2026. CSE & ECE.

MATHEMATICS – II 2nd Semester.

(BS-102)

Full Marks : 60 **SCTE/NGL/R-2026-II**

Pass Marks : 24

Time : 3 Hours

Q No.	Question	Marks	CO
1	a. For non-homogeneous system of equations, the system of equation is consistent and had a unique solution if i. $\|A\| = 0$ ii. $\|A\| \neq 0$ iii. $\|A\| > 0$ iv. $\|A\| < 0$	1	CO1
	b. The unit matrix of order 2 is i. $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$ ii. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ iii. $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ iv. $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$	1	
	c. Define null and scalar matrix.	2	
	d. Calculate the value of x if $\begin{vmatrix} x & 3 \\ 4 & 2 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 1 & 2 \end{vmatrix}$.	2	
	e. Find the determinant of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 3 & 3 \\ 2 & -1 & 1 \end{bmatrix}$.	3	
	f. If $A = \begin{bmatrix} 0 & 1 & 3 \\ 4 & 2 & 0 \\ 3 & 1 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -3 \\ 4 & 0 \\ 0 & 1 \end{bmatrix}$. Find the product AB.	3	

	g. Solve the following system of equations by *Cramer's* rule. Comment on their consistency. $x + y = 5$ $3x - 2y = 7$	4	
2	a. If $f(x)$ is an even function, then $\int_{-a}^{a} f(x)dx$ is i. $\int_0^a f(x)\,dx$ ii. 0 iii. $2\int_0^a f(x)dx$ iv. $-\int_{-a}^{a} f(x)dx$	1	CO2
	b. The area bounded by the curve $y = f(x)$, x −axis and the ordinates $x = a$ and $x = b$ is i. $\int_a^b f(x)dx$ ii. $\int_a^b \pi f(x)dx$ iii. $\int_a^b f(y)dy$ iv. $\int_a^b \pi f(y)dy$	1	
	c. Evaluate $\int \sin\frac{x}{3}dx$.	2	
	d. Evaluate $\int_0^3 x^3 dx$.	2	
	e. Evaluate $\int \frac{\cos(\log x)}{x}dx$ using substitution method.	3	
	f. Decompose $\frac{3x+1}{(x+1)(x-2)}$ into partial fraction and integrate the given proper ration fraction.	3	
	g. Evaluate the area enclosed by one quadrant of the circle $x^2 + y^2 = a^2$. Hence find the total area enclosed by the given circle.	4	
3	a. The distance between the origin (0,0) and (3,-3) is i. $\sqrt{6}$ ii. 0 iii. $3\sqrt{2}$ iv. 18	1	

	b. Find the equation of the line passing through the points (0,0) and (2,2).	2	CO3
	c. Find the value of k such that the lines $3x + 4y - 5 = 0$ and $2x + ky + 6 = 0$ are perpendicular to each other	2	
	d. Find the centre and radius of the circle $2x^2 + \lambda xy + 2y^2 + (\lambda - 2)x + 4y - 6 = 0$ for some λ.	3	
	e. Find the coordinates of the foci, vertices, length of major axis, minor axis, eccentricity and latus rectum of the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$.	3	
	f. Find the equation of the circle which passes through the points (0,1), (1,0) and (3,2). Also find the value of the radius and coordinates of the centre.	4	
4	a. The magnitude of a unit vector is i. 1 ii. 0 iii. -1 iv. Not defined	1	CO4
	b. Two vectors $\vec{a}$ and $\vec{b}$ are said to be perpendicular iff a. $\vec{a} \times \vec{b} = 0$ b. $\vec{a} = \lambda\vec{b}$ c. $\vec{a}.\vec{b} = 0$ d. $\vec{a} = \vec{b}$	1	
	c. Evaluate the angle θ between the vectors $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$.	2	

	d. Find the work done by the force $\vec{F} = 2\hat{\imath} + 5\hat{\jmath} - \hat{k}$ acting at a point A. The point of application of force moves from the point A to point B, where $2\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$ and $3\hat{\imath} + 5\hat{\jmath} + \hat{k}$ are the position vectors of A and B respectively	4	
5	a. Find the order and degree (if defined) of the given differential equation $\sqrt{\frac{dy}{dx}} = \frac{d^3y}{dx^3}$	2	CO4
	b. Evaluate $\frac{dy}{dx} = e^{x-2y} + x^4e^{-2y}$ by using variable seperable.	3	

ENGINEERING MECHANICS
ES-106

Full Marks : 60 **SCTE/NGL/R-2026-II**

Pass Marks : 24

Time : 3 Hours

Note:

1. Answer all questions. Marks as indicated in the column.
2. BL and CO indicate Blooms Taxonomy level and Course Outcomes respectively.

PART-A				
Q. No.	**Question**	**Marks**	**BL**	**CO**
1	a) State the triangle law of forces.	2	K	1
	b) Explain the method of resolution for the resultant force.	3	C	
	c) Explain the effects of force on a body.	3	C	
	d) The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points taken in order. Find the magnitude and direction of the resultant force.	3	A	
	e) Derive an expression for the magnitude of the resultant R, using parallelogram law of forces. OR f) Two forces of 60 N and 40 N are inclined to each other at an angle of 60^0. Find their resultant	3	A	
2	a) State Lami's theorem.	2	K	2
	b) Define free body diagram.	1		
	c) Explain the types of equilibrium with appropriate examples.	3	C	
	d) Discuss the different types of beam supports.	3		

	e) Five strings are tied at a point and are pulled in all directions, equally spaced from one another. If the magnitude of the pulls on three consecutive strings is 50N, 70N, and 60N, respectively, find graphically the magnitude of the pulls on two other strings.	2	A	
	f) Determine the support reactions of a simply-supported beam carrying a UDL of w kN/m throughout the beam. The length of the beam is l m.	2		
3	a) Define Friction and list the types of Friction.	2	K	3
	b) Explain limiting friction with the help of a neat sketch.	2	C	
	c) A body weighing 400 N rests on a rough horizontal surface. If the force required to just move the body is 120 N horizontally, find (i) the coefficient of friction and (ii) the angle of friction.	2	A	
4	a) State the theorem of Perpendicular axis.	2	K	4
	b)Distinguish between CG and centroid	3	C	
	c) Explain the CG of a cylinder with the help of a diagram.	3	C	
	d)A body consists of a right circular cone of height 40 mm and radius 30 mm placed on a solid hemisphere of radius 30 mm of the same material. Determine the position of cg of the body. OR e) Find the moment of inertia of a T-section with flange as 150 $mm \times 50\ mm$ and web as 150 $mm \times 50\ mm$ about Y-Y axes.	4	A	

5	a) Define the following terms: i) Mechanical Advantage ii) Load and Effort	2	K	5
	b) State the law of machine.	2		
	b) Distinguish between reversible and non-reversible machines with examples.	4	C	
	c) A lifting machine raises 1200 N load with an effort of 300 N. Find efficiency if V.R. = 5	2	A	

PART-B (MCQ K Type Question)

Each question carries 1 mark, **1x5 = 5 marks**

Q.No	Question	CO
1	The force whose line of action lies on the same plane are known as_____ force. a) coplanar b) collinear c) concurrent d) non-coplanar	1
2	The process of finding out the resultant force of a number of given forces is called a) resolution b) resultant c) composition d) polygon law	1
3	Angle of friction is the angle between: a) Weight and normal reaction b) Resultant reaction and normal reaction c) Effort and load d) Plane and horizontal	3
4	The CG of a square lies at a distance of____ from each side. a)a b)$a/2$ c)$a/3$ d)$a/4$	4
5	The CG of a quarter circle lies along its central radius at a distance of____ a)$\frac{4R}{3\pi}$ b)$\frac{4R}{5\pi}$ c)$\frac{4R}{2\pi}$ d)$\frac{4R}{\pi}$	4

Fundamentals of Electrical & Electronics Engineering
(ES-104)

Full Marks : 60 **SCTE/NGL/R-2026-II**

Pass Marks : 24

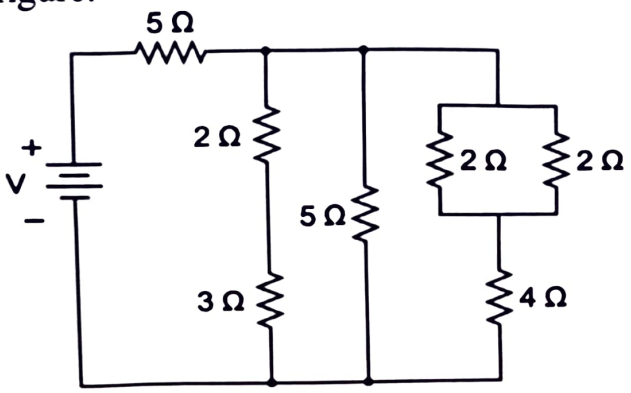
Time : 3 Hours

Note:

1. Answer all questions. Marks as indicated in the column.
2. BL and CO indicate Blooms Taxonomy level and Course Outcomes respectively.

Q N0	Questions	Mark	BL	CO
	Part -A			
1	Multiple choice questions:	1×10= 10		
	A. diode conducts when _____bias. i) forward ii) Positive iii) Reverse iv) None	1	K	1
	B. frequency is equal to ____. i) T ii) 1/T iii)2T iv)3T	1	C	1
	C. unit of inductor. i) Newton ii) Farad iii) Ohm iv) Henry	1	K	1
	D. the logic gate that produces a 0 or low level output when one or both of the input are one, is called_____ gate. i)AND ii)OR iii)NOR iv)NAND	1	A	3
	E. the radix of the decimal number is i) 16 ii) 8 iii)10 iv)2	1	K	3
	F. The formula for ohm's law is i) V=IR ii) I=VR iii) R=VI iv) All of the above	1	K	4
	G. Magnetic field lines always travel from i) North to South ii) South to North iii) East to west iv) west to east	1	K	5

	H. The SI unit of magnetic flux is i) Tesla ii) Weber iii) Kelvin iv) Candela	1	K	5
	I. A transformer works on i) AC ii) DC iii) Both AC and DC iv) none	1	K	6
	J. Buffer is also called _____. i) voltage follower ii) amplifier iii) current follower iv) integrator	1	K	2
	Part -B			
2	Answer the following question:	2×8=16		
	a. what are the types of FET?	2	K	1
	b. full form of MOS and CMOS	2	K	1
	c. decimal to binary conversion $(27)_{10}$ and $(0.75)_{10}$	2	A	3
	d. Implementing circuit from Boolean expressions. Y(A,B,C,D) = (A+B).(C+D)	2	A	3
	e. Define current and voltage	2	K	4
	f. What is statically induced EMF?	2	K	5
	g. What is an ideal transformer?	2	K	6
	h. Define commutator	2	K	6
	Part -C			
3	Answer the following questions:	4×6=24		
	a. What is an operational amplifier? Explain with a circuit diagram	4	K C	2
	b. prove the following Boolean theorem: i) $AB+\bar{A}C=(A+C)(\bar{A}+B)$ ii) $(A+B)(A+\bar{B})=A$	4	A	3

	c. The AC supply at a house is 230v, 50Hz. Find maximum value, average value and RMS value of voltage.	**4**	A	4
	d. what is electromagnetic induction? Give examples of where electromagnetic induction is used.	**4**	K C	5
	e. Define the following i) Magnetic field lines ii) Reluctance iii) Permeability iv) Retentivity	**4**	K	5
	f. Find the total resistance of the given figure:  	**4**	A	4
	Part-D			
4	Answer either i) or ii) of the following questions:	**2×5=10**		
	a). Answer the following question: i. What is a diode? Explain and draw the VI characteristic of a diode. **Or** ii. Explain the inverting amplifier with circuit diagram and derive the voltage gain of the amplifier.	**5**	K C A	1 2

	b). Answer the following question: i. What is a transformer? What are the different parts of a transformer **Or** ii. Explain the working principle of an electric motor with diagram	**5**	**K C**	6 6

INTRODUCTION TO I.T SYSTEMS

ES-102

Full Marks : 60 **SCTE/NGL/R-2026-II**

Pass Marks : 24

Time : 3 Hours

A. Multiple choice questions. **1x10=10**

1. Which of the following is a web browser?
   a) Excel b) Word
   c) Safari d) PowerPoint
2. Which of the following is not a search engine?
   a) Yahoo b) Bing
   c) Chrome d) Google
3. An Operating System (OS) acts as the interface between:
   a) User & Application b) Application & Hardware
   c) User & User d) Hardware & Hardware
4. Linux was created by:
   a) Elon Musk b) Steve Jobs
   c) Bill Gates d) Linus Torvalds
5. The attribute used to define a link destination is:
   a) src b) href
   c) link d) url
6. The OpenOffice software for working PowerPoint presentations is:
   a) PowerPoint b) Impress
   c) Excel d) Writer
7. In Microsoft Office, Excel is used to deal with spreadsheets and numerical data. In OpenOffice, _____ is used.
   a) Writer b) Calc
   c) Impress d) Base
8. The main difference between OpenOffice and Microsoft Office is:
   a) Microsoft Office is free
   b) OpenOffice cannot open MS Office files
   c) OpenOffice is free
   d) MS Office cannot open OpenOffice files

9. Information Security primarily deals with which of the following?
   a) Improving computer hardware performance
   b) Protecting information from unauthorized access
   c) Developing new programming languages
   d) Designing user interfaces
10. Phishing refers to which of the following?
   a) A method of encrypting data to protect it from hackers
   b) A type of online fraud where attackers pretend to be a trusted source
   c) A software used to detect viruses in computers
   d) A process of backing up data to cloud storage

B. Answer the following questions.

1. List and explain 2 specific uses of a web browser. **(2)**
2. Why is efficient use of search engines important?
   You want to find the exact information about *global warming effects on agriculture* on the internet from the United Nations website *www.un.org*.
   Write a Google search query using quotation marks and searching inside specific sites. **(3)**
3. What are the main differences between SSDs and HDDs. **(2)**
4. Explain the key services and benefits of any 2 Digital India Portals. **(2)**
5. Define the Unix Shell. List the main differences between Linux and Windows. **(3)**
6. List some key features of Vi editor. **(2)**
7. Explain the differences between the header element and the paragraph element with example. **(3)**
8. Explain div in HTML. What is its purpose? **(2)**
9. Explain OpenOffice software package and list out the main applications. Why is Open Office useful for students? **(3)**
10. Your class is organizing a program on "Annual Cultural Day".
    Your group must:
    i. Write a notice
    ii. Prepare your budget (how much you will spend)
    iii. Present ideas during the program

    Which softwares will you use for all the three tasks mentioned above? Explain each one in detail. **(3)**

11. Explain in detail the C.I.A triad along with real world examples for each. **(3)**

12. During online shopping, Lipok enters his card details on a random website he finds. Mention two best practices he should follow to ensure safe transactions. **(2)**

13. Explain the importance of Integrity in the CIA triad. **(2)**

C. Answer the following questions.

1. You are using the institute computer and your lecturer has instructed you to organize your assignment file properly before submission. Using the commands **mkdir**, **cd**, **cp**, **ls**, **pwd** and **rmdir,** you need to:
   i. Create a new directory called **Assignment1**
   ii. Move into that directory
   iii. Copy a file called report.txt into it
   iv. Check the contents of the directory
   v. Confirm your current location in the system
   iv. Delete an empty directory called **draft** **(4)**
2. What are elements in HTML? Explain any 3 elements. **(4)**
3. What are the different ways to insert CSS? Along with an example of an HTML and CSS website, explain any one. **(5)**
4. Create a simple HTML website about your institute and apply styling to it using an internal CSS. **(5)**

Marks Distribution

Q. No.	Chapter/Unit	Total Marks	Marks			C.O
			K	C	A	
A.1	Basic Internet Skills	11	1			C.O 1
A.2			1			
B.1			2			
B.2					3	
B.3				2		
B.4				2		
A.3	OS Installation (Linux & MS Windows)	11	1			C.O 2
A.4			1			
B.5			1	2		
B.6				2		
C.1					4	
A.5	HTML4 and CSS	20	1			C.O 3
B.7				3		
B.8				2		
C.2			4			
C.3					5	
C.4					5	
A.6	Office Tools	9	1			C.O 4
A.7			1			
A.8			1			
B.9				3		
B.10					3	
A.9	Information Security Basics	9	1			C.O 5
A.10			1			
B.11				3		
B.12					2	
B.13			2			

APPLIED PHYSICS - II

BS 104

Full Marks : 60 **SCTE/NGL/R-2026-II**

Pass Marks : 24

Time : 3 r

No.	Questions	Marks	CO
I (1)	Which of the following equation represents the correct relation for SHM? a. $\vec{F} = -k\,\vec{y}$ b. $\vec{F} = k\,\vec{y}$ c. $\vec{F} = -k/\,\vec{y}$ d. $\vec{F} = k + \vec{y}$	1	I
I (2)	When the object is placed at the centre of curvature C for a concave mirror, the image is formed: - a. at Infinity b. at F b. c. at C d. between F and C	1	II
I (3)	The SI unit of capacitance of a capacitor is: - a. Volt b. Pascal c. Ohms d. Farad	1	II
I (4)	The resistance of a conductor does not depend on which of the following: - a. Length b. cross-section are c. temperature d. density	1	III
I (5)	Which equation represents the correct Kirchoff's current law: - a. $\sum I = 0$ b. $\sum I_{in} = \sum I_{out}$ c. both a and b c. only a	1	III
I (6)	Which among the following is paramagnetic? a. Oxygen b. Copper c. Iron d. nickel	1	IV

I (7)	The energy band gap is maximum in which of the following: a. Metals b. insulators c. semi – conductors d. conductors	1	I
I (8)	The process of supplying energy to a medium to move electrons from a lower energy level to a higher energy level is called: a. Population inversion b. ionization potential c. pumping d. threshold reaction	1	V
II (1)	Define wave motion.	1	I
II (2)	State Snell's law of refraction of light.	1	II
II (3)	State Coulomb's law of electrostatics.	1	II
II (4)	Give the SI unit of electrical energy.	1	III
II (5)	State the principle of a moving coil galvanometer.	1	IV
II (6)	The magnetic field (B) of a magnet is incident normally on a given surface of area (A). What will be the value of the magnetic flux through the given area?	1	IV
II (7)	Draw the symbol of a p-n junction diode.	1	IV
II (8)	Give the full form of LASER.	1	V
III (1)	Define resonance. Give one application of resonance of waves.	2	I
III (2)	**(a)** A point charge of $+3.00 \times 10^{-6}$ C is 12.0 cm distant from a second point charge of -1.50×10^{-6} C. Calculate the magnitude of the force on each charge. OR	2	II

	(b) Three capacitors of 2 μF, 3 μF and 6μF capacitances have a net capacitance C_s in series combination and C_p in parallel combination. Calculate the ratio $\frac{C_s}{C_p}$.		
III (3)	Give two advantages of electrical energy over other forms of energy.	2	III
III (4)	Explain the colour coding of carbon resistors.	2	III
III (5)	Write any two properties of magnetic field lines of force.	2	IV
III (6)	Explain the conversion of Galvanometer into an ammeter.	2	IV
III (7)	State two applications of solar cells.	2	V
III (8)	Give two characteristics of He- Ne lasers.	2	V
IV (1)	Explain the different types of sound based on their frequencies.	3	I
IV (2)	**(a)**The amplitude and the time period in a simple harmonic motion are 0.5 cm and 0.2 s respectively. If the phase angle is π/3 rad, obtain the displacement equation of SHM. OR **(b)** A green laser pointer emits light with a wavelength of 532 nm. Given that the speed of light is approximately 3 x 10^8 m/s, calculate the frequency of light.	3	I
IV (3)	State the conditions for total internal reflection of light	3	II

IV (4)	Prove the Gauss's theorem.	3	II
V (1)	**(a)** If an object is 6 cm tall and its image is formed at 30 cm while it is placed at 15 cm in front of a convex lens, find the magnification and height of the image. OR **(b)** Draw the ray diagram of a compound microscope in normal adjustment.	4	II
V (2)	A heater of resistance 300 Ω is connected to the main supply for 30 mins. If 10 A current flows through the filament of the heater; then what is the heat produced in the heater?	4	III
V (3)	**(a)** Explain the use of p-n junction diode as a full wave rectifier. OR **(b)** Explain the distinction between conductors, insulators and semi – conductors based on the energy band in solids	4	IV
V (4)	Differentiate between spontaneous and stimulated emission.	4	III