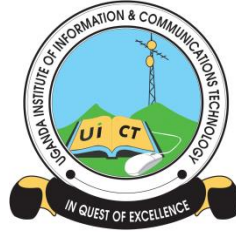


**UGANDA INSTITUTE OF
COMMUNICATIONS
END OF SEMESTER ONE**



**INFORMATION AND
TECHNOLOGY
EXAMINATIONS**

ACADEMIC YEAR 2022/2023

DEPARTMENT: ICT

SEMESTER: ONE

PROGRAMME(S): DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING (DEEE)

YEAR OF STUDY: ONE

COURSE: ENGINEERING MECHANICS

COURSE CODE : EMC111

DATE: FRIDAY 24TH, MARCH 2023

TIME: 2:00 PM – 5:00 PM

DURATION: 3 HOURS

INSTRUCTIONS:

- (i) This paper contains two Sections: A (40 marks) & B (60 marks).**
- (ii) Attempt ALL questions in Section A, and ONLY THREE questions in Section B.**
- (iii) All questions in Section B carry equal marks.**
- (iv) Credit will be given for use of relevant examples and illustrations.**
- (v) Begin each number in Section B on a new page of the answer sheet.**

PRINCIPLES OF MECHANICS

(vi) **DO NOT** write on this question paper.

SECTION A [40 MARKS]

Attempt **ALL** the Questions in this Section.

Question 1

Write the correct alternative in the answer booklet provided **(1 mark @)**

1. When brakes are applied in a vehicle, its kinetic energy is converted into
A) Potential energy B) Electrical energy C) Magnetic energy D) None
2. Internal friction is in case of
A) Stress B) Strain C) Modulus D) None
3. If a beam is subjected to a constant bending moment along its length , then the shear force will
A) Also have a constant value everywhere along its length
B) Be zero at all sections along the beam
C) Be maximum at the centre and zero at the ends
D) Zero at the centre and maximum at the ends
4. What is the bending moment at the end supports of a simply supported beam?
A) Maximum B) Minimum C) Zero D) Uniform
5. A cantilever is a beam whose
A) Both ends are supported either on rollers or hinges
B) One end is fixed and other end is free
C) Both ends are fixed
D) Whose both or one of the end has overhang
6. Following are the basic types of stress except
A) Tensile stress B) Compressive stress C) Shear stress D) Volumetric stress
7. Hooke's law is applicable within
A) Elastic limit B) Plastic limit C) Fracture point D) Ultimate strength
8. A continuous beam is one which has
A) One support B) Two supports C) Three supports D) None
9. Which type of friction causes wear and tear?
A) Static friction B) Dynamic friction C) Both (a) & (b) D) None

PRINCIPLES OF MECHANICS

10. Coefficient of friction (μ) in terms of angle of friction is equal to the

- A) $\sin \Phi$ B) $\cos \Phi$ C) $\tan \Phi$ D) None

11. Angle of friction is

- A) Less than the angle of repose B) Greater than the angle of repose
C) Equal to the angle of repose D) None

12. Compressive Strain is

- A) Increase in length/original length B) Decrease in length/original length
C) Change in volume/original volume D) All of the above

13. Which of the following material is more elastic?

- A) Rubber B) Glass C) Steel D) Wood

14. The property of a material by which it can be beaten or rolled into thin sheets, is called

- A) Elasticity B) Plasticity C) Ductility D) Malleability

15. The stress at which extension of a material takes place more quickly as compared to increase in load, is called

- A) No elastic zone B) Plastic point C) Yield point D) Breaking point

16. When a body is just ready to move, force of friction is

- A) Unlimited B) Limited C) Can't say D) None

17. In a simple supported beam having length = L and subjected to a concentrated load (W) at mid-point

- A) Maximum Bending moment = $WL/4$ at the mid-point
B) Maximum Bending moment = $WL/4$ at the end
C) Maximum Bending moment = $WL/8$ at the mid-point
D) Maximum Bending moment = $WL/8$ at the end

18. A beam is a structural member which is subjected to

- A) Axial tension or compression
B) Transverse loads and couples
C) Twisting moment
D) No load, but its axis should be horizontal and x-section rectangular or circular

19. The limiting force of friction depends upon

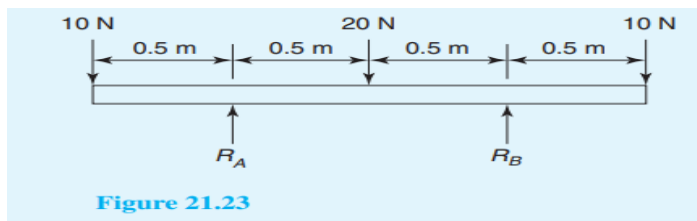
- A) Shape of surface B) Area of surface
C) Both area and shape of surface D) None

PRINCIPLES OF MECHANICS

20. When the bending moment is parabolic curve between two points, it indicates that there is
- A) No loading between the two points
 - B) Point loads between the two points
 - C) U.D.L. between the two points
 - D) Uniformly varying load between the two points
21. Young's Modulus of elasticity is
- A) Tensile stress/Tensile strain
 - B) Shear stress/Shear strain
 - C) Tensile stress / Shear strain
 - D) Shear stress/Tensile strain
22. A rod, 120cm long and of diameter 3.0 cm is subjected to an axial pull of 18 kN. The stress in N/mm^2 is.
- A) 22.57
 - B) 23.47
 - C) 24.57
 - D) 25.47
23. The statement : stress is proportional to strain holds good up to:
- A) Elastic Limit
 - B) Proportional Limit
 - C) Plastic Limit
 - D) Yield point
24. What is the unit of the Principal Stress and Principal strain
- A) N/mm^2 and mm
 - B) N and mm
 - C) N/mm and mm^2
 - D) N/mm^2 and No unit
25. Brittleness is opposite to
- A) Toughness
 - B) Plasticity
 - C) Malleability
 - D) None of these
26. Which of the following is a dimensionless quantity?
- A) Shear stress
 - B) Poisson's ratio
 - C) Strain
 - D) Both (b) and (c)
27. If a material has identical properties in all directions, it is called
- A) Elastic
 - B) Plastic
 - C) Isotropic
 - D) Homogeneous
28. The percentage elongation and the percentage reduction in area depends upon
- A) Tensile strength of the material
 - B) Ductility of the material
 - C) Toughness of the material
 - D) None of these
29. For a simply supported beam, loaded with point load, the B.M.D. will be
- A) A triangle
 - B) A parabolic curve
 - C) A cubic curve
 - D) None of these
30. A beam of uniform strength has
- A) Same cross-section throughout the beam
 - B) Same bending stress at every section
 - C) Same bending moment at every section
 - D) Same shear stress at every section
31. Which of the following does not relate to spark ignition engine?
- A) Spark plug
 - B) Carburetor
 - C) Fuel injector
 - D) Ignition coil

PRINCIPLES OF MECHANICS

32. Which is the most effective air cleaner in the case of diesel engines?
 A) Oil bath type B) whirl type C) wet type D) dry type
33. The stress which acts in a direction perpendicular to the area is called
 A) Shear stress B) thermal stress C) normal stress D) none
34. The resistance per unit area to deformation is
 A) modulus of elasticity B) stress C) strain D) shear strain
35. Hooke's law holds good up to
 A) Yield point B) limit of proportionality
 C) Breaking point D) elastic limit
36. The mechanical friction _____ with increase in speed.
 A) Reduces B) unpredictable C) increases D) none



37. With reference to Figure 21.23, the reaction R_A is:
 A) 2 N B) 20 C) 20 N D) 40 N
38. With reference to Figure 21.23, when moments are taken about R_A , the sum of the anticlockwise moments is:
 A) a) 25 Nm B) 20 Nm C) 35 Nm D) 30 Nm
39. With reference to Figure 21.23, which of the following statements is false?
 A) $(5 + R_B) = 25 \text{ Nm}$ B) $R_A = R_B$
 C) $(10 \times 0.5) = (10 \times 1) + (10 \times 1.5) + R_A$ D) $R_A + R_B = 40 \text{ N}$
40. A member which regains its original shape after removal of the load producing deformation is
 A) Plastic B) Elastic C) Rigid D) None

PRINCIPLES OF MECHANICS

SECTION B [60 MARKS]

Attempt **ONLY THREE** Questions in this Section.

Question 2

- a) State coulomb's laws of dry friction **(3 marks)**
- b) Draw a graph of frictional force against applied force and explain the relevant points **(4 marks)**
- c) Discuss the following terms **(6 marks)**
- i) Limiting friction
 - ii) Angle of friction
 - iii) Angle of repose
 - iv) Coefficient of friction
- d) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 metre from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. **(7 marks)**

Question 3

- a) Explain the two types of direct stress **(4 marks)**
- b) Discuss the following terms applied in engineering mechanics **(5 marks)**
- i) Plasticity
 - ii) Mass
 - iii) Fundamental units
 - iv) Compressive stress
 - v) Young's modulus
- c) With the help of a neat diagram, explain the stress-strain curve for brittle material **(4 marks)**
- d) The following results were obtained after carrying out a tensile test on a mild steel specimen **(7 marks)**

Load(kN)	0	10	23	32
Extension(mm)	0	0.023	0.053	0.074

Plot a graph of load against extension, and from the graph determine

- i) the load at an extension of 0.04 mm,
- ii) the extension corresponding to a load of 28 kN.

PRINCIPLES OF MECHANICS

Question 4

- a) State and draw **three** types of loads that a beam can be subjected to **(3 marks)**
- b) Explain the types of beams with neat diagrams **(5 marks)**
- c) A simply supported beam of length 6m carries a point load of 3kN and 6kN at distances 2m and 4m respectively from the left end. **(12 marks)**
 - i) Draw the shear force diagram for the beam
 - ii) Draw the bending moment diagram for the beam

Question 5

- a) State Varignon's Principle of moments **(1 mark)**
- b) Discuss the following two types of moments **(5 marks)**
 - i) Clock wise moments
 - ii) Anti clock wise moments
- c) Explain the three classifications of simple levers using neat diagrams and specific examples. **(9 marks)**
- d) Three forces of 2P, 3P and 4P act along the three sides of an equilateral triangle of side 100mm taken in order. Find the magnitude and position of the resultant force **(5 marks)**

Question 6

- a) Compare external combustion engines and internal combustion engines **(5 marks)**
- b) Explain the following terminologies used in IC engines **(5 marks)**
 - i) Piston Area (A)
 - ii) Stroke (L)
 - iii) Displacement volume (V_s)
 - iv) Clearance volume (V_c)
 - v) Compression ratio (r)
- c) Explain the principle of operation of a four stroke engine **(8 marks)**
- d) Give **two** advantages of four-stroke cycle engines **(2 marks)**