

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Winter 2022

Course Code: CE 1211

Level-I Term-II

Time: 03 (Three) hours

Full Marks: 180

Course Title: Engineering Mechanics

- N.B.
- The questions are of equal value.
 - Figures in the margin indicate full marks allotted to each question.
 - Symbols and abbreviations bear their standard meaning.
 - Use a separate answer script for each PART.
 - The corresponding course learning outcomes (CLOs) are given in the right most column.
 - Assume any reasonable value for missing data.

PART- A (Marks: 90)

(Answer any three questions including Q. No. 1)

- | | Marks | CLOs |
|--|-------|------|
| 1. a) A simply supported beam is subjected to loadings as shown in Fig. 1 below. Calculate the support reactions at A and B. | (15) | 1 |

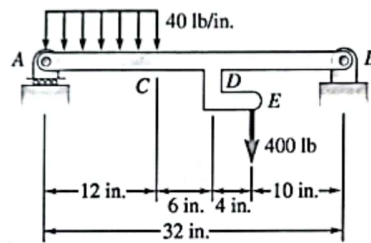


Fig. 1

- | | | |
|---|------|---|
| b) Determine the forces in the members BD and CD of the truss in Fig. 2. All triangles are equilateral. | (15) | 2 |
|---|------|---|

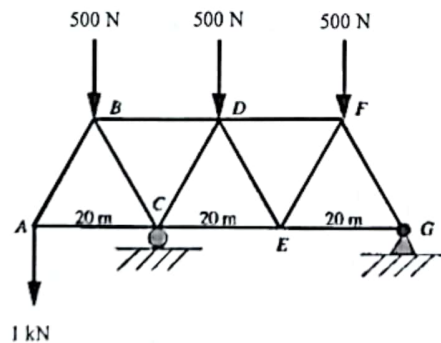


Fig. 2

- | | | |
|--|------|---|
| 2. a) Calculate all the reactions of Fig.3. Weight of the ball is 500 N. | (15) | 1 |
|--|------|---|

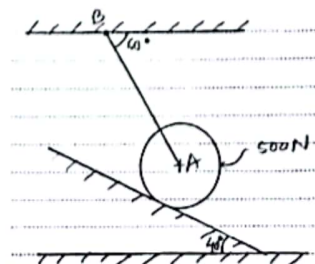


Fig. 3

- b) In Fig. 4, $F = 150$ lbs and $Q = 0$ lbs. Find the reaction at pin A & B and member force in the two force members AD, CD and DE. (15) 2

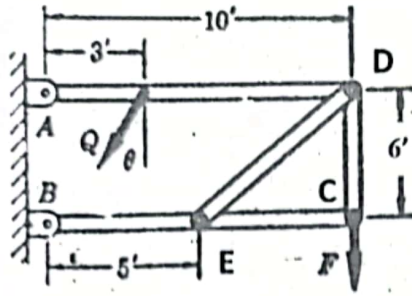


Fig. 4

3. a) A 4 m ladder is supported on wall at point B and at floor at point A as shown below in Fig. 5. The weight of the ladder is 200 N and a man weighing 600 N is standing 1 m below point B. A horizontal force P is applied to the ladder at point A to prevent slippage. Determine the value of P. (15) 1

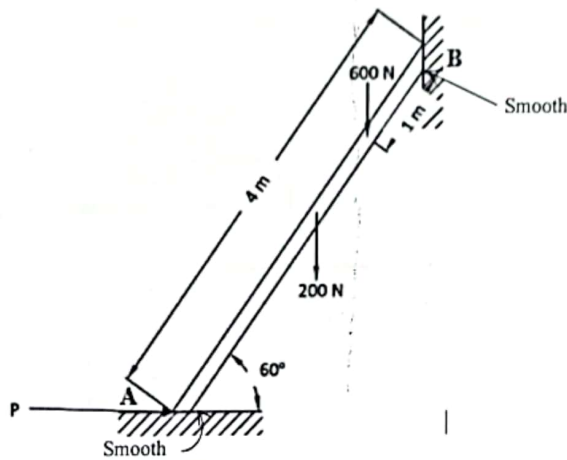


Fig. 5

- b) Determine the resultant of the coplanar concurrent forces shown in Fig. 6. (15) 1

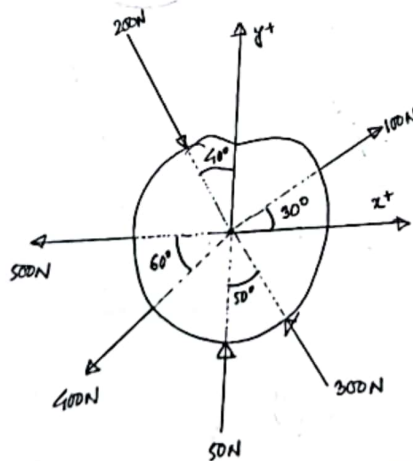


Fig. 6

4. a) Explain the following terms with neat sketches if applicable (any five): (20) 1
- Hinge support
 - Overhanging beam
 - Cantilever beam
 - Characteristics of truss
 - Catenary shape of the flexible chord
 - Frictional force

b) Calculate the force P from Fig.7.

(10) 1

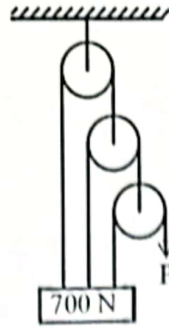


Fig. 7

PART- B (Marks: 90)

(Answer any three questions including Q. No. 5)

- | | Marks | CLOs |
|---|-------|------|
| 5. a) Determine (i) the moment of inertia (MOI) and (ii) radius of gyration of the shaded area with respect to x shown in Fig. 8. | (20) | 3 |

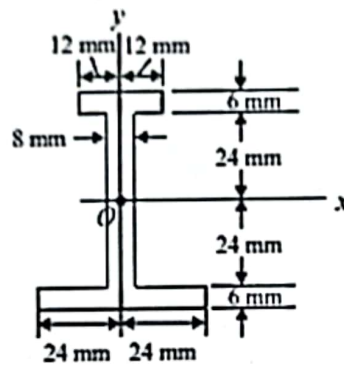


Fig. 8

- | | | |
|--|------|---|
| b) A body starting from rest rotates counterclockwise. According to the relation $\theta = 0.1t^3 - 0.3t^2 + 0.8t$ | (10) | 4 |
|--|------|---|

After 6 sec find

- (i) the angular displacement
- (ii) the angular velocity.

- | | | |
|--|------|---|
| 6. Locate the centroid of the shaded area shown in Fig. 9. | (30) | 3 |
|--|------|---|

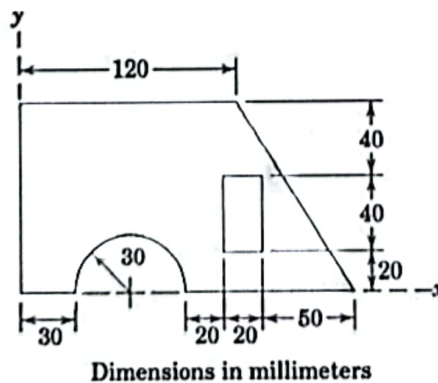


Fig. 9

- a) State and explain the parallel axis theorem and perpendicular axes theorem which are used in determining moment of inertia (MOI). (15) 3
- b) A body, shown in Fig. 10, weighing 20 lb. is resting on 45° incline for which $f = 0.2$ (kinetic friction). A horizontal force $Q = 10$ lb. acts on the body as shown in Fig. 10. If the body starts from rest, calculate the velocity after 5 sec. (15) 4

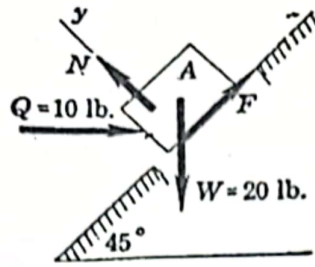


Fig. 10

8. a) A 4-ft cylinder, shown in Fig. 11, which weighs 966 lb., rolls down a 15° incline from rest. Assume no friction between the plane and cylinder. Determine its speed after it has rolled 50 ft. (15) 4

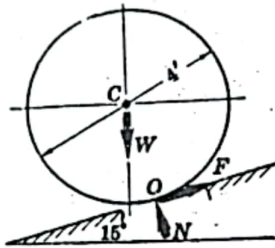


Fig. 11

- b) A 100 lb. body is on a horizontal plane, where the coefficient of kinetic friction is $f = 0.2$. A force of $Q = 60$ lb. acts as shown in Fig. 12. Determine the net impulse on the body during 2 sec. (15) 4

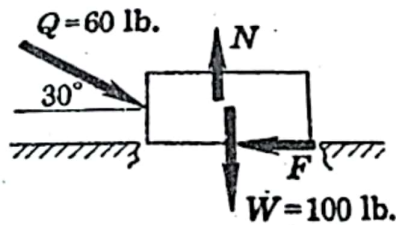


Fig. 12

Bangladesh Army University of Science and Technology
Department of Civil Engineering
 Final Examination, Winter 2022

Course Code: MATH 1209

Level-I Term-II

Time: 03 (Three) hours

Full Marks: 180

Course Title: Math II (Ordinary & Partial Differential Equations and Matrices)

- N.B. • Figures in the margin indicate full marks allotted to each question.
 • Symbols and abbreviations bear their standard meaning.
 • Use separate answer script for each PART.
 • The corresponding course outcomes (COs) are given in the right most column.

PART- A (Marks: 90)

(Answer any three questions from 1 to 4 including Q. No. 1)

	Marks	COs
1. a) Define ordinary differential equation. Classify each of the following differential equations as linear or nonlinear and hence find the order and degree of each equations:	15	1
(i) $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y^2 = 0$		
(ii) $\frac{d^4y}{dx^4} + 3\left(\frac{d^2y}{dx^2}\right)^3 + 5y = 0$		
(iii) $\frac{d^6x}{dt^6} + \left(\frac{d^3x}{dt^3}\right)^2 + x = t$		
(iv) $\frac{d^2y}{dx^2} + y \sin x = 0.$		
b) Find the differential equation of the family of circle of radius r with center on the x -axis.	15	2
2. a) Obtain the differential equation $(2x \cos y + 3x^2y)dx + (x^3 - x^2 \sin y - y)dy = 0$ by standard method.	15	2
b) Find the solution of the differential equation $y''' - 5y'' + 7y' - 3y = 0.$	15	2
3. a) Write standard form of 1 st order linear ordinary differential equation. Solve the differential equation $(1 + x^2) \frac{dy}{dx} + 4xy = x.$	15	3
b) Obtain the general solution of the differential equation $y'' + 2y' + 5y = 0.$	15	2
4. a) Find the general solution to $\frac{d^2y}{dx^2} = \frac{1}{x} \left(\frac{dy}{dx} + x^2 \cos x \right), x > 0.$	15	3
b) Define partial differential equation. Form a partial differential equation by eliminating constants a and b from $z = (x - a)^2 + (y - b)^2.$	08	1
c) Solve the partial differential equation $p \tan x + q \tan y = \tan z$ by Lagrange method.	07	3

PART- B (Marks: 90)

(Answer any three questions from 5 to 8 including Q. No. 5)

	Marks	COs
5. a) Find the complete integral and singular integral of the partial differential equations $p^3 + q^3 = 27z$ where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$.	15	1
b) Show that the differential equations $xp = yq$ and $z(xp + yq) = 2xy$ are compatible and hence solve them, where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$.	15	2
6. a) Define Charpit's method. Find the complete integral of $q = 3p^2$ by Charpit's method.	15	2
b) Solve the partial differential equation $(D^2 + 2DD' + D'^2)z = e^{2x+3y}$.	15	2
7. a) Determine the values of x, y, z , when $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ is orthogonal.	10	4
b) Solve the following system of equations by Cramer's Rule. $x + y + z = 6$ $y + 3z = 11$ $x - 2y + z = 0.$	10	3
c) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$.	10	2
8. a) Define Hermitian and skew-Hermitian matrix. Verify that matrix $X = \begin{bmatrix} 0 & -1-i & 2 \\ 1-i & 3i & i \\ -2 & i & 0 \end{bmatrix}$ is Hermitian or skew-Hermitian matrix.	10	3
b) Find the rank and nullity of matrix $A = \begin{bmatrix} 9 & 7 & -6 & -8 \\ -9 & -6 & 6 & -5 \\ -10 & 9 & 1 & -7 \end{bmatrix}$.	10	3
c) Verify that the following set of Vectors in \mathbb{R}^3 is linearly dependent or independent $(0, -10, 10), (6, 10, -4)$ and $(-2, -10, 5)$.	10	4

Bangladesh Army University of Science and Technology
Department of Civil Engineering
Final Examination, Summer 2022

Course Code: PHY 1209
 Time: 03 (Three) hours

Level-I Term-II
 Full Marks: 180

Course Title: Physics II

- N.B.:
- Figures in the margin indicate full marks allotted to each question.
 - Symbols and abbreviations bear their standard meaning.
 - Use separate answer script for each PART.
 - The corresponding course outcomes (COs) are given in the right most column.

PART- A (Marks: 90)

(Answer any three questions from 1 to 4 including Q. No. 1)

	Marks	COs
1. a) When the central spot of Newton's ring become dark and bright? Explain.	05	1
b) In the case of interference of light, prove that $I = 4I_0 \cos^2\left(\frac{\delta}{2}\right)$.	20	2
c) In a Newton's rings experiment the diameter of 10 th ring changes from 1.40 to 1.27 cm when a drop of liquid is introduced between the lens and the glass plate. Calculate the refractive index of the liquid.	05	3
2. a) Explain Faraday's laws of electromagnetic induction.	05	1
b) Find an expression for magnetic field due to a long straight wire carrying current 'i'.	20	2
c) A solenoid of length 20 cm and diameter 4 cm is wound uniformly with 3000 turns of wire. It carries current of 2 A. What is the value of B at the center?	05	3
3. a) What are the findings of Oersted's experiment.	05	1
b) Find an expression for electric potential due to a point charge.	20	2
c) Two point charges + 6 μC and -2 μC are 0.8 m apart. Locate the point at which the electric potential is zero.	05	3
4. a) Define magnetic susceptibility.	05	1
b) Find an expression for the capacitance of a parallel plate capacitor.	20	2
c) What is the drift velocity of electrons in a copper conductor having a cross-sectional area of $5 \times 10^{-6} \text{m}^2$, if the current is 10 A? Assume that there are 8×10^{28} electrons/ m^3 ($q_e = 1.6 \times 10^{-19} \text{C}$).	05	3

PART- B (Marks: 90)

(Answer any three questions from 5 to 8 including Q. No. 5)

		Marks	COs
5.	a) Discuss the Fraunhofer diffraction at a single slit and draw the intensity distribution for the diffraction pattern.	22	2
	b) The critical angle for certain wavelength of light in the case of a piece of glass is 40° . Find the polarizing angle for glass.	08	3
6.	a) What is photoelectric effect?	03	1
	b) Deduce an expression for the change in wavelength of a particle due to Compton effect.	20	2
	c) A photoelectric surface has a work function of 4 eV. What is the maximum velocity of the photoelectron emitted by light of frequency 10^{15} Hertz incident on the surface.	07	3
7.	a) Define mass defect and binding energy of a nucleus.	08	1
	b) Prove that $L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$.	15	2
	c) A spacecraft is moving relative to the earth. An observer on the earth finds that, according to his clock, 3601 sec. elapse between 1 PM and 2 PM, on the spacecraft's clock. What is the spacecrafts speed relative to the earth?	07	3
8.	a) Explain relativity of mass.	05	1
	b) Derive an expression for the energy of a particle having rest mass zero and velocity c unit.	18	2
	c) A particle is moving with a speed of $0.5c$. Calculate the ratio of its rest mass and the mass while in motion.	07	3

Bangladesh Army University of Science and Technology
Department of Civil Engineering
Final Examination, Summer 2022

Course Code: HUM 1209
 Time: 03 (Three) hours

Level-I Term-II
 Full Marks: 120

Course Title: Sociology

- N.B.:
- Figures in the margin indicate full marks allotted to each question.
 - Symbols and abbreviations bear their standard meaning.
 - Use separate answer script for each PART.
 - The corresponding course outcomes (COs) are given in the right most column.

PART- A (Marks: 60)

(Answer any three questions from 1 to 4 including Q. No. 1)

		Marks	COs
1.	a) Define society. Discuss the characteristics of society.	10	1
	b) What is association? Point out the characteristics of association and show the differences between association and institution.	10	1
2.	a) What is meant by social structure? Discuss the features of social stratification.	10	2
	b) Distinguish between caste and class.	10	2
3.	a) Define family. Write down the characteristics of family.	10	1
	b) Illustrate the recent functions of family in Bangladesh.	10	1
4.	a) What do you mean by culture? Mention the types of culture with suitable examples.	10	1
	b) Explain the basic conditions of sustainable development.	10	3

PART- B (Marks: 60)

(Answer any three questions from 5 to 8 including Q. No. 5)

		Marks	COs
5.	a) What did Malthus mean by preventive and positive check?	10	2
	b) Briefly discuss the theory of demographic transition.	10	2
6.	a) What are meant by industrial and post-industrial society?	10	3
	b) Discuss the common features of industrial society.	10	3
7.	a) Define crime. What are the basic differences in deviant behavior and crime?	10	1
	b) Identify the factors that facilitate deviant behavior.	10	1
8.	a) 'A healthy socialization process produces a good citizen.'- Explain the statement.	10	2
	b) Discuss the causes of poverty in Bangladesh.	10	3

বাংলাদেশ আর্মি ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি
সিভিল ইঞ্জিনিয়ারিং বিভাগ
সেমিস্টার ফাইনাল পরীক্ষা, উইন্টার ২০২২

কোর্স কোড : HUM 1219
সময় : ০৩ (তিন) ঘণ্টা

লেভেল-১ টার্ম-২
পূর্ণমান : ১২০

কোর্স শিরোনাম : বাংলা ভাষা ও সাহিত্য

- বিঃ দ্রঃ
- প্রতিটি প্রশ্নের মান ডান পাশে দেওয়া আছে।
 - প্রতিটি অংশের জন্য পৃথক উত্তরপত্র ব্যবহার কর।
 - সংশ্লিষ্ট কোর্সের সিও ডান দিকের কলামে দেওয়া হয়েছে।

ক- বিভাগ (নম্বরঃ ৬০)

(১ নং থেকে ৩নং পর্যন্ত দুইটি প্রশ্নের উত্তর দাও, ১ নং প্রশ্নের উত্তর বাধ্যতামূলক)

	নম্বর	সিও
১. বাংলা একাডেমি প্রণীত প্রমিত বাংলা বানানের অতঃসম শব্দের ১০টি নিয়ম লেখ।	৩০	১
২. ক. অনুচ্ছেদ লেখ- আধুনিক তথ্যপ্রযুক্তি। খ. তেজমার বিশ্ববিদ্যালয়ের হলে সিট চেয়ে প্রক্টর বরাবর একটি আবেদন পত্র লেখ।	১৫+১৫	২
৩. বাংলা ভাষার উদ্ভবের ইতিহাস আলোচনা কর।	৩০	১

খ- বিভাগ (নম্বরঃ ৬০)

(৪ নং থেকে ৬নং পর্যন্ত দুইটি প্রশ্নের উত্তর দাও, ৪ নং প্রশ্নের উত্তর বাধ্যতামূলক)

	নম্বর	সিও
৪. ভাষা আন্দোলনভিত্তিক প্রথম নাটক হিসেবে 'কবর' নাটকের গুরুত্ব আলোচনা কর।	৩০	১
৫. 'বাংলার মুখ আমি' কবিতায় জীবনানন্দ দাশের প্রকৃতি চেতনা দেখাও।	৩০	৩
৬. 'পোস্টমাস্টার' গল্পের শিল্পমূল্য বিচার কর।	৩০	৩