Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2015
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) Define "Project" according to Project Management Institute (PMI) and British Standard Institute (BSI)? (06)

   (b) What are the characteristics of a construction project? Show the different stages of the "Project Life Cycle". (10)

   (c) List and discuss the fourteen principles for a successful management. (14)

   (d) What are the roles of a construction project manager? (05)

2. (a) Define engineering economy. Why engineering economics important in Building Engineering and Construction Management (BECM)? (05)

   (b) A design build operate engineering company in Texas that owns a sizable 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 $ 15,000 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 $ 8,000 six years from now and $ 12,000 sixteen years from now. Utilize engineering economy relations to determine the five equivalent values listed below at 15% per year. (30)
   1. Total present worth P_T in year 0.
   2. Future worth F in year 22.
   3. Annual series over all 22 years.
   4. Annual series over the first 12 years.
   5. Annual series over the last 10 years.

3. (a) Define construction management. What are the objectives of construction management? (06)

   (b) Compare the alternatives shown below on the basis of a present worth analysis, using an interest rate at 8% per year. (12)

	P	Q
First Cost, $	- 23,000	- 30,000
Annual Operating Cost, $ per year	- 4,000	- 2,500
Salvage Value, $	3,000	1,000
Life, year	3	6

   (c) Applications of green, lean manufacturing techniques coupled with value stream mapping can make larger financial differences over future years while placing greater emphasis on environment factors. Engineers with Monarch Paints have recommended to management an investment of $ 200,000 now in novel methods that will reduce the amount of waste water, packaging (17)

materials, and other solid waste in their consumer paint manufacturing facility. Estimated savings are $ 15,000 per year for each of the next 10 years and an additional savings of $ 300,000 at the end of 10 years in facility and equipment upgrade costs. Determine the rate of return using engineering economics relationship.

4. (a) Define the following terms of engineering economics: (i) Rate of return (ii) Cash flow (iii) Effective interest (iv) Conventional B/C (v) Modified B/C. (15)

   (b) Sandy, a construction manager, just received a year-end bonus of $ 20,000 that will be invested immediately. With the expectation of earning at the rate of 10% per year. Sandy hopes to take the entire amount out in exactly 20 years to pay for a family vacation when the oldest daughter is due to graduate from college. Find the amount of funds that will be available in 20 years. (10)

   (c) Select the better of two proposal to improve street safely and lighting in a Colonia in South central New Mexico. Use a B/C analysis and an interest rate of 8% per year. (10)

	Proposal 1	Proposal 2
Initial Cost, $	1,000,000	1,700,000
Annual M & O Cost, $/year	120,000	60,000
Annual benefits, $/year	530,000	650,000
Annual disbenefits, $/year	300,000	200,000
Life, years	10	20

Section – B

5. (a) What are the advantages and limitations of linear programming? (10)

   (b) An electronics firm is undecided as to the most profitable mix for its products. The products now manufactured are transistors, resistors and carbon tubes with a profit (per 100 units) of Tk. 10, Tk. 6 and Tk. 4 respectively. To produce a shipment of transistors containing 100 units requires 1 hour of engineering, 10 hours of direct labors and 2 hour of administration service. To produce 100 resistors are 1 hour, 4 hours and 2 hours of engineering, direct labor and administration time respectively. To produce one shipment of the tubes (100 units) requires 1 hour of engineering, 5 hours of direct labor and 6 hours of administration. These are 100 hours of engineering services available, 600 hours of direct labor and 300 hours of administration. What is the most profitable mix? (25)

6. (a) What are the factors that affecting inventory control? (10)

   (b) The demand for an item in a company is 20000 units per year and the company can produce the item at a rate 5000 per month. The cost of one setup is Tk. 500.00 and the holding cost of 1 unit per month is 50 paisa. The shortage cost of one unit is Tk. 25.00 per month. Determine the optimum manufacturing quantity and the number of shortage. Also, determine the manufacturing time and the time between set-ups. (15)

   (c) An item is produced at the rate of 50 items per day. The demand occurs at the rate of 25 items per day. If the setup cost Tk. 200.00 and holding cost is Tk. 0.05 per unit of item per day. Find the economic lot size for one run, assuming that the shortages are not permitted. Also find the time of cycle and minimum total cost for one run. (10)

7. (a) Define works, goods, services, tender security and performance security. (10)

(b) What are the general conditions for use of open tendering method? (08)

(c) What are the general qualifications of tender. (08)

(d) Write short notes: (i) Liquid asset, (ii) Annual term over, (iii) Frame work contract. (09)

8. (a) Define forecasting. Write down the application of demand forecasting. What are the advantages and limitations of moving average method of demand forecasting? (10)

(b) A small factory wants to determine the quantity of cement in bag it should be produce to meet the demand. Past records have shown the following demand pattern. (25)

Quantity (bags)	15	20	25	30	35	40	50
No. of days demand occurred	6	14	20	80	40	30	10

The cement costs Tk. 400 per bag and is sold at Tk. 500 per bag. Also the cement left unsold at the end of the day must be disposed due to inadequate storing facilities. Determine how many cement in bags the factory should produce by using EMV and EOL criteria.

Khulna University of Engineering & Technology

Department of Building Engineering and Construction Management

B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2015

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 from engineering point of view. (05)

   (b) Find a real root of the following equation to six decimal places by Newton-Rapson method. (15)
   $$3x - \log_{10} x = 7$$

   (c) Use the method of iteration to find out a real root of the following equation. $(\xi = 10^{-5})$ (15)
   $$\cos x = 3x - 1$$

2. (a) Define interpolation and extrapolation. Prove that the first difference of a polynomial of the n^{th} degree is another polynomial of (n-1) degree. (15)

   (b) A simply supported beam carries a point load x at its mid point corresponding to various values of x. The maximum deflection y is measured as follows: (20)

x (kN)	100	125	150	175	200	225	250
y (mm)	30	42	51	60	68	74	84

   Compute the deflection when the load is (i) 100 kN, (ii) 162.5 kN, (iii) 235 kN, (iv) 260 kN.

③ (a) Solve the following set of simultaneous linear equation by the method of Gauss-Elimination. (18)
$$475p - 316q - 407r + 253s = 521$$
$$296p - 482q - 395r + 242s = 720$$
$$364p - 421q - 643r + 342s = 634$$
$$282p - 286q - 315r + 448s = 266$$

   (b) Find the best fit curve through the data given below in the form of $y = ae^{bx}$ (17)

x	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

④ (a) Find the value of the following definite integral by Trapezoidal rule, Simpson's rule and Weddle's rule taking at least seven points. (17)
$$\int_0^{\frac{\pi}{2}} \cos(x^2)\,dx$$

   (b) Using Runge-Kutta method, find the value of 'y' for x = 0.2, if $\frac{dy}{dx} = -2y + x + 4$ with the initial condition $y(0) = 1$. (18)

Section – B

5. (a) Define computer. Briefly describe the characteristics of a computer. Also discuss in brief the internal components of a personal computer. (14)

   (b) What are the uses of computer in building engineering and construction management sector? (09)

   (c) Define the following terms: (i) GUI (ii) Data (iii) Information (iv) WiLAN (v) Dialup connection (vi) Network. (12)

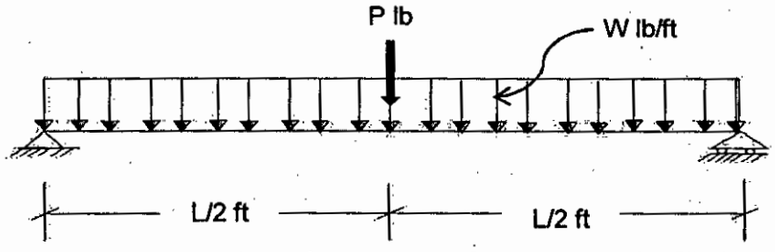
6. (a) What is FORTRAN Programming. How to build a FORTRAN program. (08)

   (b) Write a FORTRAN program to calculate the sum (to five decimal places) of the following series $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\text{----------}\pm\frac{1}{N}$ (12)

   (c) Develop a FORTRAN program to find the value of $\cos x$ using FUNCTION subprogram, where $\cos x = 1-\frac{x^2}{2!}+\frac{x^4}{4!}\text{----------}\pm(-1)^n\frac{x^{2n}}{(2n)!}$ (15)

7. (a) Define subprogram and subroutine subprogram. Why a subprogram is a complete and independent program? (07)

   (b) Develop a FORTRAN program to calculate shear force and bending moment at 0.65 ft interval for the beam shown in below. (13)



   (c) What is array? How could you declare array? Develop a FORTRAN program to find out the multiplication of two matrices given below- (15)

$$A=\begin{bmatrix}-3 & 0\\ 3 & 7\\ 9 & 6\end{bmatrix},\quad B=\begin{bmatrix}-1 & 5 & 7\\ 2 & 9 & 6\end{bmatrix}$$

8. (a) What do you mean by C programming? Define infinite loop. Is C programming easier than FORTRAN programming, why? (08)

   (b) Develop a C program to write the word "BECM" in such a way that given below (five times): (08)

```
B
 E
  C
   M
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   (c) Develop a C program to write the series 2, 4, 6, 8,.....N. (08)

   (d) Develop a C program to solve the function: $f(x,y)=10x^2+10x+5y^2+5y+25$, where x = 1, y = - 2. (11)

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B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2015

CE 2211

(Mechanics of Solids - II)

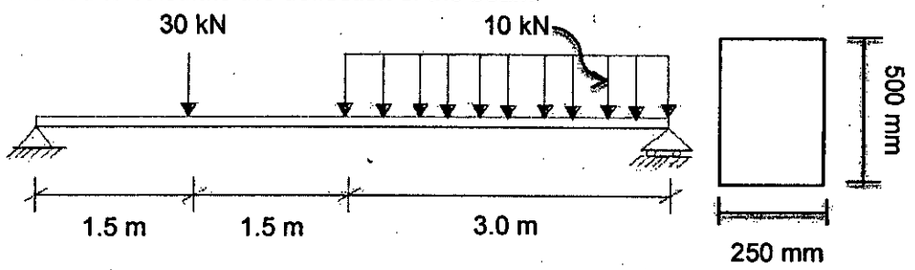
Full Marks: 210 Time: 3 hrs

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

Section – A

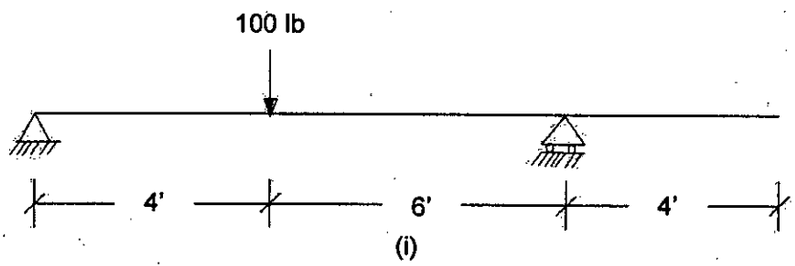
1. (a) Define 'Elastic Curve' of a beam. Derive the slope and deflection equations of the elastic curve of a beam for arbitrary loading and support conditions. (15)

   (b) Determine the maximum deflection for the beam loaded as shown in figure below. The allowable deflection for the beam is 20 mm. Is the given beam section sufficient to control the allowable deflection? If not, what would be the probable solutions to control excessive deflection of the beam at the given loading and support conditions? Consider, E = 9 GPa. Use double-integration method to calculate the deflection of the beam. (20)

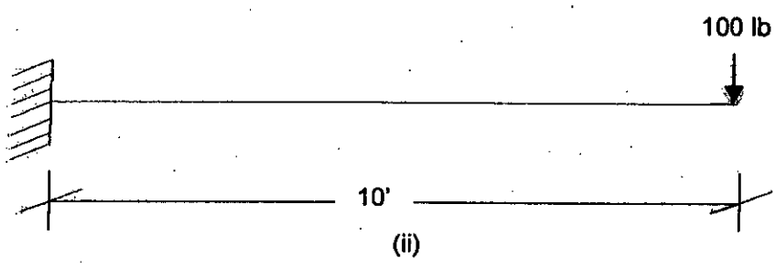


2. (a) Define critical load. Differentiate among long column, intermediate column and short compression block in terms of their failure criteria. (09)

   (b) Draw the qualitative deflection diagram of the following loaded beams. (06)

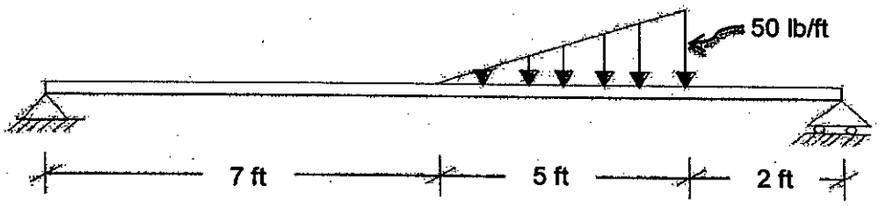


(i)



(ii)

(c) By using area-moment method, determine the mid span deflection for the beam shown in figure below that carries a uniformly varying load over part of the span. Assumen, EI = constant. (20)

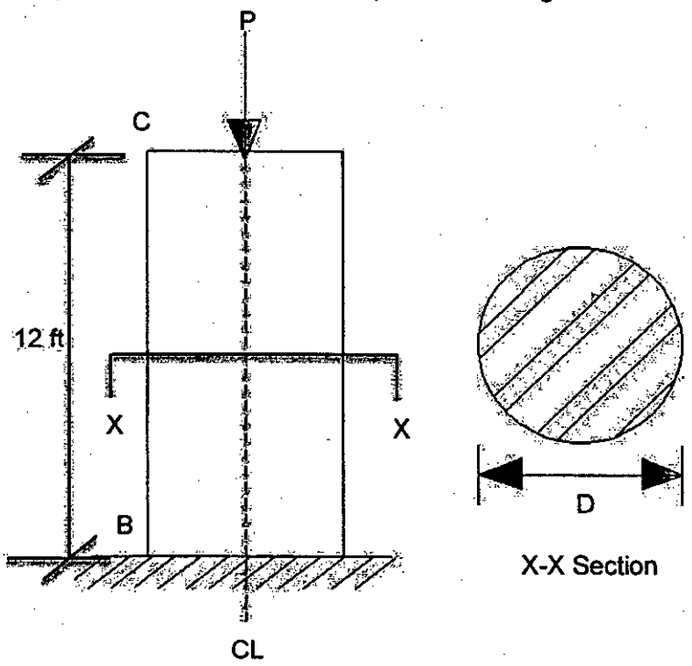


3. (a) What are the methods available to determine the deflection of a beam? Why is the excessive deflection of a floor beam not acceptable? (06)

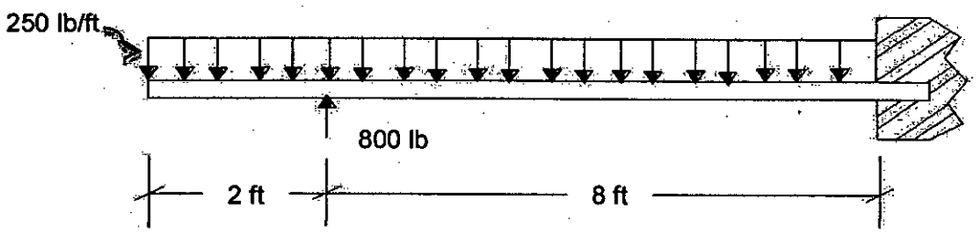
(b) For an eccentrically loaded column derive the following expression, (14)

$y_{max} = e(Sec\frac{\pi}{2}\sqrt{\frac{p}{p_{cr}}} - 1)$, where the symbols bear their usual meaning.

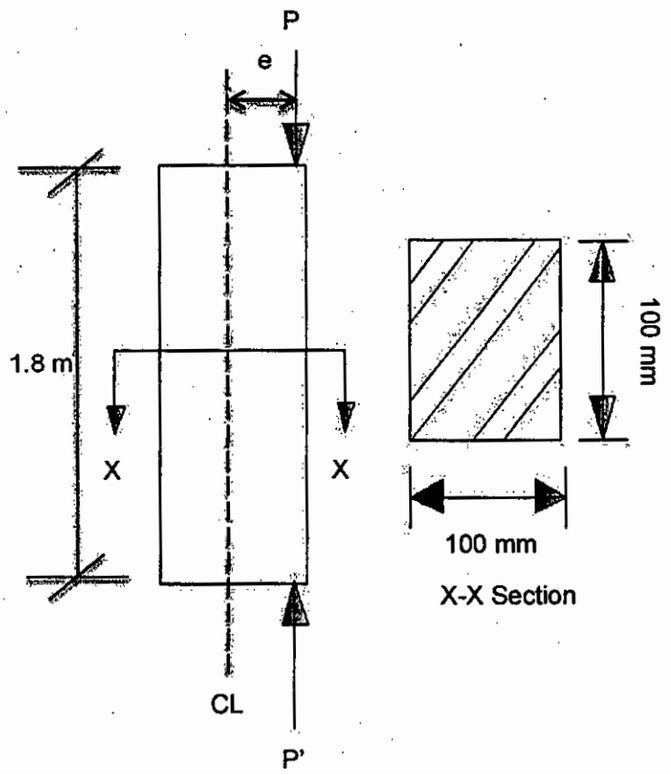
(c) An axial load 'P' is applied at the center of a circular steel rod BC that is free at its top C and fixed at its base B as shown in the following figure. Knowing that the stuck of rods available for use have diameters in increments of $\frac{1}{4}$ inch from 2.0 inch to 3.0 inch, determine the allowable centric load for available rods and the lightest rod that can be used if $\sigma_{all} = 380psi$. Assume that, the factor of safety for available rods with respect to buckling is 2.5. Use E = 29 x 10^6 psi. (15)



4. (a) A downward distributed load and an upward concentrated force act on the cantilever beam as shown in figure below. Find the amount of the free end deflection and mention the directions if E = 1.5 x 10^6 psi and I = 50 in^4. (18)



(b) An axial load 'P' is applied to a square column as shown in figure below. For P = 50 kN and e 1.4 mm, determine (i) the deflection at the midpoint of the column and (ii) the maximum stress in the column. Use E = 200 Gpa. (17)

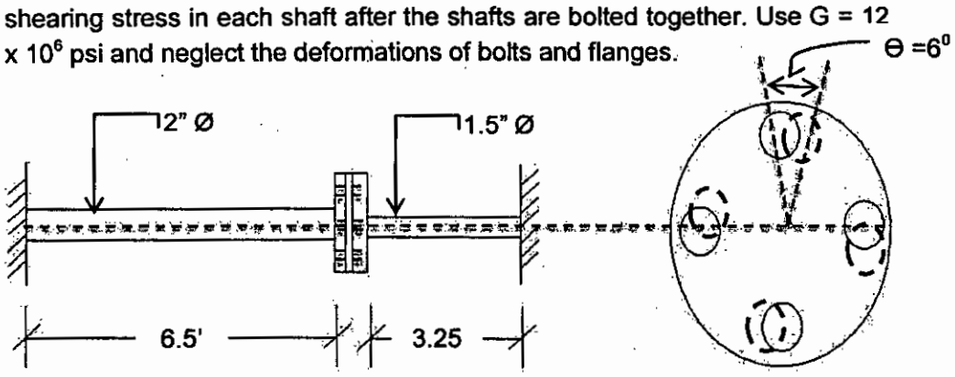


Section – B

5. (a) Define torsion. State the assumptions of torsion formula. (06)

(b) Write down the effect of torsion. Derive the equation of torsion for a hollow circular shaft. (14)

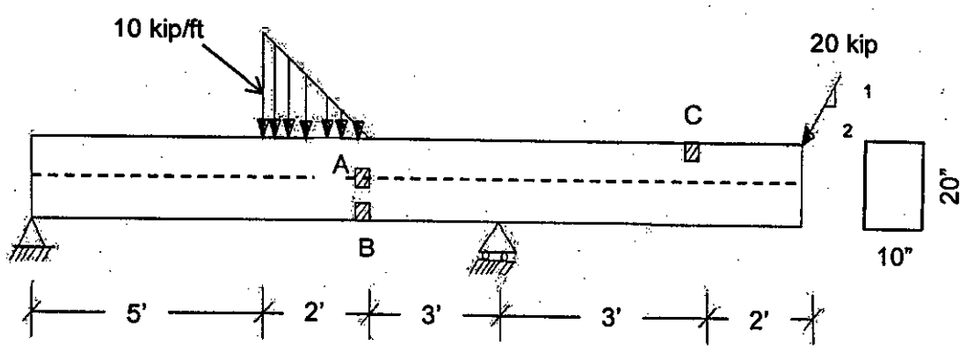
(c) The two steel shafts as shown in below, each with one end built into a rigid support, have flanges rigidly attached to their free ends. The shafts are to be bolted together at their flanges. However, initially there is a 6^0 mismatch in the location of the bolt holes, as shown in the figure. Determine the maximum shearing stress in each shaft after the shafts are bolted together. Use G = 12 x 10^6 psi and neglect the deformations of bolts and flanges. (15)



6. (a) Define 'kern of a section and 'line of zero stress'. (05)

(b) Show that the kern of a circular section is a circle whose diameter is one-quarter the diameter of the section. (12)

(c) Compute the combined stress at A, B, and C of the overhanging beam as shown in figure below. (18)



7. (a) What do you mean by stress trajectory? Why does failure occur always along 45^0 helix for brittle materials? Explain. (08)

   (b) Prove that the planes of maximum shearing stress are at 45^0 with planes of principal stress. (12)

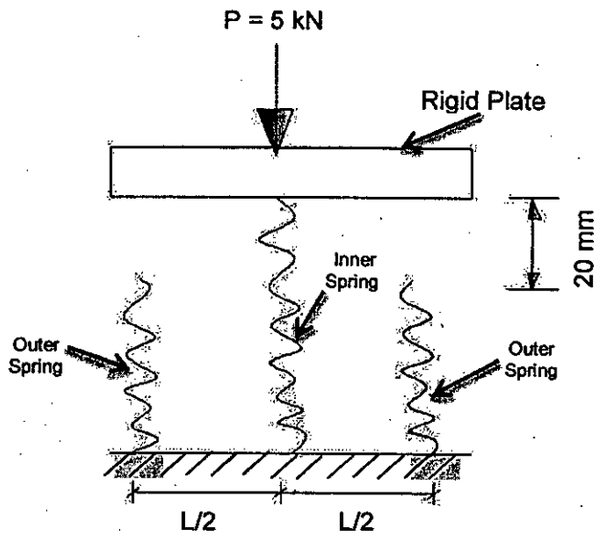
   (c) A solid shaft is subjected to simultaneous twisting and bending due to a torque T and a maximum bending moment M. Express the maximum shearing stress τ and the maximum normal stress σ in terms of T, M and the radius r of the shaft. By means of these relations, determine the proper diameter of a solid shaft to carry simultaneously T = 9000 lb-ft and M = 600 lb-ft $\tau \leq 10ksi$ and $\sigma \leq 16ksi$. (15)

8. (a) Define (i) solid length (ii) spring index (iii) pitch (iv) helix angle of a helical spring. (08)

   (b) Derive the expression for maximum shearing stress of a closely coiled helical spring. (10)

   (c) Determine the shearing stress developed in each spring for the following data as shown in figure below. (17)

Property	Outer Spring	Inner Spring
n	18	24
d	10 mm	20 mm
D	100 mm	200 mm
G	83 Gpa	83 Gpa



Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2015
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 unilateral element, bilateral element, active element, and passive element with proper example. (08)

   (b) State and explain Ohm's law and Joule's law. (08)

   (c) Find the equivalent resistance and battery current of the following network shown in figure 1(c). All resistances are in ohms. (10)

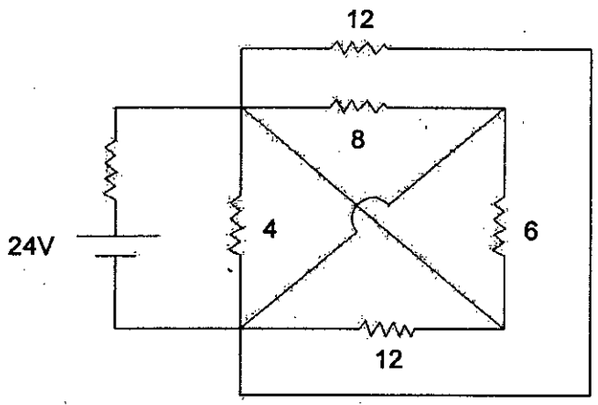


Figure 1(c)

   (d) Determine the loop current of the following circuit shown in figure 1(d) using mesh analysis. All resistances are in Ohms. (09)

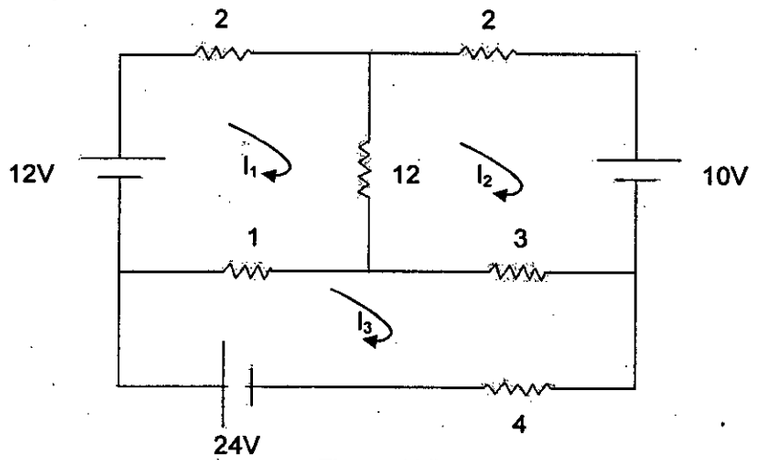


Figure 1(d)

2. (a) State and explain the basic laws of electrical engineering. (06)

   (b) Determine the current across 6Ω resistance shown in figure 2(b) using nodal (10)

analysis.

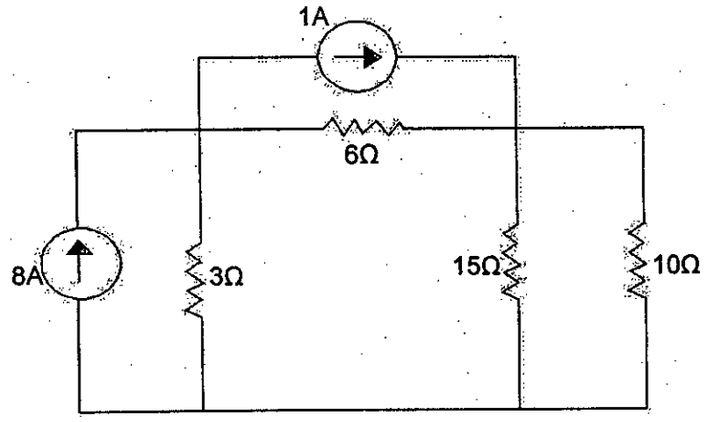


Figure 2(b)

(c) Determine R_{AB} using Wye-delta transformation of the network shown in figure 2(c). (09

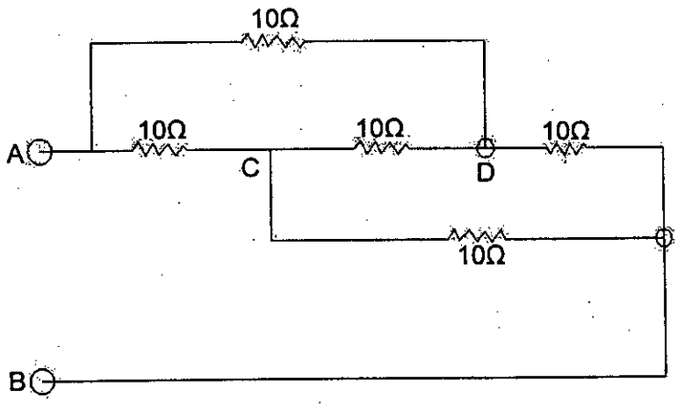


Figure 2(c)

(d) State superposition theorem. Show that the under maximum power transfer condition, the power transfer efficiency is 50%. (10)

3. (a) Find thevenin's equivalent circuit of the following network shown in figure 3(a). (08)

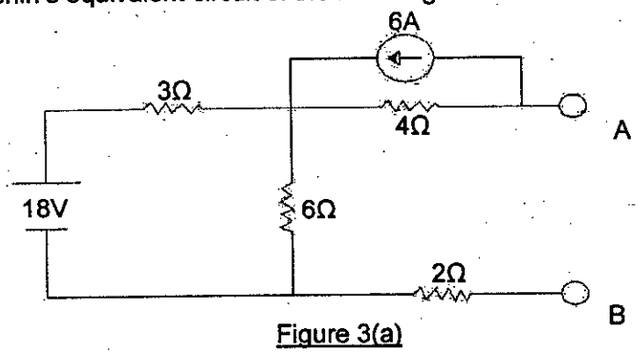


Figure 3(a)

(b) State Norton's theorem. Determine the current through 10Ω resistance using Norton's theorem. The circuits shown in figure 3(b). (10)

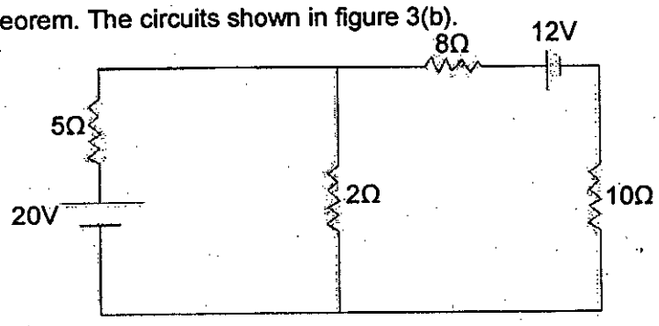


Figure 3(b)

(c) Explain the construction of PMMC instrument. Also mention its advantages and disadvantages. (10)

(d) Define phase and frequency. Determine the phase difference between voltage and current of the following expressions. Also draw their wave shapes. (07)

$$v = 100\sin(wt + 45^0)$$

$$i = 10\sin(wt - 15^0)$$

4. (a) Describe the two wattmeter method of measuring three phase power with necessary vector diagram. (13)

(b) Briefly explain the construction and working principle of a single phase energy meter. (15)

(c) Find the cubic roots of A, where $A = 3.08 + j18.455$. Also find $\log_e A$. (07)

Section – B

5. (a) State Faraday's law of electromagnetic induction. Write down the functions of: (i) Yoke (ii) Brushes (iii) Commutator and (iv) Poles. (10)

(b) Briefly explain the working principle of dc generator. How dc current is obtained from ac current? Explain. (15)

(c) A shunt generator delivers 195 A at terminal voltage of 250 V. The armature resistance and shunt field resistance are 0.02Ω and 50Ω respectively. The iron and friction losses equal 950 W. Find, (10)
(i) E.M.F generated (ii) C_u losses (iii) Output of the prime motor (iv) Commercial, mechanical and electrical efficiencies.

6. (a) Classify dc generators. Also demonstrate the power stage of dc generator. (06)

(b) What is the significance of back emf. Derive the condition of maximum power of a dc motor. (07)

(c) Why starter is used in a dc motor? Describe the working principle of a three point starter. How four point starters overcomes the limitation of three point starter? (13)

(d) A 250 V, 25 KW dc shunt motor has an efficiency of 85% when running at 1000 r.p.m on full load. The armature resistance is 0.1 ohm and field resistance is 125 ohms. Find the starting resistance required to limit the starting current to 150% of the rated current. (09)

7. (a) Define synchronous speed and slip for an induction motor. Also explain "how does 3-Ø induction motor rotates?" (12)

(b) Why single phase induction motor is not self-starting? Explain with double field revolving theory. (13)

(c) A three phase, 60 Hz, four pole inductions motor operates at 5% slip. Find, (10)
(i) Synchronous speed (ii) Motor speed (iii) Frequency of rotor current (iv) Frequency of rotor current at standstill.

8. (a) Explain the working principle of single phase transformer. (07)

(b) What are the main parts of a transformer? Describe different cooling arrangements of transformer. (10)

(c) Derive the emf of a single phase transformer. (10)

(d) A 1-Ø transformer has 400 primary & 1000 secondary turns. The net cross-sectional area of the core is 60 cm^2. If the winding be connected to a 50 Hz supply at 520 V. Calculate, (08)

(i) the peak value of flux density in the core.

(ii) voltage induced in the secondary winding.

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2015
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.
iii) Assume reasonable data if missing any.

Section – A

1. (a) Define Bessel's function $J_n(x)$. (12)
Prove that $J_n(-x) = (-1)^n J_n(x)$ when n is any integer.

(b) Expand the function $f(x) = 1$, $0 \le x \le a$ in series of the form $\sum_{i=1}^{\infty} c_i J_0(\lambda_1, x)$ (12)
where λ are the roots of the equation $J_0(\lambda, a) = 0$.

(c) Prove that $2J_0''(x) = J_2(x) - J_0(x)$. Hence find $J_0''(1)$, given that (11)
$J_0(1) = 0.7652$, $J_1(1) = 0.4401$ [Hints use recurrence formula].

2. (a) Write down the generating function for Legendre's polynomial and hence prove (12)
that $nP_n(x) = xP_n'(x) - P_{n-1}'(x)$.

(b) Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomial. (12)

(c) Prove that $\int_{-1}^{1} P_m(x) P_n(x) dx = 0$; when $m = n$. (11)

3. (a) Define ordinary and singular point of a differential equation with example. Find (20)
the series solution of $y'' + xy' + x^2 y = 0$ about $x = 0$.

(b) Solve $2x^2 y - xy' + (x-5)y = 0$ about $x = 0$ by Forbenious method. (15)

4. (a) Find the particular solution for deflection $U(x, y, t)$ of the square membrane (16)
with $a = b = 1$ and $c = 1$. If the initial velocity is zero and initial deflection is $f(x, y) = A \sin \pi x \sin 2\pi y$, where general deflection of above membrane is $U(x, y, t) = \sum_{n=1}^{\infty} \sum_{m=1}^{\infty} A_{mn} \cos k_{mn} t \sin m\pi x \sin n\pi y$. Finally find deflection $U(0.5, 0.5, t)$.

(b) Determine the steady state temperature distribution in a thin plate bounded by (19)
the lines $x = 0$, $x = l$, $y = 0$ and $y \to \infty$. Assuming that heat cannot escape from either surface of the plate, the edges $x = 0$ & $x = l$ are kept at a temperature zero and also the lower edge $y = 0$ is kept at temperature $F(x)$ and the edge $y \to \infty$ at temperature zero.

Section – B

5. (a) Explain raw data and secondary data. Draw (i) Histogram (ii) Ogive (iii) Frequency polygon from the following data: (15)

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Marks	7	10	5	8	2	20	11	5

(b) Define mean, median and mode. (05)

(c) The following values represent a portion of the result of an investigation of various characteristics of low-income families. (15)

Age of head	15-24	25-34	35-44	45-54	55-64	65 or older
Number of families	6	17	21	16	14	22

(i) Find the median and modal age of the family head and comment.
(ii) Why the mean age can't be calculated?

6. (a) What is coefficient of variation? Mention the use of standard deviation. (08)

(b) Define raw moment and critical moment. (07)

(c) Define skewness and kurtosis. The frequency distribution is given below: (20)

Marks obtained	30-40	40-50	50-60	60-70	70-80
No. of student	8	12	15	20	10

Find the first four raw moment about the point 65 and moment coefficient skewness.

7. (a) Define with example (i) Sample space (ii) Conditional probability (iii) Mutually exclusive events. (09)

(b) Ten unbiased coins are tossed simultaneously. Find the probability of getting: (16)
(i) five heads
(ii) at least seven heads
(iii) no head
(iv) at best four head.

(c) 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 $P(\frac{B}{A})$, where A and B are independent. (10)

8. (a) Define Binomial distribution with mentioning necessary assumption. Hence obtain the variance of Binomial distribution. (10)

(b) Fit the following data in Poisson distribution, then test the goodness fit with 5% level of significance. (13)

Defective product in a packet	0	1	2	3	4	5
No. of packet count	5	7	8	6	3	2

(c) Define regression and coefficient of determination. Find the correlation coefficient between age and playing habits of the following students and comment: (12)

Age	15	16	17	18	19	20
No. of students	250	200	150	120	100	80
Regular player	200	150	90	48	30	12
