Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2021

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 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 including Q. No. 1)

		Marks	COs
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

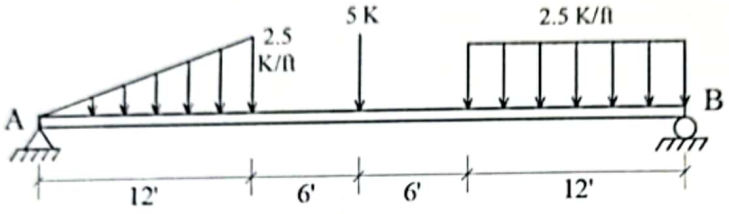

Fig. 1

b)	A truss is given below in Fig. 2. Calculate the member forces of AB, BC and BF.	(15)	2

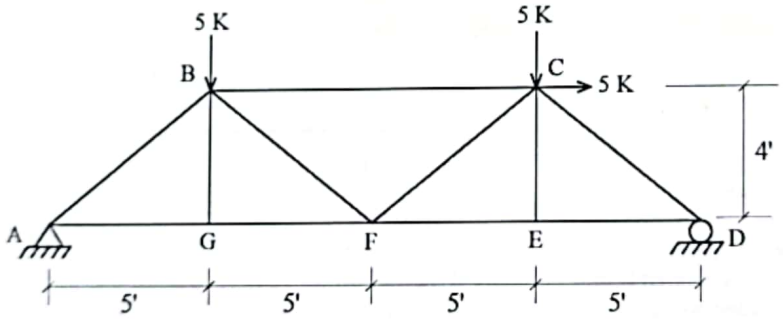

Fig. 2

2. a)	A 5000 lb. sphere rests on a smooth plane inclined at an angle θ = 40° with the horizontal and against a smooth vertical wall as shown in Fig. 3 below. Find the reactions at the contact surfaces A and B.	(15)	1

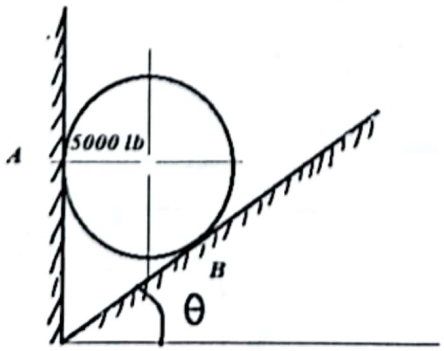

Fig. 3

b) Determine the resultant force of the coplanar concurrent forces as shown in Fig. 4. (15) 1

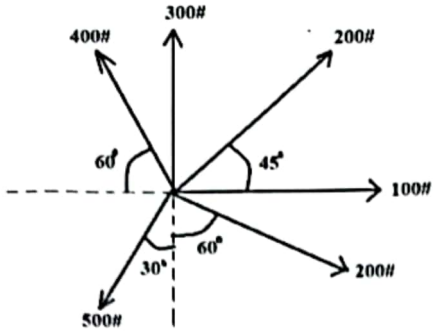

Fig. 4

3. a) A ladder of length 5 m and weighing 300 N is placed against a vertical wall as shown in Fig. 5. The ladder also supports a man weighing 500 N. The coefficient of static friction between the wall and the ladder is 0.3 and that between the floor and the ladder is 0.2. Calculate the minimum horizontal force P to be applied at the bottom of the ladder to prevent slipping of the ladder. (20) 1

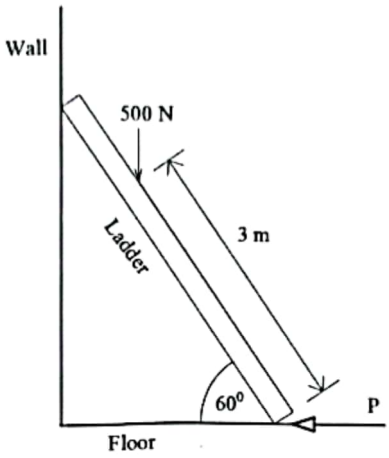

Fig. 5

b) Explain the terms "friction" and "frictional coefficient". (10) 1

4. a) Mention the properties of truss. (5) 2

b) Illustrate the following terms with neat sketches: (25) 1

i. Hinge support
ii. Roller support
iii. Fixed support
iv. Simply supported beam
v. Cantilever beam

PART- B (Marks: 90)

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

Marks COs

5. a) Determine the moment of inertia (MOI) and radius of gyration of the I-section as shown in Fig. 6 with respect to x and y axes. (10+5) 3

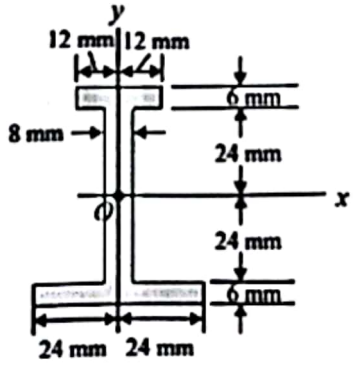

Fig. 6

b) A body is rotating about a fixed axis so that its angular acceleration is- (8+7) 4

$$\alpha = 4t^2 - t + 4 \; rad \; per sec^2$$

If the initial angular velocity is $10 \; rad \; per \; sec$, calculate the angular velocity and angular displacement after 2 sec.

6. a) Determine the centroid of the A-shaped section given in Fig. 7 below. (15) 3

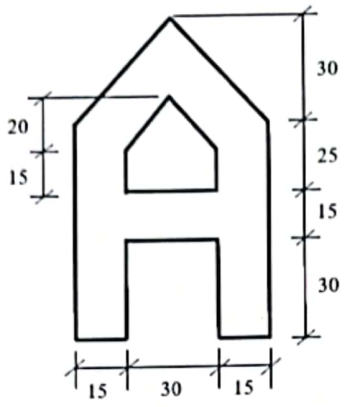

Fig. 7

b) Find the tension in the string during motion of the system as shown in Fig. 8 below if W_1 = 900 lb, W_2 = 900 lb, coefficient of friction between the plane and the block is 0.2. (15) 3

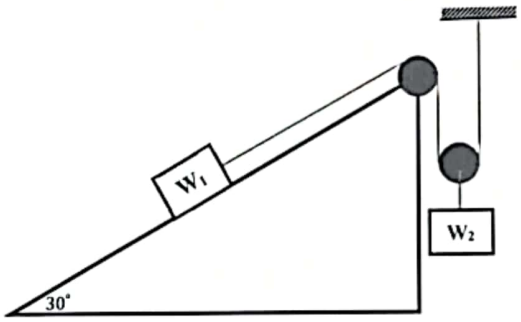

Fig. 8

7. The weightless cord wraps about a central groove 12" in diameter and passes over a smooth peg to a 30-lb body B as shown in Fig. 9. The central groove is in a 24" disk A which weighs W_A = 96.6 lb and has a radius of gyration of $\bar{\kappa}$ = 9" with respect to its axis. 4

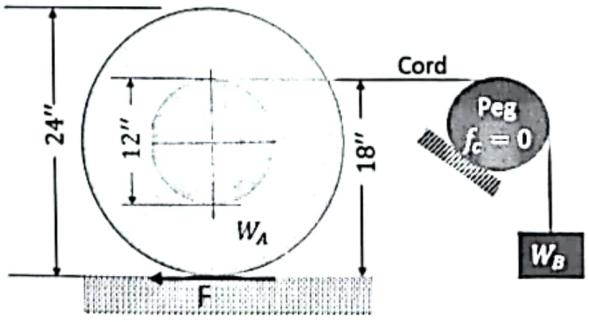

Fig. 9

a) If the disk rolls without slipping, what is the speed of B after 6 sec. when the bodies start from rest? (10)

b) What is the tension in the cord? (10)

c) What is the frictional force F? (10)

8. a) A 4-ft cylinder is shown in Fig. 10, which weighs 966 lb, rolls down a 15^0 incline from rest. Calculate its speed after it has rolled 50 ft. (18) 4

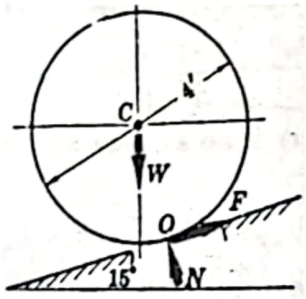

Fig. 10

b) Determine the mass moments of inertia of the bar as shown in Fig. 11 with respect to axes perpendicular to P & R, where Q is the center of PR. The length of the bar is 6 m and its weight is 12 N per meter. (12) 3

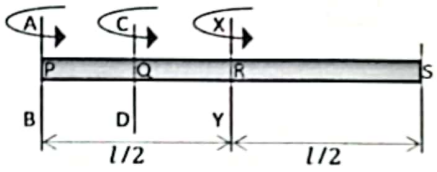

Fig. 11

Bangladesh Army University of Science and Technology
Department of Civil Engineering
Final Examination, Summer 2021

Course Code: PHY 1209 | Level-I Term-II
Time: 03 (Three) hours | 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)	Define electric flux and electric potential.	08	1
	b)	Deduce Coulomb's law from Gauss's law.	17	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
2.	a)	Explain Faraday's law of electromagnetic induction.	07	1
	b)	Find an expression for magnetic field due to a long straight wire carrying current.	16	2
	c)	A long straight wire is kept fixed in a vertical position and carrier a current in the vertically upward direction. A magnetic field of intensity 5×10^{-5} T is available at a point 0.15 m away from the wire. What is the current in the wire?	07	3
3.	a)	Write down Maxwell's electromagnetic equations and mention each term.	08	1
	b)	In the case of interference of light, prove that $I = 4I_0 cos^2\left(\frac{\delta}{2}\right)$.	17	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
4.	a)	Explain Lorentz force.	07	1
	b)	Find an expression for the capacitance of a cylindrical capacitor.	18	2
	c)	What is the drift velocity of electrons in a copper conductor having a cross-sectional area of $5 \times 10^{-6} m^2$, if the current is 10 A? Assume that there are 8×10^{28} electrons/m^3 ($q_e = 1.6 \times 10^{-19}$C).	05	3

PART- B (Marks: 90)

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

			Marks	COs
5.	a)	Define Fresnel's and Fraunhoffer's diffraction of light.	08	1
	b)	Discuss Fraunhoffer diffraction pattern produced by a single slit and calculate the width of the central maximum.	15	2
	c)	In the Fraunhoffer diffraction due to a narrow slit a screen is placed 2 m away from the lens. If the slit width is 0.2 mm and first minimum lie 5 mm on either side of the central maximum, find the wavelength of light.	07	3
6.	a)	What is relativistic mass?	05	1
	b)	Show that, $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$. What will be the value of mass of a particle when it moves with the speed of light?	17	2
	c)	The rest mass of a proton is 2000 times the rest mass of an electron. Calculate the speed of the electron.	08	3
7.	a)	What is photo-electric effect?	04	1
	b)	State the laws of photo-electric emission. Explain why did classical physics fail to explain the characteristic of photo-electric effect.	18	2
	c)	Explain Bohr theory using de-Broglie model.	08	3
8.	a)	What do you mean by radioactivity? Discuss about the units of radioactivity.	08	1
	b)	What are different modes of radioactive decay? Give example for each mode.	15	2
	c)	How long will it take for a sample of Radium decrease to 10%?	07	3

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2021

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)

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- 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 order and degree of differential equations with example.	5	1
	b)	Form the differential equation for $y = 4a(x + a)$.	10	2
	c)	Solve the DE $x\sqrt{y^2 - 1}dy + y\sqrt{x^2 - 1}dx = 0$.	15	2
2.	a)	Define Integrating factor.	3	1
	b)	Solve the DE $(xy \sin xy + \cos xy)\, ydx + (xy \sin xy - \cos xy)xdy = 0$	12	
	c)	Solve the DE $2\frac{dy}{dx} = \frac{y}{x} + \frac{y^2}{x^2}$.	15	2
3.	a)	Solve the DE $y'' - 4y' + 4y = (x + 1)e^{2x}$.	15	2
	b)	Solve the DE $\frac{dy}{dx} + \frac{y}{x} = xy^2$.	15	2
4.	a)	Solve the DE $\frac{d^2y}{dx^2} = \left[1 - \left(\frac{dy}{dx}\right)^2\right]^{\frac{1}{2}}$.	13	3
	b)	Solve the DE $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin(\ln x^2)$.	17	3

PART- B (Marks: 90)

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

			Marks	COs
5.	a)	Show that $AB \neq BA$ where $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 1 \\ 1 & 5 \end{bmatrix}$	10	3
	b)	Find inverse of the following matrix $A = \begin{bmatrix} 2 & -2 & -1 \\ 1 & 4 & 4 \\ 3 & 1 & 5 \end{bmatrix}$ and verify that $AA^{-1} = I$.	20	3
6.	a)	Solve the following homogeneous systems of linear equations $x + 2y + z = 0$, $2x - y + 2z = 0$, $3x + y - z = 0$	15	3
	b)	Solve the following non-homogeneous systems of linear equations $x - 2y + 6z = 1$, $2x - y - z = 2$, $x - y - 2z = 3$	15	3
7.	a)	Find rank and nullity of the following matrix $\begin{bmatrix} 1 & 2 & 2 & 4 \\ -1 & 2 & 4 & 7 \\ 3 & 2 & 1 & 3 \end{bmatrix}$	10	4
	b)	Test that the following vectors form a basis for the vector space R^3 $u_1 = (1,2,1)$, $u_2 = (2,-1,2)$ and $u_3 = (3,1,-1)$	20	4
8.	a)	Convert the following conic into its standard form using matrix notation of quadratic form $5x^2 - 4xy + 8y^2 - 36 = 0$	15	4
	b)	Verify Cayley-Hamilton Theorem for the following matrix $B = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$	15	4

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2021

Course Code: HUM 1209 Level- I Term-II
Time: 03 (Three) hours Full Marks: 120

Course Title: Sociology

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PART- A (Marks: 60)

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

			Marks	COs
1.	a)	'Society is a web of social relationship.'- Explain this statement.	10	1
	b)	What are capitalism and mode of production?	10	1
2.	a)	Define sustainable development. Describe 'fairness' and 'interdependence' as the basic conditions of sustainable development.	10	2
	b)	'Without democracy sustainable development is mere an imagination.'- Do you agree With this statement? Give reason in favor of your opinion.	10	2
3.	a)	What is collective behavior? Discuss the Smelser's theory of collective behavior.	10	2
	b)	What is called social movements? Explain the forms of crowd behavior.	10	
4.	a)	What is meant by gender socialization? Concisely discuss the agents of socialization.	10	1
	b)	Define globalization. Write down the impact of globalization in Bangladesh.	10	2

PART- B (Marks: 60)

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

			Marks	COs
5.	a)	Define group. Discuss the characteristics of group.	10	1
	b)	What is meant by organization? What are the differences between formal organization and non-formal organization?	10	1
6.	a)	Describe the slavery system as the form of social stratification.	10	2
	b)	Identify the characteristics of social stratification.	10	2
7.	a)	'All deviant behavior is not crime but all crime is deviant behavior'. – Explain it.	10	1
	b)	Elucidate 'ease of rationalizations' and 'poor enforcement' as the form of facilitating factors of deviant behavior.		2
8.	a)	What is material culture? How would you distinguish between material and non material culture?	10	2
	b)	Explain 'cultural lag' theory.	10	1

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2021

Course Code: EEE 1213 **Level-1 Term-II**

Time: 03 (Three) hours **Full Marks: 180**

Course Title: Introduction to Electrical Engineering

N.B.
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PART- A (Marks:90)

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

			Marks	COs
1.	a)	Explain Voltage, Current, Power and Energy of electrical circuit.	10	1
	b)	State Ohm's law. Find the equivalent resistance R_{ab} and hence find I for the circuit of Fig. 1(b)	10	3
	c)	If R_{eq} = 20 Ω in the circuit of Fig. 1(c), then find the value of R	10	2

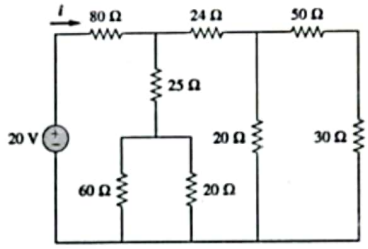

Fig. 1(b)

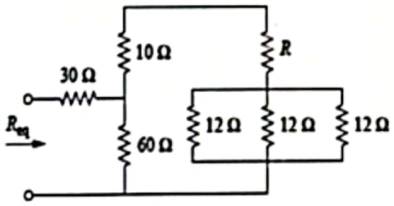

Fig. 1(c)

2.	a)	For the bridge network in Fig. 2(a), find R_{ab} and i.	15	
	b)	Find v_{ab} and i in the circuit of Fig. 2(b). Also determine power consumed by 8 Ω resistor.	15	

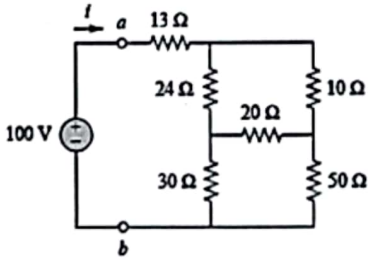

Fig. 2(a)

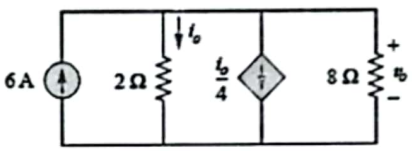

Fig. 2(b)

3.	a)	Explain dependent and independent source. Draw and explain different types of dependent sources.	5	
	b)	Find v_{ab} and I in the circuit of Fig. 3(b).	13	
	c)	For the circuit shown in Fig. 3(c), find the node voltages.	12	

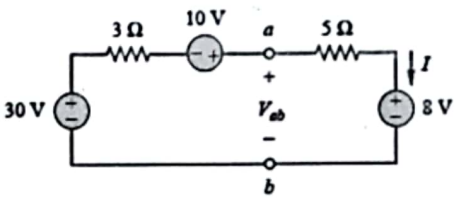

Fig. 3(b)

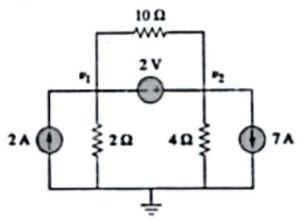

Fig. 3(c)

4. a) State and explain Superposition Principle. Use superposition principle to find current I and the power dissipated by 8 ohm resistor in Fig. 4(a). 16

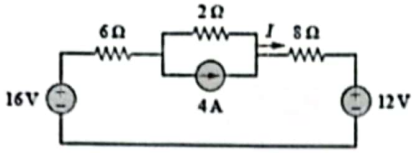

Fig. 4(a)

b) State and explain Norton's Theorem. Find the Thevenin equivalent circuit of the circuit of Fig. 4(b). 14

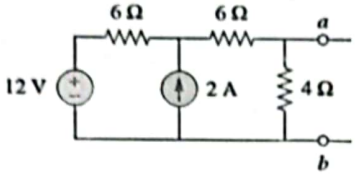

Fig. 4(b)

PART- B (Marks:90)

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

			Marks	COs
5.	a)	Justify "Inductor shows inertia to current while capacitor do the same for voltage"	5	1
	b)	Explain (i) Instantaneous value, (ii) Peak Value, (iii) Cycle, (iv) Time period and (v) Frequency with necessary wave shapes.	10	2
	c)	The waveform shown in Fig. 5(c) is a full-wave rectified sine wave. Find (i) peak Value (ii) RMS value (iii) Average Value (iv) Crest factor and (v) Form factor	15	2

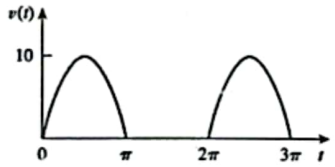

Fig. 5(c)

6. a) Define power factor. Explain different types of power factors. Explain leading and lagging power factor using vector diagram. 8

b) Find the input impedance of the circuit in Fig. 6(b). Assume that the circuit operates at $\omega = 50$ rad/s. 14

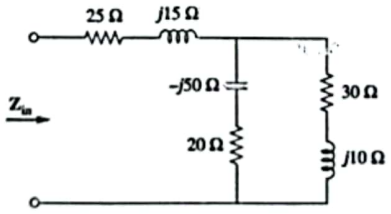

Fig. 6(b)

c) Determine the phase difference between v & i and also find out that which component is in leading condition. Given, v=10 sin (ωt+30°) V & i=5 sin (ωt-70°) A. 8

7. a) Find node voltages(v_1, v_2) in the circuit of Fig.7(a) 12

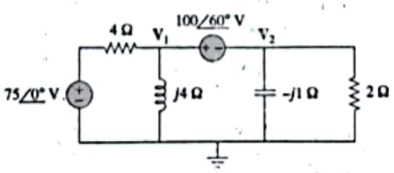

Fig. 7(a)

b) For a load, Vrms = $110\angle 0°$ Irms = $10\angle 60°$: Determine: (a) the complex and apparent powers, (b) the real and reactive powers, and (c) the power factor and the nature of load impedance. 10

c) Draw and explain Power triangle. 8

8. a) Explain phase sequence, line voltage and phase voltage of three phase system. 12

b) Write down the advantages of three phase system over single phase system. 5

c) A balanced Y-Y four-wire system has phase voltages $V_{an}=110\angle 0°$ V, $V_{bn}=110\angle -120°$ V and $V_{cn}=110\angle 120°$ V. The load impedance per phase is 10+j10 Ω and the line impedance per phase is 1+j2 Ω. Solve for the line currents. 13