Khulna University of Engineering & Technology (KUET)
Department of Building Engineering & Construction Management
B.Sc. Engineering 2nd Year 2nd Term Regular Examination, 2017
Ph 1223
(Physics – II)

Full Marks: 210 Time: 3 hrs

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

Section – A

1. (a) Consider a photoelectric effect experiment, no electron are produced when the frequency of the incident radiation drops below a cut off value (which varies depending on the metal used in the experiment) no matter how bright or intense the light is. How can you explain this fact using a "particle" theory of light instead of a wave theory of light? (10)
   (b) Explain Compton effect and show that Compton shift depends only on the angle of scattering and it is independent of the wavelength of the incident photons. (15)
   (c) Light having a wavelength of 6000 A^0 falls on a material having a photoelectric work function 1.9 eV. Find (i) the energy of the photon in eV (ii) the kinetic energy of the most energetic photoelectron in eV and in Joules and (iii) the stopping potential. (10)

2. (a) According to the Bohr atom model under what condition an electron can radiate electromagnetic radiation? Why was a change in the Bohr Model of atom required? (10)
   (b) Explain in short, what is the difference between the phase velocity and group velocity? Show that the phase velocity and group velocity are related by $V_g = V_P - \frac{\lambda d V_P}{d\lambda}$ (15)
   (c) What is the de – Broglie wavelength of a ball of mass 3.0 g after it is slammed across the table with speed 5 m/s? (10)

3. (a) Discuss briefly the distinguishing features of ferromagnetic and ferrimegnetic substances. (12)
   (b) Calculate atomic packing factor of a simple cubic, body centered cubic and face centered cubic structure. (13)
   (c) Calculate the glancing angle on the cube (110) of a rock salt crystal (a = 2.81 A^0) corresponding to second order diffraction maximum for the X – rays of wavelength 0.71 A^0. (10)

4. (a) What do you mean by unit cell and ionization energy? Give the name starting the relationship between crystallography axes and the angle between them. (12)
   (b) Discuss about the salient features of Vector atom model and explain the different quantum numbers associated with this model. (15)
   (c) Calculate the shortest and longest wavelengths present in the pfund series of hydrogen atom. (08)

Section- B

5. (a) Can two independent source of light produce interference? Differentiate between interference and diffraction? (10)
   (b) Two monochromatic waves emanating from two coherent sources have the displacements represented by (15)

$$y_1 = a \cos \omega t$$
$$y_2 = a \cos (\omega t + \Phi)$$

Where, Φ is the phase difference between the two waves. Show that the resultant intensity at a point due to their superposition is given by

$$I = 4 I_o \cos^2 \Phi/2$$

Where, $I_o = a^2$. Hence, obtain the conditions for constructive and destructive interference.

(c) A beam of monochromatic light of wavelength 5.82×10^{-7} m falls normally on a glass wedge with the wedge angle of 20S of an arc. If the refractive index of glass is 1.5, find the number of interference fringes per centimeter of the wedge length. (10)

6. (a) How would you prove that light wave is transverse wave? Why sound wave is not polarized but the electromagnetic wave is polarized? (10)

(b) When a monochromatic beam of parallel rays of wavelength λ falls normally on a long narrow slit of width a, the emergent rays produce single-slit diffraction pattern. Show that the diffracted intensity corresponding to the diffraction angle θ is given by (15)

$$I = I_m \sin^2 \alpha/\alpha^2$$

Where, $\alpha = \frac{\pi a}{\lambda} \sin\theta$ and I_m is the intensity of the central maximum (θ = 0).

(c) Find the positions and intensities of the maxima and the position of the minima of the single slit diffraction pattern (using problem (b)). (10)

7. (a) What is polarization of light? Show that at polarizing angle of incidence the reflected and refracted rays are mutually perpendicular to each other. (10)

(b) How can you produce Newton's ring in the laboratory? Discuss the determination of the wavelength for a monochromatic light by Newton's ring experiment. (15)

(c) The refractive index for plastic is 1.25. Calculate the angle of refraction for a ray of light incident at polarizing angle. (10)

8. (a) Explain nuclear fission and nuclear fusion reactions with examples. (10)

(b) Starting with the definition of radioactivity and the law of radioactive disintegration, show that for a successive radioactive disintegration, the amount of daughter substance at instant, t is given by (15)

$$N_2 = \frac{\lambda_1 N_1^0}{\lambda_2 - \lambda_1} [e^{-\lambda_1 t} - e^{-\lambda_2 t}]$$

(c) One gram of Ra^{226} has an activity of nearly 1 Ci. Determine the half life of Ra^{226}. (10)

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2017
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 from different points of view. Explain the different stages of the project life cycle with typical figure. (12)

   (b) List the fourteen principles for a successful management. Briefly discuss any five of them. (15)

   (c) What is meant by project management? Write down the consequences of bad or poor project management. (08)

2. (a) A company produces P_1, P_2 and P_3 from two raw materials A, B and Labour L. One unit of product P_1 requires one unit of A, 3 units of B, 2 units of L. A unit of product P_2 required 2 units of A and B each, and 3 units of L, while one unit of P_3 needs 2 units of A, 6 units of B and 4 units of L. The company has a daily availability of 8 units of A, 12 units of B and 12 units of L. The unit contribution margin for the product is Rs. 3, 2 and 5 respectively for P_1, P_2 and P_3. Formulate the linear programming model. (15)

   (b) Solve the LPP by simplex method: Maximize, $z = x + 1.2y$ subjected to the constrains, (20)

$$2x + y \le 180$$
$$x + 3y \le 300$$
$$x, y \ge 0.$$

3. (a) Define tender notice. What are the items involved in an ideal tender notice? (07)

   (b) List different methods for procurement of goods and works. Briefly explain the process of open tendering method (OTM). (20)

   (c) What are the general conditions for use direct procurement method (DPM). (08)

4. (a) What is inventory? Write down the applications of inventory control in construction engineering. (05)

   (b) An item is produced at the rate 50 items per day. The demand occurs at the rate of 25 items per day. If the setup cost is Tk. 100 per setup and holding cost Tk. 0.01 per unit 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. (15)

   (c) A commodity is to be supplied at a constant rate of 200 units per day. Supplies of any amounts can be had at any required time, but each ordering costs Tk. 50, cost of holding the commodity costs Tk. 50, cost of holding the commodity in inventory is Tk. 2 per unit per day while the delay in the supply of the item induces a penalty of Tk. 10 per unit per delay of 1 day. Find the optional policy (15)

(q, t), where t is the re-order cycle period and q is the inventory level after re-order. What would be the policy, if the penalty cost becomes ∞?

Section – B

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

   (b) A manufacturing firm plans a line of new products and expects to be in operation for 10 years only. Two machines for consideration in this operation have different characteristics and are expected to produce different results. Assuming that the replacements are identical to the original machines and that benefits will cease at the end of 10 years, determine which machine should be selected on the basis of present worth analysis using an interest rate of 10% per year from the following table. (18)

	Machine 1	Machine 2
Initial purchase cost	$ 75,000	$ 90,000
Uniform annual revenue	$ 30,000	$ 29,000
Uniform annual operating cost	$ 9,000	$ 6,000
Salvage value at the end of life	$ 5,000	$ 10,000
Salvage value at the end of 3 years	$ 20,000	$ 35,000
Estimate useful life	5 years	7 years

   (c) Select the better of two proposals on the basis of conventional and modified B/C analysis using an interest rate of 8% per year. (12)

	Proposal A	Proposal B
Initial cost, Tk	900,000	1,700,0000
Annual O & M cost, Tk/year	120,000	60,000
Annual benefits, Tk/Year	530,000	650,000
Annual disbenefits, Tk/Year	300,000	195,000
Life,Years	10	20

6. (a) Calculate the capitalized cost of a project that has an initial cost of 150,000 Tk and additional investment of 50,000 Tk after 12 years. The annual operating cost will be 5000 Tk for the first 5 years and 8000 Tk thereafter. There is expected to be a recurring major rework cost of 15,000 Tk in every years. Use, i = 15% per year. (17)

   (b) Define: (i) Cash flow, (ii) Effective interest, (iii) Rate of return. (08)

   (c) Select the better of two proposal to improve street safety 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, $/yr	120,000	60,000
Annual benefits, $/yr	530,000	650,000
Annual disbenefits, $/yr	300,000	200,000
Life, yrs	10	20

7. (a) Define: (i) Time value of money (ii) Perpetual investment. What is the difference between (i) Nominal and effective interest (ii) MARR and IRR. (08)

   (b) A corporation that pays 53% of its profit in income taxes investment $ 10,000 in an asset that will produces $ 3000 annual revenue for eight years. If the annual expenses are $ 700, salvage after eight years is $ 500 and 9% interest is used. What is the after-tax present worth? (10)

(c) Which machine should you select on the basis of equivalent uniform annual worth using an interest rate 20% per year from the following table? (17)

	Machine A	Machine B
Capital investment	$ 33,200	$ 47,600
Annual operation expenses	$ 2,165	$ 1,720
	$ 1,100 in year 1 and increasing $ 500 /yr thereafter	$ 500 in year 4 and increasing $ 100 /yr thereafter
Useful life (years)	5	9
Market value (end of useful life)	0	5,000

8. (a) Define forecasting. Write down the advantages and limitations of moving average method of demand forecasting. (12)

(b) A small company wants to determine the quantity of cement in bag it should be produced to meet the demand. Past records have shown the following demand pattern. (23)

Quantity (bags)	15	20	25	30	35	40	50
No. of days demand occur	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, 2017

BECM 2213

(Numerical Analysis & 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.

Section – A

1. (a) What is personal computer? Briefly describe the applications of computer in construction engineering sector. Describe the internal components of a personal computer. (12)

   (b) Define the following terms: (i) Versatility, (ii) Data, (iii) Information, (iv) Workstation, (v) Speed, (vi) Accuracy and Reliability (12)

   (c) What is computer virus? How to prevent virus damage? Mention five third party anti-virus names. Briefly describe standard emailing procedure. (11)

2. (a) Define FORTRAN Programming. Describe the guidelines to write a FORTRAN language. (12)

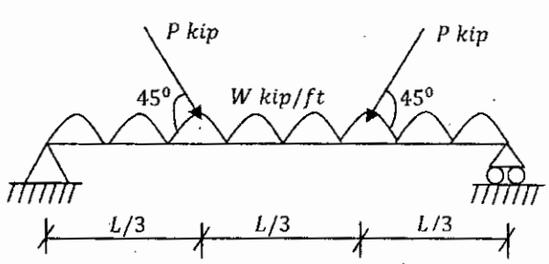
   (b) What formated statement and mixed mode operations? Enurate the format specifiers (any five). Why format specifiers are necessary? (12)

   (c) Develop a FORTRAN program to find the sum of the series up to four decimal, where $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \frac{1}{5^2} - \cdots \pm N$ (11)

3. (a) What is function subprogram and sub-routine subprogram? Why a subprogram is a complete and independent program? (08)

   (b) Develop a FORTRAN Program to find the value of $\sin x$ using Function subprogram, where $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots + (-1)^{n+1} \frac{x^{(2n+1)}}{(2n+1)!}$ (13)

   (c) Develop a program either using C language or FORTRAN to calculate shear force and bending moment at 0.25 ft interval of the following beam as shown in figure below. (14)



4. (a) Define array. How could you declare array? Develop a FORTRAN Program to find out the multiplication of two matrices given below: (15)

$$A = \begin{bmatrix} 3 & 7 & 5 \\ -2 & 0 & 1 \\ 1 & 1 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 7 & 0 & -5 \\ 3 & 2 & -2 \\ 0 & 0 & -1 \end{bmatrix}$$

(b) Develop a common C program to write any even series.

(c) Describe the general expression of "if else statement" and "for loop".

(d) Develop a common C program to calculate F.M value of sand, where

Sieve No. (ASTM)	#4	#8	#16	#30	#50	#100	#200
Weight Retained(gm)	0.00	9.50	92.50	173.00	160.70	55.00	9.30

Section – B

5 (a) What do you mean by transcendental equation? Find a positive root of the equation up to four decimal places by " Iteration Method": $x^2 e^{x \sin x} - 1 = 0$ (12)

(b) Solve the following set of simultaneous linear equation by the method of Gauss-elimination Method: (11)

$$83x + 11y - 4z = 95$$
$$7x + 52y + 13z = 104$$
$$3x + 8y + 29z = 71$$

(c) Define least square curve fitting. Find the best fit curve through the data given below in the form of $y = a + bx + cx^2$ (12)

x	160	260	360	460	560	660
y	0.1	0.15	0.21	0.26	0.33	0.49

6 (a) Find a real root of the equation $x^3 - \cos x - 2.5 = 0$ up to six decimal places using Newton Rap son method. (10)

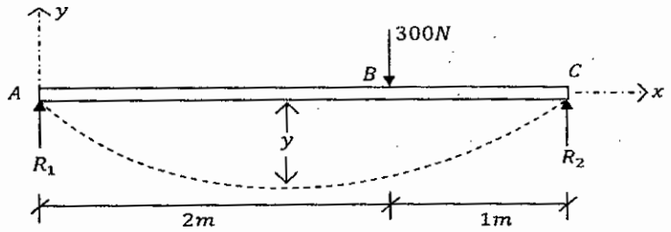
(b) From the following table find the value of y when $x = 0.644$ by both stirling and Bessel's Formula and also find % difference. (15)

x	0.61	0.62	0.63	0.64	0.65	0.66	0.67
y	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

(c) Find the value of the following integral by Simpson's $3/8$ rule and Weddle's rule taking at least 5 intervals. (10)

$$\int_{0.4}^{3.6} e^x \sin hx \; dx$$

7 (a) Define inverse interpolation. The beam as shown in figure below having $EI = 1500\ N.m^2$. x denotes distance from left end to right and y denotes the deflection found by analyzing the beam by double integration method. Find y, when $x = 0.25$ and % error. (15)



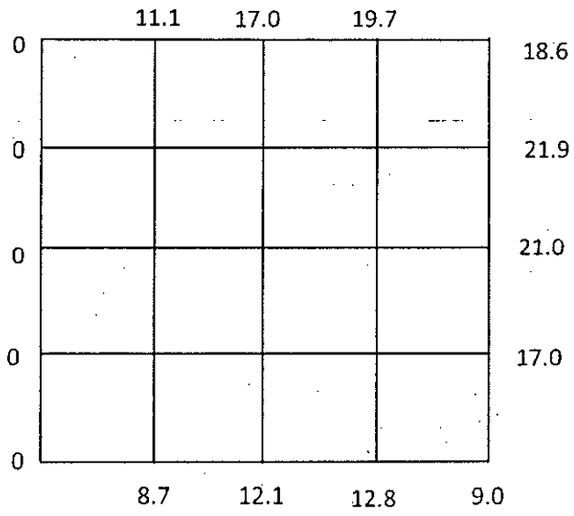
$x(m)$	0	0.5	1	1.5	2	2.5	3
$y(mm)$	0	-4.31	-7.78	-9.58	-8.89	-5.28	0

Note. Negative sign indicates downward deflection

(b) Define initial value problem. Use Picard method to obtain second approximation of y to the solution of $\frac{dy}{dx} = x^2 + y^{-2}$ with initial condition $x_0 = 0$ and $y_0 = 5$. (10)

(c) Find the eigen values and eigen vectors of the matrix: $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 3 \end{bmatrix}$ (10)

8 (a) Solve the Laplace difference equation for a square region and having the boundary condition values showing in figure. (11)



(b) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x = 3$. (12)

x	0	1	2	3	4	5
y	6.987	7.403	7.771	8.021	8.331	9.327

(c) The following table gives the relationship between shear pressure and temperature. Find pressure at temperature 372^0 and 392^0 using two different methods of interpolation. (12)

$T(x)$	361	367	378	387	399
$P(y)$	154.9	167.0	191.0	212.5	244.2

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2017

CE 2211

(Mechanics of Solids - II)

Full Marks: 210 Time: 3 hrs

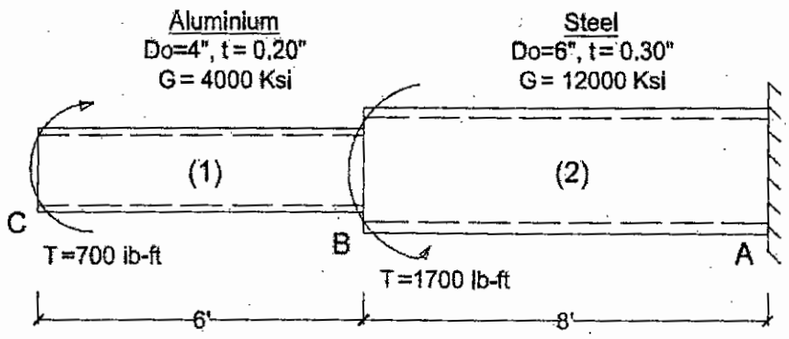
N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Define torsion. State the assumptions of torsion formula. (05)

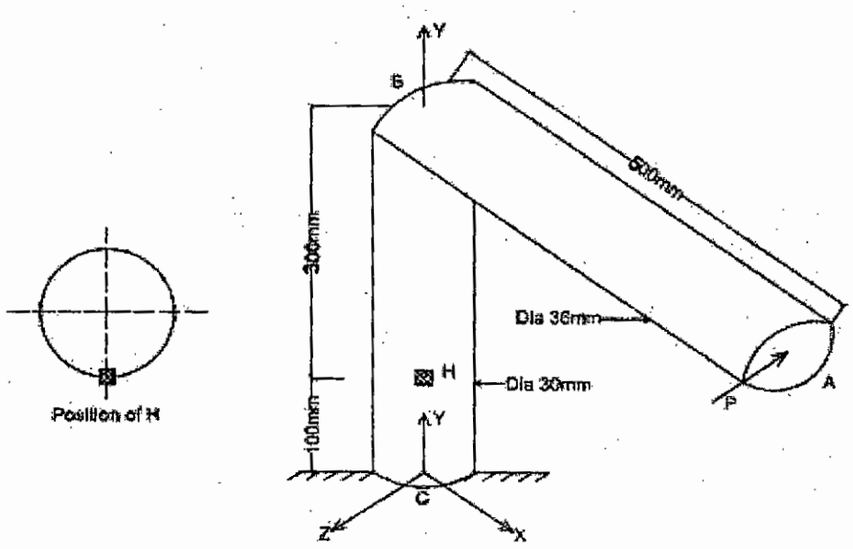
   (b) Prove that shear stress varies linearly in circular section with applied torque. (12)

   (c) The compound shaft, shown in figure below, consists of aluminum segment (1) and steel segment (2). The compound shaft is subjected to torques applied at B and C. (i) Draw a diagram of internal torque and maximum shear stress in segment (1) and (2) of the shaft; (ii) Determine the rotation angle B with respect to A; (iii) Determine the rotation angle C with respect to A. (18)

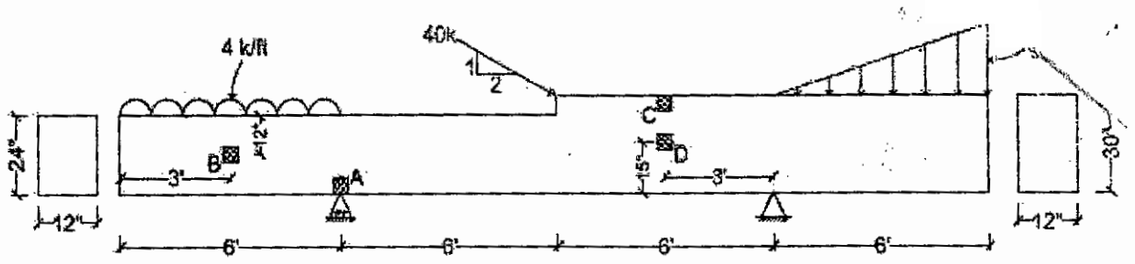


2. (a) Define state of stress and principal stress. Derive the stress transformation equation and construct Mohr circle. (15)

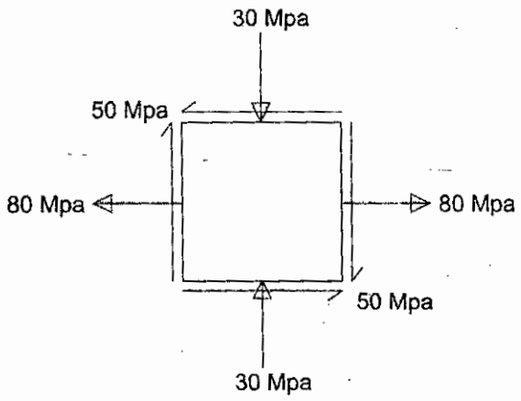
   (b) A single horizontal force P = 800 N is applied to the end of AB member, shown in figure below. Determine (i) state of stresses at element H; (II) principal stresses, maximum shear stress and their orientations. (20)



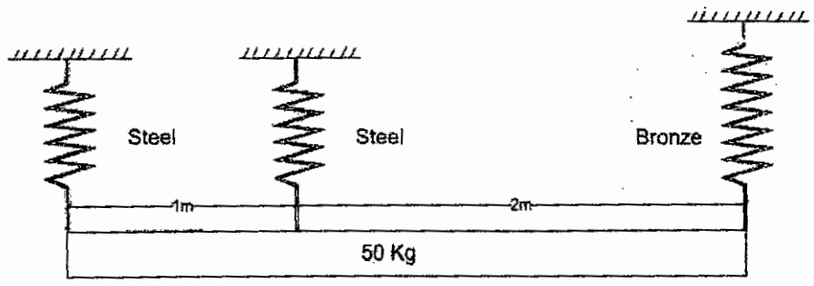
3. (a) Compute the combined stresses at A, B, C and D shown in figure below. (20)



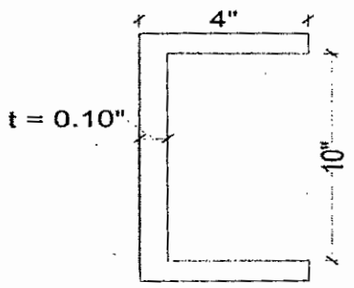
(b) Find σ_1, σ_2, Tmax and their orientations for the following stress system. (15)



4. (a) A homogeneous 50 kg rigid block is suspended by the three springs whose lower ends were originally at the same level shown in figure below. Each steel spring has 24 turns of 10mm diameter wire on a mean diameter wire on a mean diameter of 100 mm and G = 83 GPa. The bronze spring has 48 turns of 20 mm diameter wire on a mean diameter of 150 mm, and G = 42 GPa. Compute the maximum shearing stress in each spring. Use Wahl's factor. (18)



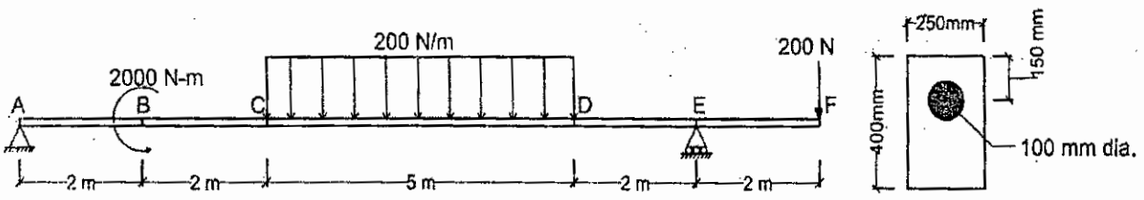
(b) Define shear flow and shear centre. Compute and illustrate the shear flow and determine the shear centre for the following channel section. Consider V=1500lb (↑). (1



Section – B

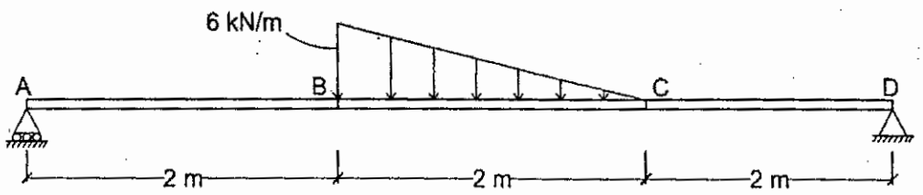
5. (a) Define "Elastic Curve" of a beam. Derive the slope and deflection equations of the elastic curve. (

(b) 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=10X10^9 N/m^2. Use double-integration method. (



6. (a) State the area-moment theorems. Prove the second theorem of area-moment method. (15)

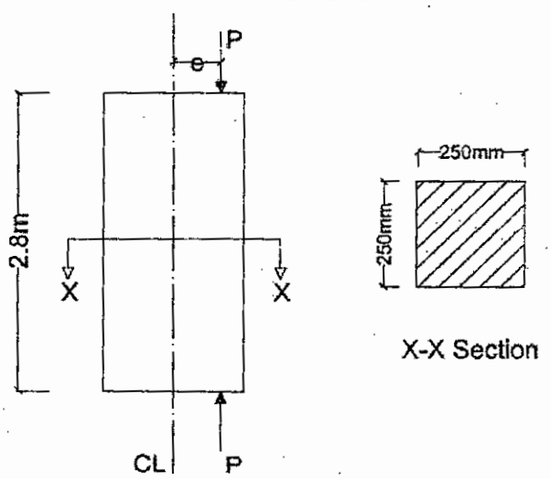
   (b) By using area-moment method, determine the mid span deflection for the beam shown in figure below. Assume EI constant. (20)



7. (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) For an eccentrically loaded column derive the following expression, (15)
   $Y_{max} = e(\text{Sec } \pi/2\sqrt{P/P_{cr}} - 1)$, Where the symbols bear usual meanings.

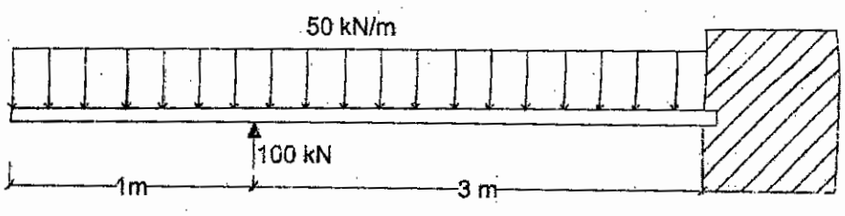
   (c) An axial load 'P' is applied to a square column as shown in figure below. For P = 100 kN and e = 5mm, determine (i) the deflection at the midpoint of the column and (ii) the maximum stress in the column. Use E = 200 x 10^9 N/m^2. (15)



8. (a) Write down the limitations of Euler's formula (04)

   (b) A T-section joist 200mm x 150mm x 30mm is used as a column of 4m long with one end fixed and the other hinged. Calculate the crippling load for the column. Take Young modulus for the joist as 200 x 10^3 N/mm^2. (14)

   (c) A downward distributed load and an upward concentrated load act on the cantilever beam as shown in figure below. Find the amount of the free end deflection and mention the direction. If E = 10 x 10^9 N/m^2 and I = 1.5 x 10^6 mm^4. (17)



Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 2nd Term Regular Examination, 2017
EEE 2223
(Basic Electrical Engineering)

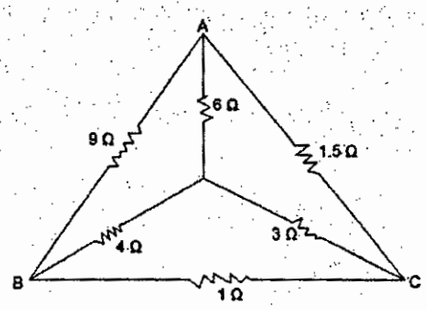
Full Marks: 210 Time: 3 hrs

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 and classify dependent sources. (06)

(b) Find R_{AB} for circuit shown in figure below. (13)

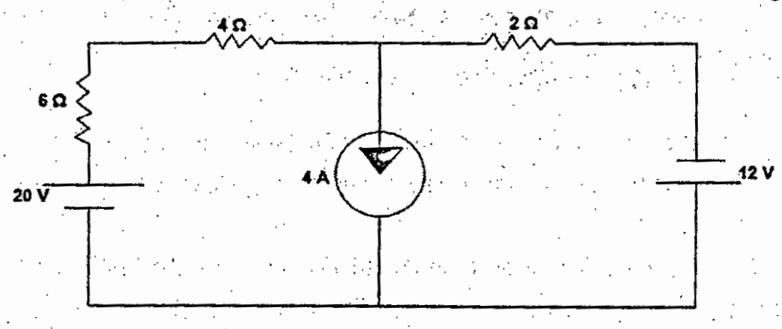


(c) Write down short notes on - (09)
(i) Ammeter (ii) Voltmeter (iii) Multimeter.

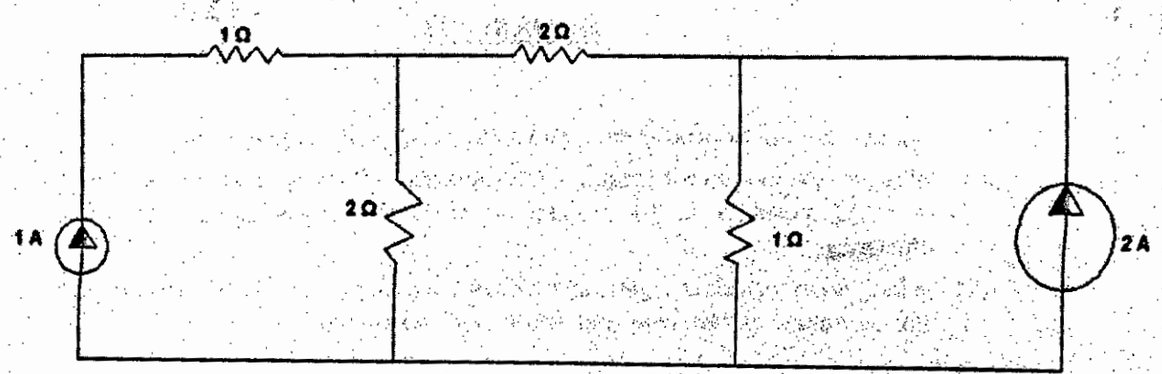
(d) How power factor part is involved in wattmeter reading? (07)

2. (a) State KVL and KCL. (06)

(b) Using mesh analysis determines the currents of each resistor shown in figure below. (12)

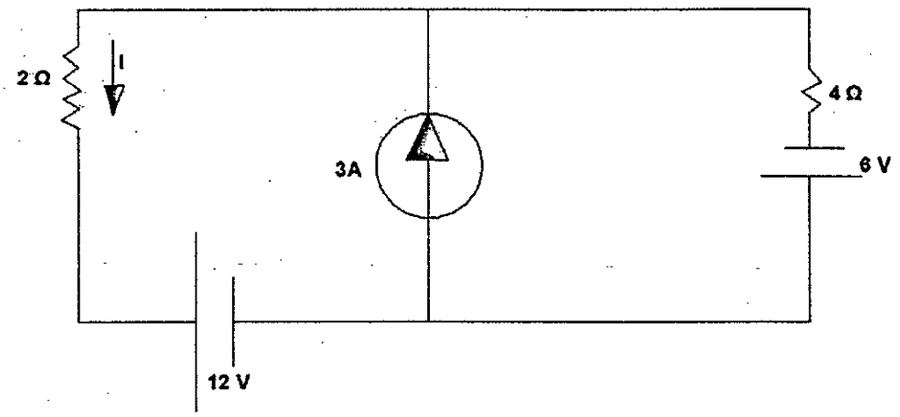


(c) Determine node voltages of figure below. (12)



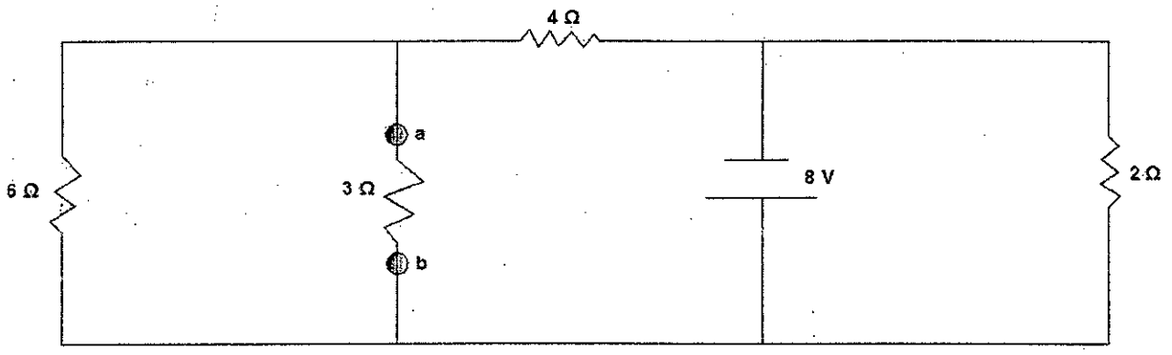
(d) Write short notes on source conversion. (05)

3. (a) State superposition theorem. Find I of the circuit shown in figure below using superposition theorem. (12)



(b) Derive the condition for obtaining maximum power of an electrical circuit. Also, write down the power and efficiency equation at this condition. (12)

(c) State Thevenin's theorem. Draw the Thevenin equivalent circuit of the terminal "ab" shown in figure below. (11)



4. (a) Assume that the current $i = I_m \sin wt$ flows through a given R-L branch. Show that the voltage across the branch is $v = I_m z \sin(wt + \theta)$ where $z = \sqrt{R^2 + (wL)^2}$ and $\theta = \tan^{-1}(\frac{wL}{R})$. (12)

(b) Draw and define each power of the power triangle. (08)

(c) Mention the significance of operation j. Also, evaluate $(8 + j6) \times (-10 - j7.5)$ in polar form. (08)

(d) How, power factor of an electrical system can be improved? (07)

Section – B

5. (a) Mention generator action. Write down the working principle of DC generator. (15)

(b) What are various power stages of DC generator? Show that overall efficiency of a DC generator is the product of mechanical efficiency and electrical efficiency. (10)

(c) A long shunt compound generator delivers a load current of 50A at 500V and has armature, series field and shunt field resistances of 0.05Ω, 0.03Ω and (10)

250Ω respectively. Calculate the generated voltage and the armature current. Allow 1V per brush for contact drop.

6. (a) Describe different parts of a DC motor? (15)

   (b) Derive the condition for maximum mechanical power developed by a DC motor. (10)

   (c) A 440V, shunt motor has armature resistance of 0.8Ω and field resistance of 200Ω. Determine back emf when giving an output of 7.46 kW at 85 percent efficiency. (10)

7. (a) Describe the working principle of a single phase transformer. (10)

   (b) The maximum flux density in the cone of a 250/300 volts, 50 Hz single phase transformer is 1.2 wb/m^2. If the emf per turn is 8 volt, determine (i) primary and secondary turn and (ii) Area of the cone. (09)

   (c) Mention the operating principle of an induction motor with its advantages and disadvantages. (10)

   (d) Mention some application of brushless DC motor. (06)

8. (a) Explain the reason why the rotor of an induction motor is set into motion. (11)

   (b) How does a universal motor operate? Mention some of its application. (12)

   (c) Explain the working principle of stepper motor for resolutions of 90 degree and 45 degree. (12)

Khulna University of Engineering & Technology (KUET)
Department of Building Engineering & Construction Management
B.Sc. Engineering 2nd Year 2nd Term Regular Examination, 2017
Math 2223
(Mathematics – IV)

Full Marks: 210 Time: 3 hrs

N.B. (i) Figures in the right margin indicate full marks.
(ii) Answer any three questions from each section in separate scripts.
(iii) Necessary table/graphs/charts: t – table, z – table, x^2 – table.

Section – A

1. (a) Define singular and regular singular point of a differential equation with examples. (17)
Find a power series solution of the differential equation $(x^2-1)y''+3xy'+xy=0$ in the powers of x.
(b) Use the method of Frobenius to find solution of the differential equation (18)
$2x^2y''-xy'+(x-5)y=0$ in some interval $0<x<R$

2. (a) Write the Bessel's function of order n. Prove that (10)
$$e^{\frac{x}{2}(t-\frac{1}{t})}=\sum_{n=-\infty}^{\infty}t^nJ_n(x)$$
(b) Using the recurrence relation show that (10)
$$4J_n''(x)=J_{n-2}(x)-2J_n(x)+J_{n+2}(x)$$
(c) Show that (15)
$$\cos(x\cos\theta)=J_0(x)+2\sum_{n=1}^{\infty}(-1)^nJ_{2n}(x)\cos 2n\theta$$

3. (a) Express $f(x)=3+6x+9x^2+12x^3$ in terms of Legendre's polynomials. (08)
(b) Show that Legendre's polynomials are orthogonal. Hence evaluate (12)
$$\int_{-1}^{1}P_3(x)P_6(-x)dx$$
(c) Using recurrence formula or Rodregue's formula find $P_2(x)$, $P_3(x)$ and $P_4(x)$. Hence find $P_3'(x), P_3'\left(-\frac{1}{2}\right)$ and $P_3'(-1)$ at x=0. Also sketch $P_0(x), P_1(x)$ and $P_2(x)$. (15)

4. (a) Solve the following form of Laplace's equation (15)
$$U_{xx}+U_{yy}=0$$
with the boundary conditions
$u(x,0)=u(0,y)=u(x,l)=0$ and $u(w,y)=g(y)$
(b) Write wave equation in three dimension form. Hence express it for steady state. (05)
(c) Find the general solution of Laplace equation in 3D spherical polar coordinates system. (15)

Section- B

5. (a) Find the mean, median, mode, standard deviation and coefficient of variation of the following observations. Also draw the frequency polygon and cumulative frequency polygon. Also indicate mean, median and ~~median~~ mode on the frequency polygon graph. (20)

Class interval	5-7	8-10	11-13	14-16
Observations	2	5	10	3

(b) Find first four moments measured from origin. Hence find mean, variance, coefficient of skewness and coefficient of kurtosis. The experimental data: 4, 3, 5, 9, 15. (15)

6. (a) Test whether the following functions are probability distribution function or not. (18)

(i)

x	-2	0	2	3
P(x)	-3a	0.5a	4a	0.5

(ii)

x	-1	0	1	2
P(x)	2k	k	2k	0.5

(iii) $P(x) = \begin{cases} kx & if -1 \le x \le 2 \\ 0 & otherwise \end{cases}$

Hence if possible find $E(5x+3)$ and $P(-1.5 \le x < 2)$ for each instance.

(b) Define a probability density function of Normal distribution whose mean is "0" and variance is "4". Then prove that this (the distribution you defined) is a continuous probability density function. Hence write its median, mode and coefficient of skewness. (17)

7. (a) What are the necessary assumptions you need regarding Binomial distribution? In a small town there are 800 houses. Each house contains four pillars (perfect or defect) and two beams. The probability of perfect pillar is 0.8 (i.e. 80% pillars are perfect in size). For a single house find the probability that there is (10)

(i) No any perfect pillars;
(ii) At best one perfect pillar

In that town how many houses you expect that there is no any defective pillar.

(b) Suppose there are 1100 candidates in any examination of a qualification test. Let average score is 70 (in percentage) and variance is 25. Assume that scores are normally distributed. Find the expected number of candidates who are (10)

(i) not qualified (i.e. score is less than 60)
(ii) qualified but not eligible for choosing all departments (i.e. 60 < score < 80)
(iii) eligible for choosing any departments (i.e. score ≥ 80)

(c) Fit the following data to Normal distribution whose mean is 15 and standard deviation is 3. Hence taste the goodness of fit with 5% level of significance. (15)

CI	0-4	5-9	10-14	15-19	20-24
Observation	3	5	9	6	2

8. (a) Show that the coefficient of correlation is independent of origin and scale of measurement. If coefficient of correlation between H and W is 0.8, then find the coefficient of correlation between M and N such that M = - 0.5 W and N = - 2 + 7H. (10)

(b) By using the following data, calculate the linear regression equation of y on x. (17)

x	22	23	23	24	26	27
y	18	20	21	20	21	22

Also find the coefficient of determination. Hence estimate y when x = 100 if the coefficient of determination is greater than 0.5.

(c) The coefficient of correlation between width of RCC pillar an height of building is obtained 0.7 from 20 pairs of data. Test it with 5% level of significance that there exist in really correlation between them. (08)
