$ and $\alpha = 0.7$. Which forecast will you accept and why? Also assume old forecast for period 1 is 26. (12)

Period	1	2	3	4	5	6	7	8	9	10
Observations	27	30	32	31	28	27	30	33	33	31

   (c) Compute the forecast accuracy for the following series when $\alpha = 0.5$. (15)

Period	1	2	3	4	5	6	7	8	9	10
Orders	122	91	100	77	115	58	75	128	111	88

Khulna University of Engineering & Technology

Department of Building Engineering and Construction Management

B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2018

BECM 2213

(Numerical Analysis and Computer Programming)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable value for any missing data.

Section – A

1. (a) Define numerical analysis. Write down the applications of numerical analysis and computer programming from engineering point of view. (05)

   (b) Find the real root of the following equation up to six decimal places by Regula-Falsi method. (15)

   $$x\log_{10} x - 1.2 = 0$$

   (c) Solve the following set of simultaneous linear equation by the method of Iterative. ($\varepsilon=10^{-5}$) (15)

   $$3.122x+0.5756y-0.1565z-0.0067t = 1.571$$
   $$0.5756x+2.938y+0.1103z-0.0015t = -0.9275$$
   $$-0.1565x+0.1103y+4.127z+0.2051t = -0.0652$$
   $$-0.0067x-0.0015y+0.2051z+4.133t = -0.0178$$

2. (a) Define interpolation and extrapolation with example. (05)

   (b) The values of x and e^{-x} are given in the following table. Find the value of e^{-x} when x=1.7489 using Stirling's and Bessel formula. (15)

x	1.72	1.73	1.74	1.75	1.76	1.77	1.78
$y=e^{-x}$	0.179066	0.177284	0.175520	0.173774	0.172045	0.170333	0.168638

   (c) Given a table of values of the probability integral $\frac{2}{\sqrt{2}}\int_0^{\pi} e^{-x^2}\,dx$, for what the values of x is this integral equal to ½ (15)

x	0.45	0.46	0.47	0.48	0.49	0.50
y	0.4754818	0.4846555	0.4937452	0.5027498	0.5116683	0.5204999

3. (a) Solve $\frac{dy}{dx}=\frac{y-x}{y+x}$ by Euler's Modified method for x=0.2, initially x=0, y=0, y_o=1 ($\varepsilon=10^{-5}$) (20)

   (b) Using Runge-Kutta method, find an approximate value of y for x=0.4 if $\frac{dy}{dx}=x+y^2$, given that y_o=1, x_o=0 (15)

4. (a) Find the best fit curve through an exponential function of the type $y=ae^{bx}$ to the following data. (14)

   (b) Find the value of the following integral by Simpson's 1/3 rule and Weedle's rule. Taking the difference of the interval is maximum 0.1 (21)

   $$\int_{0.2}^{1.4} (sinx - lnx + e^x)dx$$

Section – B

5. (a) Define C programming. Write down the syntax of printf and scanf function. (13)
Develop a program to write a pattern(six times) like

```
B
  E
    C
      M
K
  U
    E
      T
```

Using C programming language.

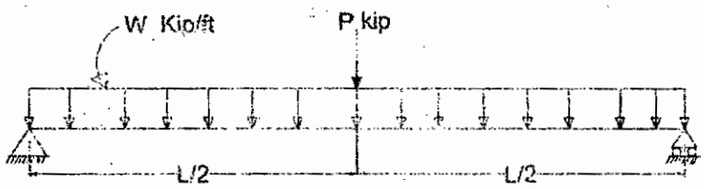
(b) Develop a program for estimating a slab using C programming language. (12)

(c) Develop a program to find the greatest or largest number from three inputted numbers using C programming language. (10)

6. (a) Write the syntax of for loop. Develop a program to calculate the sum of series below using C programming language. (10)
2! - 4! + 6! - 8! +---------- (2n)!.

(b) Develop a C program to find the value of Sin(x), where (12)
$$\text{Sin}x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots\cdots\cdots\cdots\cdots\cdots\cdots (-1)^{n+1}\frac{x^{2n+1}}{(2n+1)!}$$

(c) Develop a program using C language to calculate shear force and bending moment at 1 feet interval of the following beam shown in figure below. (13)



7. (a) Develop a program to add, substract, multiply, divide, average of five values using FORTRAN programming language. (10)

(b) State the categories of function. Create a program to write Fibonacci series. (10)

(c) Develop a program to multiply two matrix of order MxN and Pxq where N=P. (15)

8. (a) Describe the key punching statements in FORTRAN programming. (05)

(b) Develop a program to convert from degree Celsius to Fahrenheit and Kelvin using C language. (10)

(c) Develop a program to write N to 1 as a descending order using Do Loop statement in FORTRAN programming language. (10)

(d) Develop a program to calculate the sum of the series in FORTRAN (10)
$$1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\frac{1}{5^2}+\frac{1}{7^2}+ - - - - - - +\frac{1}{n^2}$$

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B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2018

CE 2211

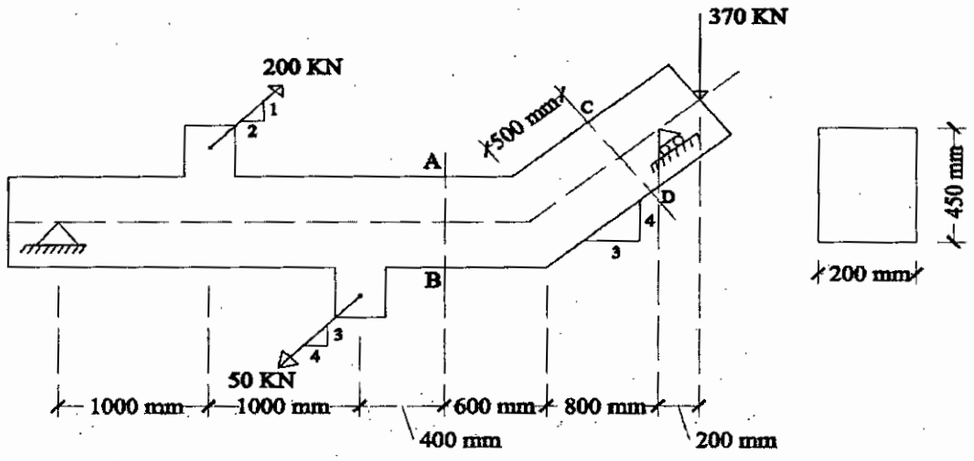
(Mechanics of Solids - II)

Full Marks: 210 Time: 3 hrs

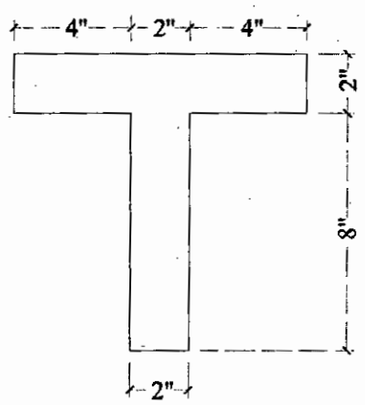
N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

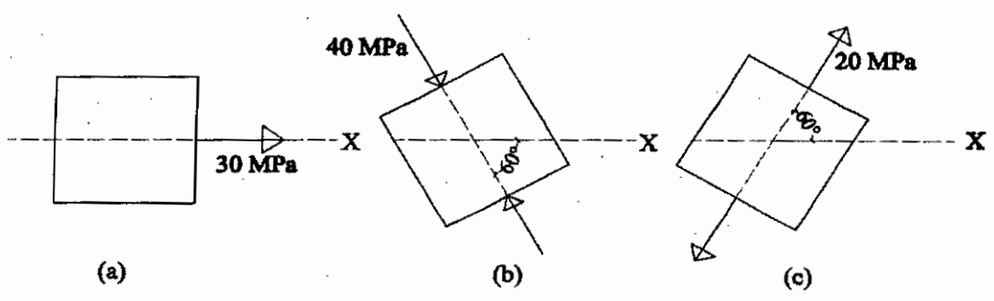
1. (a) Distinguish between kern of a section and shear center. Compute the stresses at A and B, C and D on the link loaded as shown in figure below. (18)



(b) Draw the kern of the T-section shown in figure below. Also, show the neutral axis for any load P eccentrically applied on the section that divides tension and compression zone. (17)

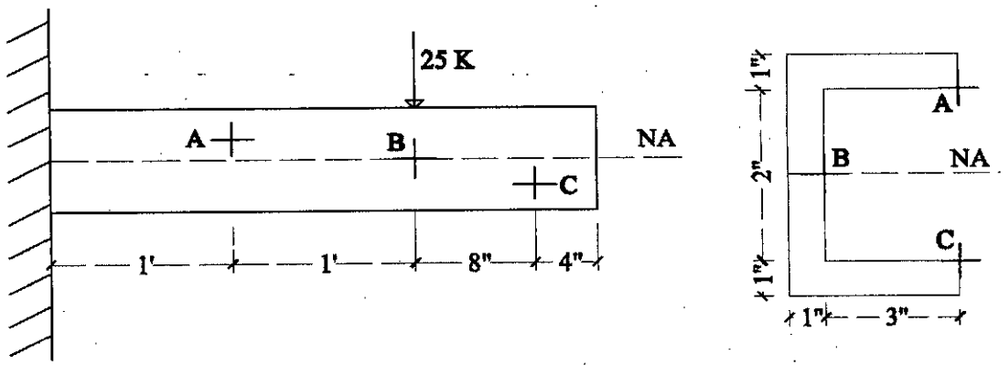


2. (a) Define stress at a point. The state of stress at a point is the result of the three separate actions that produce the three states of stress shown in figure. Determine the principal stresses and principal planes caused by the superposition of these three stress states. (Use graph paper to draw Mohr Circle Diagram) (18)

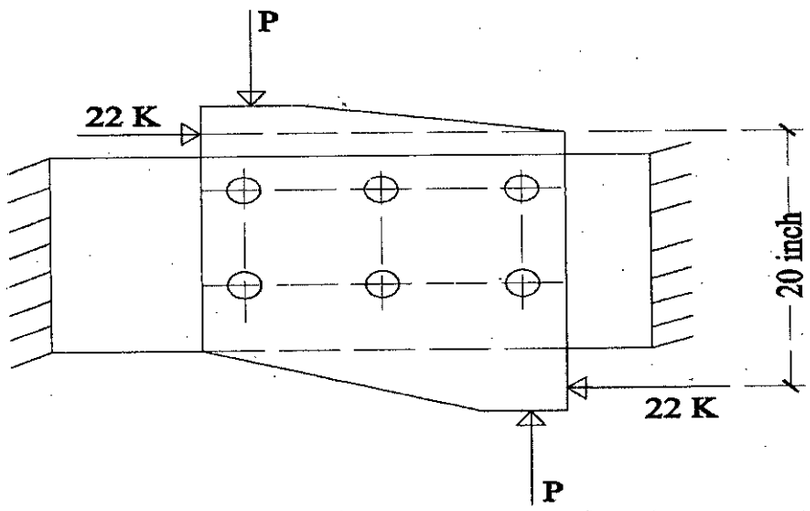


(b) A flexible shaft consists of a 0.45 in Ø steel wire encased in a stationary tube that fits closely enough to impose a frictional torque of 0.38 lb.in/in. Determine the maximum length of the shaft if the shearing stresses are not allowed to exceed 18 ksi. Determine the angular deformation of one end relative to the other end. Use G = $5x10^6$ psi. (17)

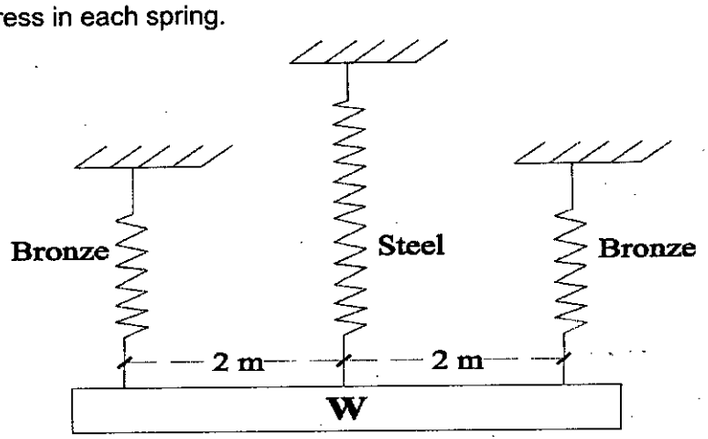
3. (a) Define principal stress and principal plane. Draw the Mohr Circle for the differential element A, B and C on a cantilever beam loaded as shown in figure below. Use graph paper and show all the Mohr circles in a same figure. (23)



(b) Six 7/8-in-diameter rivets fasten the plate in figure to the fixed member. Determine the average shearing stress caused in each rivet by the 22 kip loads. What additional loads P can be applied before the average shearing stress in any rivet exceed 10,500 psi? (12)

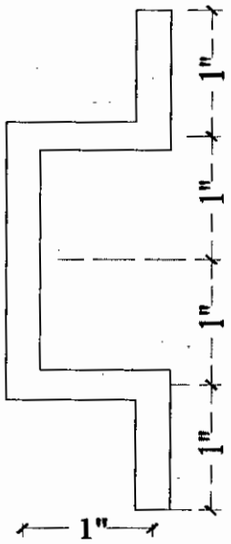


4. (a) A homogeneous 80 Kg rigid block is suspended by three springs whose lower ends were originally at the same level as shown in figure. Compute maximum shearing stress in each spring. (15)



Values	Turns	d_{wire}	D_{case}	G
Steel	60	25 mm	200 mm	83 GPa
Bronze	20	15 mm	150 mm	42 GPa

(b) Why the factors 0.5 and 0.615 differ in spring maximum shearing stress equations developed after Wahl, A.M? Determine the shear center of the section shown in figure. (20)

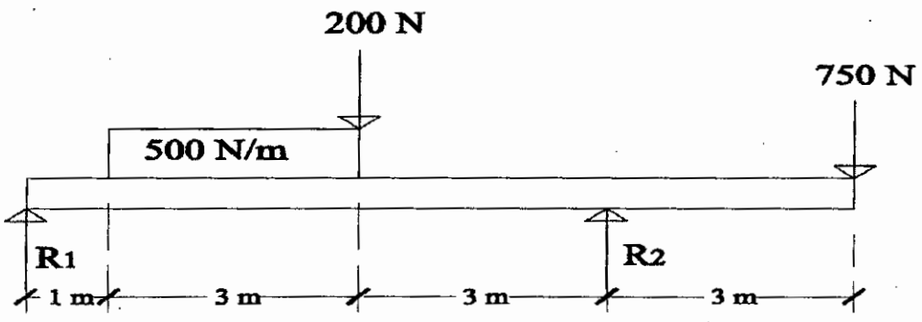


Section – B

5. (a) What are the methods available to determine the deflection of a beam? Why is the excessive deflection of a floor beam not acceptable? (05)

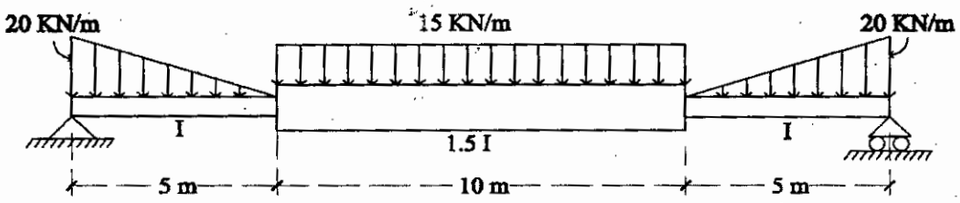
(b) Deduce the equation of double integration method and state its importance over determinate structures. (15)

(c) Find the deflection and slope at the position midway between the supports and at the overhanging end for the beam shown in figure below. Consider E = $12x10^9$ N/m^2. Use double integration method. (15)



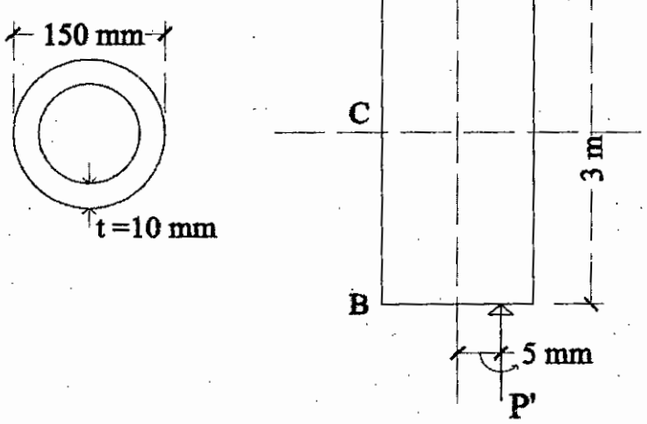
6. (a) State first and second theorems of area-moment method. Detail the procedure of moment diagrams by parts. (15)

(b) Find the midspan deflection of the following beam using moment-area method. (20)



7. (a) For an eccentrically loaded column derive the following expression, (18)
$Y_{max} = e(\text{Sec } \pi/2\sqrt{P/P_{cr}}-1)$, Where the symbols bear usual meanings.

(b) A column having the cross section shown has an axial load P applied 5 mm from its geometric axis. Using E=130 GPa, determine (a) the load P for which the horizontal deflection at the midpoint is 4 mm, (b) the corresponding maximum stress in the column. (17)



8. (a) Differentiate among long column, intermediate column and short column in terms of their failure criteria. (06)

(b) Define strut and critical load. Derive Euler's formula for long column. State the limitations of Euler's formula. (15)

(c) A T-section 150 mm X 120 mm X 22 mm is used as a column of 4 m long with one end fixed and the other hinged. Calculate the crippling load if Young's modulus for the material be 250 GPa. (14)

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2018

EEE 2223

(Basic Electrical Engineering)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Define resistance. State and explain Ohm's law. (09)

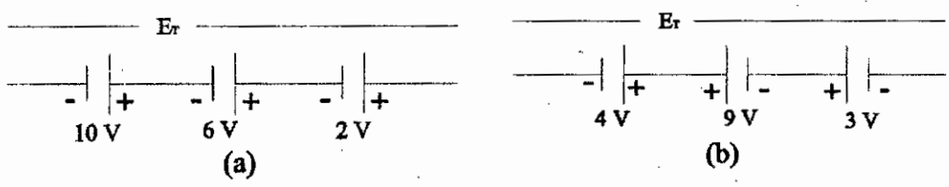
(b) What is meant by alternating current and voltage? Draw the wave shape of a sinusoidal voltage whose maximum value is 10 V and period is 5 sec. Calculate the Form factor and Peak factor of the sinusoidal voltage. (10)

(c) Draw the circuit diagram of a series and parallel R-L-C circuit, where R = 10 Ω, L = 10 H and C = 10 F. Also calculate Resistance, Inductive Reactance, Capacitive Reactance and Impedance of the series R-L-C circuit frequency is 60 Hz. (10)

(d) Draw the circuit diagram by which the power factor can be improved. (06)

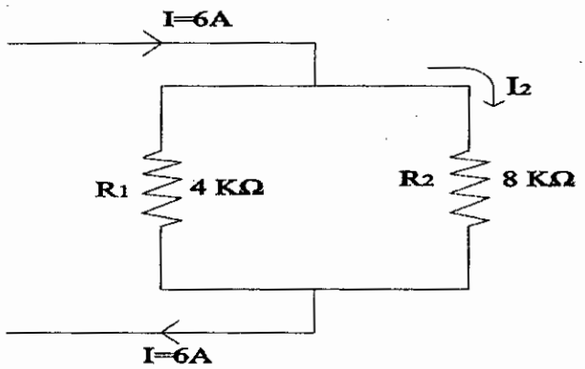
2. (a) State Kirchhoff's voltage and current law. (06)

(b) Determine the total voltage, E_T of the following series connected sources: (06)

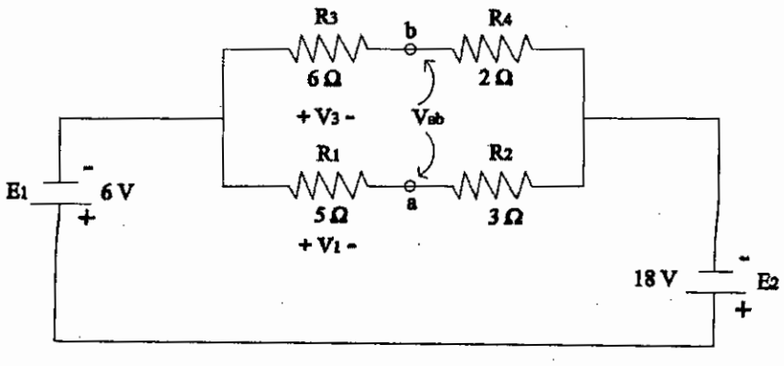


(c) Show that the total resistance of parallel resistors is always less than the value of the smallest resistor. (06)

(d) Determine the current I_2 for the network shown in figure below. (06)

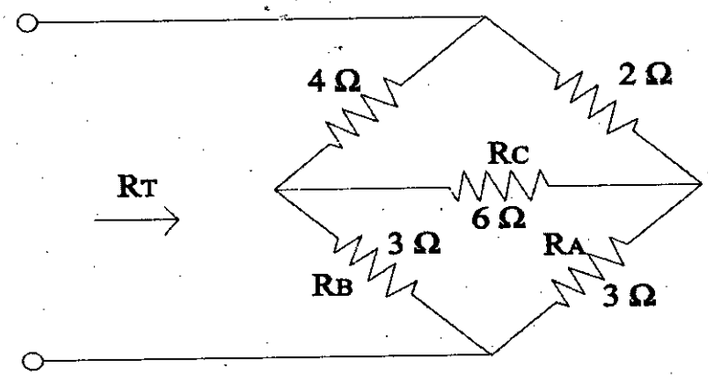


(e) Find the voltages V_1, V_3 and V_{ab} for the network shown in figure below. (11)

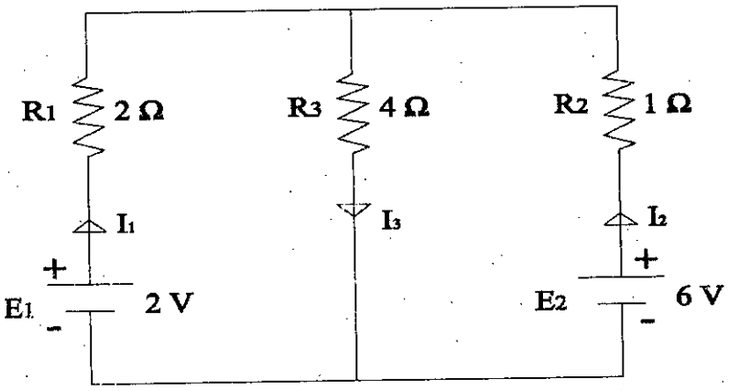


3. (a) Write down the process of converting current source into voltage source. (05)

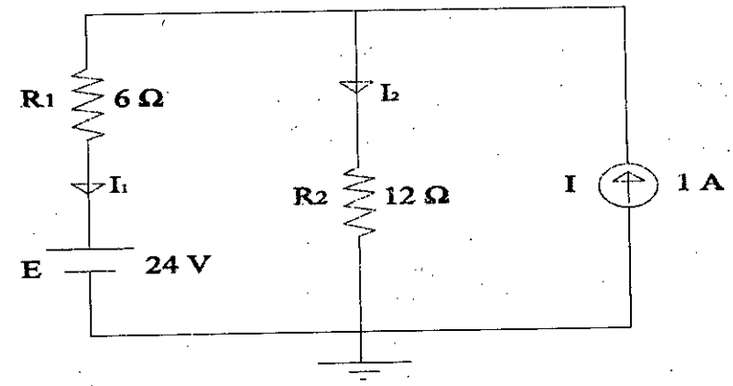
(b) Find the total resistance of the network shown in figure below. (10)



(c) Determine I_1, I_2 and I_3 of the electrical network of figure shown in below using branch-current method. (10)



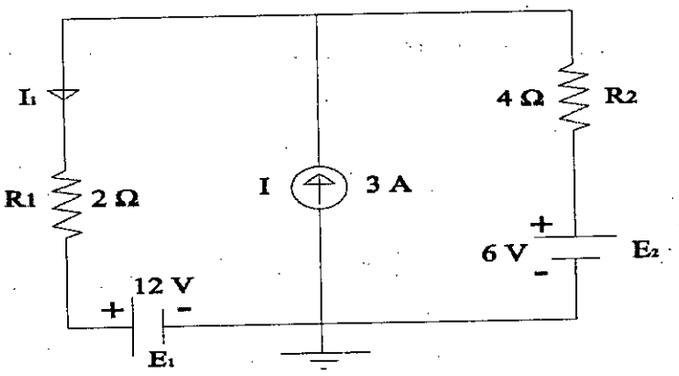
(d) Determine I_1 and I_2 of the figure shown in below using nodal analysis. (10)



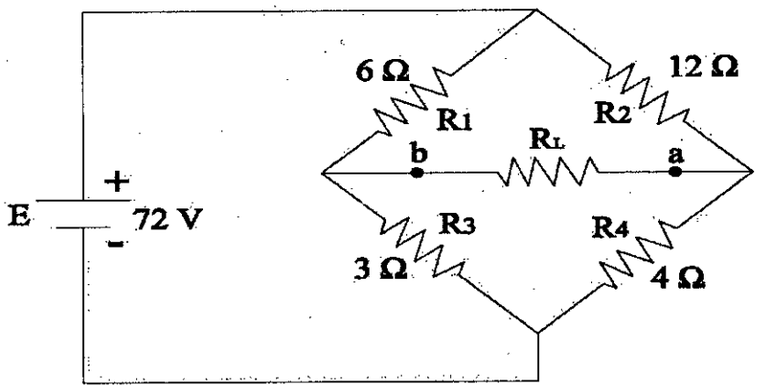
4. (a) Write down the condition of maximum power transfer. (05)

(b) Why electrical loads are connected in parallel in wiring? (05)

(c) Using superposition theorem, find the current through 2 Ω resistor of the electrical network shown in figure below. (12)



(d) Find the Thevenin equivalent circuit for the electrical network shown in figure below. Use ab as reference. (13)



Section – B

5. (a) What is Generator? Derive the EMF equation of a DC Generator. (10)
   (b) What are the different types of losses occur in a DC generator? Write down the condition for maximum efficiency of a DC generator. (15)
   (c) A short shunt compound generator delivers a load current of 20 A at 20 KW, and has armature, series field and shunt field resistance of 0.08 Ω, 0.50 Ω and 300 Ω respectively. Calculate the induced EMF and the armature current. Allow 0.5 V per brush for contact drop. (10)

6. (a) What is DC Motor? Write down the working principle of a DC Motor. Derive the speed equation of a DC Motor from its back EMF. (12)
   (b) Why single phase induction motor is not self-starting? Describe capacitor start induction run motor with neat sketch. (10)
   (c) What is universal motor? Draw the circuit diagram of a universal motor. Also explain its working principle. (07)
   (d) Write down short notes on (i) Commutator (ii) Pole core (iii) Paper Laminations (06)

7. (a) What is a Transformer? Derive the EMF equation of an elementary transformer. (09)
   (b) What are the different types of tests performed in a transformer? Write down the circuit diagram and purposes of these tests. (10)
   (c) Classify the transformer on the basis of cooling method. Why transformer is rated in KVA not in KW? (08)
   (d) An 132 KVA distribution transformer has 550 turns on the primary and 110 turns on the secondary winding. The primary is connected to 11 KV, 50 Hz supply. Find the full load primary and secondary current, the value of the secondary EMF and the maximum value of flux in the core. (08)

8. (a) Write down the name of instruments for measuring (i) Current (ii) Voltage (iii) Resistance and (iv) Power. Also draw the connection diagram for measurement of current and voltage. (08)
   (b) A 120 V DC source delivers 3.6 W to the load. Determine the peak value of the applied voltage (E_m) and current (I_m) if an AC source is deliver the same power to the load. (08)
   (c) Mention the basic differences between DC Generator and Alternator. (06)
   (d) Discuss about the advantages, disadvantages and application of 3Ø induction motor. (07)
   (e) The supply voltage of Bangladesh is 220 V, 50 Hz. Obtain the instantaneous expression of this voltage. (06)

Khulna University of Engineering & Technology

Department of Building Engineering and Construction Management

B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2018

Math 2223

(Mathematics - IV)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Define the graphical representation. Discuss the comparison between diagram and graph. (12)

   (b) Distinguish between histogram and frequency polygon. Sketch a histogram and a frequency polygon from the following data. (15)

Profits Per Company (Tk. Lakhs)	0-50	50-100	100-150	150-200
No. of Companies	12	20	26	22

   (c) Explain normal curve and skew curve. (08)

2. (a) Explain skewness and kurtosis. Distinguish between raw moments and central moments. (10)

   (b) From the data stated below: (13)

Marks obtained (above)	10	20	30	40	50	60	80
No. of students	150	120	100	80	70	30	20

   Calculate kurtosis based on moments.

   (c) Define simple probability and conditional probability. Given that $P(A)=\frac{3}{8}$; $P(B)=\frac{5}{8}$; $P(A\cup B)=\frac{3}{4}$ find $P(\frac{A}{B})$ and $P(\frac{B}{A})$. (12)

3. (a) Define Binomial distribution. Obtain mean and variance of Binomial distribution. (13)

   (b) Assume that on an average one telephone number out of 15 is busy. What is the probability that if six randomly selected telephone numbers are calls not more that three will be busy? (13)

   (c) Define point estimate and interval estimate. In what way, do we say that an interval estimate is better than a point estimate? (09)

4. (a) In an automatic safety test conducted by the equality control department, the average tire pressure in sample of 62 tires (out of 1000 tires) was found to be 24 pounds per square inch, and the standard derivation was 2.1 pounds per square inch. (12)

   (i) Calculate the estimated standard error.

   (ii) Construct 95% confidence interval for the population mean.

   (b) What's the importance of regression analysis? Write the compression between regression and correlation. (10)

(c) By using the following date: (13)

X	32	41	28	27	24	20
Y	26	37	20	25	18	17

(i) Find the relation between correlation coefficient and regression coefficients.
(ii) Estimate the value of y when $x = 49$.

Section – B

5. (a) Explain singular and regular singular point of a differential equation. Find a power series solution of the differential equation $(x^2-1)\frac{d^2y}{dx^2}+5x\frac{dy}{dx}+xy=0$ in the power of x. (17)

(b) Use the method of Frobenius to find the solution of the following differential equation $2x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+(x-3)y=0$. (18)

6. (a) Write Legendre's differential equation. Prove that, (12)

$$\int_{-1}^{1}x^2P_n^{\,2}(x)dx=\frac{1}{8(2n-1)}+\frac{3}{4(2n+1)}+\frac{1}{8(2n+3)}.$$

(b) Obtain the first three terms in the expansion of the following function in terms of Legendre polynomials $f(x)=\begin{cases}0 & \text{if } -1<x<1\\ x & \text{if } 0<x<1\end{cases}$ (15)

(c) Show that, $P_n(-x)=(-1)^nP_n(x)$. (08)

7. (a) If α and β are two roots of $I_n(x)=0$ then prove that, (12)

$$\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx=\begin{cases}0 & ; \alpha\neq\beta\\ \frac{1}{2}J_{n+1}^2(\alpha) & ; \alpha=\beta\end{cases}$$

(b) Write Bessel's differential equation of order zero. Establish relation between $J_n(x)$ and $J_{-n}(x)$ when n is integer. (10)

(c) Show that $\cos(x\cos\varphi)=J_0(x)-2[\cos 2\varphi J_2(x)-\cos 4\varphi J_4(x)+.....]$. Also express in terms of Bessel functions. (13)

8. (a) Solve $\frac{\partial^2u}{\partial t^2}=c^2(\frac{\partial^2u}{\partial x^2}+\frac{\partial^2u}{\partial y^2})$ subject to the boundary condition $u(0,y,t)=0$, $u(a,y,t)=0$, $u(x,o,t)=0$, $u(x,b,t)=0$ (20)

and initial conditions $u(x,y,0)=f(x,y)$, $u_t(x,y,0)=g(x,y)$.

(b) Find the vibration of a rectangular membrane of side $a=4\,ft$ and $b=2\,ft$ if the tension is $12.5\,{}^{lb}/_{ft}$, the density is $2.5\,{}^{slugs}/_{ft^2}$ (as for light rubber), the initial velocity is 0 and the initial displacement is $f(x,y)=0.1(4x-x^2)(2y-y^2)\,ft$. (15)
