FEDERAL TECHNOLOGY OWERRI UNIVERSITY OF
2016 PHY 101 TEST
Answer all questions in the space provided
Take g as 10
Time allowed 60 mins

1a) List all the fundamental quantities used in physics and their corresponding fundamental unites.   ANS Pg 2
1b) Given that impulse is a product of force and time, find the dimension of impulse.

2a) If a vector a = i + 2j + 3k and another vector b= 2i -3j + 4k, find a-b   ANS Pg 11
2b) Find the angle between the two vectors A= 8i – 3j + 2k and B = 5i + 6j – 3k

3a) The position of a particle is given in meters by x = 9.75+1.5t³, where t is in s. Find the instantaneous acceleration at t=3s.
3b) What is the total time of flight of an object projected vertically upward with a speed of 40m/s ?   ans pg 22

4a) A missile was projected to hit a target 500m away. Calculate the angle of projection if the initial velocity was 100m/s. ans pg 53
4b) A simple pendulum of length 0.36m is displaced at an angle of 10° and released. Find the frequency of oscillation.   ans pg 86

5a) A 3kg object originally at rest in an inertial frame is subjected to a constant force of 4N for 10s, what is its final speed ? ans pg 81
5b) Find the centripetal acceleration of a particle at the tip of a fan blade having a radius of 5cm and rotating with a frequency of 16.67Hz ans pg 86

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FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF PHYSICAL SCIENCES: DEPARTMENT OF PHYSICS
HARMATTAN SEMESTER EXAMINATIONS,
2015/2016 SESSION
PHY 101 GENERAL *PHYSICS I*   Date: 10/05/16
MOBILE PHONES ARE NOT ALLOWED IN THE EXAMINATION HALL, WHETHER ON OR OFF

Instructions: Do all Do not detach the optical mark sheet (QMS) from the question paper. Fill lit your particulars on both the question paper and the QMS. Shade clearly (with pencil) the alphabet bearing your chosen answer on the answer sheet (OMS).

Some useful constants: Acceleration due to gravity, g, on earth = 9.8m/s^2.; Acceleration due to gravity, g, on the moon =1.7 m/s^2; Universal gravitational constant G. = 6 67 x 10^{-11} Nm/kg^2; Mass of the earth = 5.97 x 10^{24} kg; Radius of the earth =6.38 x 10^{-5} m.

1. A labourer pulls a truck of mass 75 kg along a horizontal surface with constant velocity. The coefficient of kinetic friction between the tyres and the ground is 0.1 and the angle between the applied force and the horizontal ground is 42°. What at the magnitude of the applied force? A. 75.0N B. 73.5N C. 90.7N D.59.5N E. 735 N   **ANS 59**

2. A body of mass 10kg slides down on a frictionless plane inclined at an angle of 60° to the horizontal. What is the normal reaction on the plane? A 831.7 N B.84.87 N C.490.0 N D 49 0 N E. 848.7 N   **ANS 59**

3. A block of mass 10 kg moves on a frictionless surface with a velocity of 10 m/s. When an external force acted on the particle the velocity of the block changed to 20 m/s. What is the work done on the particle? A. 1500 J B. 50 J C.150J D. 3 K J E.2kJ   **ANS 69**

4. A student dragging his table at a constant velocity of 10 m/s overcomes frictional force of 100N. Calculate the power developed by the student A. 10 W B.100W C.0.1 W D. 10 kW E 1 kW   **ANS 69**

5. The work-energy theorem states that work done on a moving object by an external agent is equal to the A. change in its kinetic energy. B. change in its potential energy. C. sum of its kinetic and potential energy. D. Difference between kinetic and potential energy. E. square of the total energy.   **ANS 69**

6. I f E = energy; F = force; P = power, t = time; v = velocity; and W = work; which of the following equations is/arc correct? (i) E=PW (ii)P=Et (iii) W= Pt (iv) P=Fv A. (i) only B. (i) and(ii) C. (i i i) only D. (iii) and (iv) E.(i), (ii), (iii) and (iv)   **ANS 69**

7. Which of the following statements is/are not correct about work done on an object by a force? (i) The force component perpendicular to the object's displacement does zero work. (ii) The force component along the object's displacement does work on the object (iii) The work done by the force depends on the path taken by the object (iv) The work done by the force on an object is equal to the potential energy of the object A. (i) only B. (ii) only C (iii) only D. (iv) only E. (iii) and (iv)   **ANS 69**

8. A ball of mass 0.1 kg is thrown vertically upward with an initial velocity of 80 m/s. Calculate the potential energy at its maximum height A. 8.16 J B. 326.5 J C.320J D. 32.65 J E. 653 J   **ANS 69**

9. A 15 g bullet travelling at 300 m/s strikes and is absorbed by a 75 kg stationary object, Find the speed with which the object moves off. A. 0.06 m/s B. 4.5 m/s C 75.12 m/s D. 0.2 m/s E. 0.05 m/s   **ANS 80**

10. In an elastic collision, which of these statements is true? A. The kinetic energy before collision equals the potential energy after collision. B. The total kinetic energy and total momentum are conserved C. Only the total energy is conserved. D. Only the total momentum is conserved. E. Nothing is conserved   **ANS 80**

11. A bullet of mass 50 g was fired on a wall with a velocity of 2000 m/s. if the bullet emerges on the other side of the wall with a velocity of 1500 m/s, calculate the impulse of the bullet on the wall. A. 100 Ns B. 75 Ns C. 175 Ns D. 25 Ns E. 50 Ns   **ANS 80**

12. [...] A. 500Ns B. 100 Ns C. 40 Ns D. 10 Ns E. 2.5 Ns   **ANS 80**

13. What is the kinetic energy lost If a 4 kg ball moving at 8 m/s made a perfectly inelastic collision with a stationary ball with a mass of 12kg? A.160J B.96J C 128J D. 32J E. 16J   **ANS 80**

14. A body of mass 2 kg makes an elastic collision with another at rest and continues to move in the original direction but with ¼ of its original speed. What is the mass of the struck body? A. 3 kg B. 62kg C. 6 kg D.7kg E.8kg   **ANS 80**

15. If a body is In stable equilibrium, a slight or general displacement of the body will tend to _____ • A. raise its centre of gravity B. lower its centre of gravity C. leave its centre of gravity unchanged D. increase its weight E. do nothing to the body   **ANS 76**

16. Which of the following is not a fundamental scalar quantity? A. Mass B. Altitude C. Displacement D.Temperature E. Time   **ANS 11**

17. Which of the following has the same dimension as pressure? A. Young's modulus B. Spring constant C. Mass D. Density E. force   **ANS 4**

18. In the gas equation $(P + a/V^2)(V-b) = RT$, what is the dimension of the constant 'a' ?   A. $ML^{-1}T^2$ B. ML^2T^3 C. ML^5T^{-2} D. $ML^{-2}T^3$ E. $M^2L^5T^3$ **ANS 4**

19. If a vector a=i + 2j - 3k and another vector b= 2i - 3J + 4k, find a-b. A. -i +5J- 7k B. -3i – 5j – 7k C. 3i – 5j – 7k D.-2i + 6J + I2k E. 2i - 6j- 12k   **ANS 11**

20. If D= -5i + 6J-3k and E. 7i+8j+4k, calculate DX E. A. 62j - 82k B. 48i – J - 82k C. -48i+62J +82k D.-48i + J + 82k E.48i -62J + 82k   **ANS 11**

21. If A.B= 0 and A≠0, B≠C. then A is _____ to B (i) orthogonal (ii) equal (iii) parallel. A. (i) only B.(ii)only C. (iii) only D. (i) and (ii) E. (i) and (iii)   **ANS 11**

22. At what respective values of x, y and z would the unit of force, the Newton, be dimensionally equivalent to $M^xL^yP^z$? A.-1,1,2 B. 1,2,-2 C.1,-1.2 D.-1,1,-2 E.1,1,-2   **ANS 11**

23. Given two vectors X= i+2j+4k and Y=2i – bj + 4 k, what is the value of b if X.Y= 0? A. 6 B. 2 C.4 D.9 E.1   **ANS 11**

24. A particle moves in the y-direction. If the motion is represented by y= (3 + 10t+t^2) m, what is its velocity after 10 seconds? A 10m/s B. 20 m/s C.l0 m/s D 40 m/s E.50 m/s   **ANS 22**

25 Which of the following is not true about the acceleration due to gravity, g, for a freely foiling body?   **ANS 22**
A. g does not depend on the mass of the falling body B. g depends on the value of R, the radius of the earth at the point In question C. g is greater at the poles than at the equator D The higher the altitude the smaller the acceleration due to gravity E. g depends on the velocity of the falling body

26, A ball is thrown vertically upward with a speed of 39.2 m/s. Find the elapsed time before the ball returns to its original position. A.4.0s B. 8.0s C. 2.0s D.392s E. 6.0 s   **ANS 22**

27. A palm fruit dropped to the ground from the top of a tree 45 m high. With what velocity does if reach the ground? A.450 m/s B.900m/s C. 0 m/s D.21 m/s E.30m/s   **ANS 23**

28. A bad is thrown vertically upwards with a velocity of 30 m/s. Determine the maximum height reached. A.48.22m B 49.33m C.50.87m D.900m E. 45.87 m   **ANS 23**

29. An object undergoes a constant acceleration after starring from rest and then travels 5 m in the first second. Determine how far it will go in the next 1 second. A. 5m B. 10 m C. 15 m D 20 m E. 25 m   **ANS 23**

30. A stone was projected to hit a target 250 m away. If the velocity of projection is 50 m/s, calculate the angle of projection. A. 19.26° B. 29.26° C 39.26° D. 49.26° E. 59.26°   **ANS 53**

31. A moving object is said to be in dynamic equilibrium **ANS 76**
A. it moves with zero velocity B. it moves with maximum velocity C it moves with lowest velocity D it moves with uniform velocity E. it moves with constant acceleration

32. A very light plank of 5 m length is supported at its ends by two ropes. A man weighing 800 N stands on the plank 2 m **ANS 76** from the right end. Find the tension in the two ropes. A. 0 N; 40 N B. 0N; 80N C. 0N: 800 N D.400N;400N E. 320N; 480 N

33. What weight placed 15 cm from the fulcrum will balance a 98 N weight, placed 12 cm from the fulcrum, in a system of a balanced uniform massless beam? A. 11.76 N B. 9.8 N C. 78.4 N D. 1.76 N E. 6.5 N **ANS 76**

34. Which of the following is correct about a body in stable equilibrium? A. Its PE is maximum. B. its PE is zero C. Its PE is infinite. D. Its PE is minimum. E. Its PE is variable. **ANS 76**

35. For a body in static equilibrium, the resultant of all the external forces acting on it is. A. maximum B. non-zero C. zero D. complex E. Infinite **ANS 76**

36. The line joining any planet and the sun sweeps out equal areas in equal lime intervals' is a statement of _. A. Kepler's first law B. Kepler's second law C. Kepler's third law D. Kepler's zcroth law E. Kepler's simple law **ANS 86**

37. Which of the following is an expression of Newton's law of universal gravitation for two masses M1 and M2 separated by a distance R? A. $F = GM1M2/R^2$ B. $F = G(M_1 - M_2)/R^2$ C. $F=GM_1M_2/R$ D. $F = G(M_1 + M_2)/R^2$ E. $F=M_1M_2/R^2$ **ANS 86**

38. A satellite is to be launched into space from the earth. Calculate the escape velocity A. 0.112×10^4m/s B. 11.2×10^4 m/s C.112×10^4 m/s D. 1.12×10^4 m/s E. 112m/s **ANS 86**

39. Which of these is/are truc? (I) The velocity of a satellite moving round the earth is $v=\sqrt{(GM)/R}$. (ii)The escape velocity can be expressed as $\sqrt{(2gR)}$. (iii) the earths period of revolution is 31.56×10^6 s. A. (i) only B. (i) and (ii) C. (i) and (iii) D. (ii) and (iii) E. (i), (ii) and (iii) **ANS 59**

40. What is the weight of an astronaut of mass 85 kg on the moon? A. 144.5 N B. 122.5 N C 12.5 N D. 14.5 N E. 55.5 **ANS 59**

41. Kepler's third law of planetary motion states that_____ A.$T\alpha R^2$ B.$T^2\alpha R^2$ C.$T^3\alpha R^3$ D $T^2\alpha R^3$ E.$T\alpha R$ **ANS 87**

42. Normal body temperature is 37°C. This is equivalent to A 320.5 K B. 120 °F C. 290 K. D. 98.6°F E. 227.2 K **ANS 91**
CHECK TEMPERATURE IN SMALL BOOKLET FOR THESE ANSWERS

43. According to the zeroth law of thermodynamics, if two bodies separately have the same mass with a third body then the two bodies are in thermal equilibrium'. A True B. False **ANS 91**

44. The major difference between heat and temperature is that_____
A. heat is a scalar quantity while temperature is a vector B. heat is a form of energy but temperature is a measure of heat content C. all matter has temperature but not all matter heat content D. heat can easily disappear but temperature does not change E. there is no difference between heat and temperature. **ANS 91**

45. What is the importance of a cold junction in a thermocouple ? A. A thermocouple cannot work without it B. it makes the hot junction not to overheat C. It keeps the entire environment cool D It makes the device more stable and accurate E. it makes the device to look neat. **ANS 91**

46. The maximum height of a projectile can be correctly described from the equation A.$(u^2sin^2\theta)/g$ B. $(2usin\theta)/g$ C. $(u^2sin2\theta)/g$ D. $(u^2sin^2\theta)/g$ E. $(2usin^2\theta)/g$ **ANS 53**

47. A stone of mass 100 g is whirled in a circular path of radius R = 2 m with a constant speed of 3 m/s. Find the centripetal acceleration of the stone. A. 5.5 m/s² B.4.5 m/s² C.6.0 m/s² D.9.0 m/s² E. 0.6m/s² **ANS 87**

48. A motorcyclist speeds off on top of a cliff 50 m above level ground. How fast must his motorcycle leave the cliff top to land on the level ground below, 90 m from the base of the cliff? (Ignore air resistance.) A. 28.2 m/s B. 34.6 m/s C 28.3 m/s D. 20.0 m/s E. 18.2 m/s **ANS 53**

49. The velocity of a 0.5kg mass attached to a spring is 2.8sin(1.75t). Calculate the total energy of the system. A.3.92J B. 2.45J C. 3.84J D. 1.96J E. 0.70J **ANS 92**

50. A force of 800 N stretches a spring a distance of 0.1 m. What is the potential energy of the spring when it is stretched additional 0.2m? A.40J B.80J C. 120J D.160J E.200J **ANS 92**

51. A particle of mass 2 kg is simultaneously subjected to two forces: F1 = 2i – 4j and F2 = 2i + 4j. Find its acceleration A. i m/s² B. 2i m/s² C. 1 m/s² D. 2 m/s² E.4 m/s² **ANS 59**

52. A force of 10N acts on a body of mass 2 kg for 0.5 s. What is the change in momentum? A 10 Ns B.5Ns C.9.8 Ns D. 100 Ns E. 500 Ns **ANS 80**

53. Which of the following is the equation for the weight W of an object of mass m on the floor of an elevator accelerating upward with an acceleration a? A. W = m(g - a) B.W=m(g + a) C. W= ma D. W = m(2g + a) E. W= m (g + 2a) **ANS 59**

54. Which of the following statements about inertia is/are correct? (i) The inertia of a body wants the body to keep moving if in motion. (ii) The inertia of a body wants the body to move if at rest. (iii)The inertia of a body and its weight are interchangeable A. (i) only B (i)and(ii) C. (ii) only D. (ii) and (iii) E. (i), (ii) and (iii) **ANS 80**

55. A bend on a road has a radius of 50 m and a banking angle of 15° on the bend. What is the maximum safe speed for a car on that portion of the road? A. 12.3 m/s B 11.5 m/s C. 10.5 m/s D. 15.0 m/s E.9.7 m/s **ANS 87**

56. A body has a mass o f 2 kg. Calculate the force which acts on this body to produce a velocity of 6 m/s in a time of 12 s. A. 0.5 N B.1.0N C. 3.5 N D. 2.0N E. 4.0 N **ANS 81**

57. A wooden block placed on an inclined plane just starts sliding when the plane is at an angle of 30° to the horizontal The coefficient of static friction of the system is____ A. 0.28 B. 0.58 C . 0.50 D. 0.68 E. 0.82 **ANS 59**

58. A 40 kg mass rests on a smooth plane inclined at 60° to the horizontal. What force holds it from sliding down the plane? A.346.4N B.- 320.96 N C 128.02 N D. -0.98 N E. 240.0 N **ANS 60**

59. A force of 2 N is just enough to set a wooden block of mass 400g in motion on an inclined plane. Calculate the angle of inclination of the plane A. 30.7° B. 11.8° C.27.0° D. 59.3° E. 47.2° **ANS 60**

60. One of the following is not a law of solid friction. A Frictional force is directly proportional to normal reaction. B. Frictional force does not depend on the area of surfaces in contact. C Frictional force depends on the nature of the surfaces in contact D. Friction opposes motion. E. Friction depends on the relative velocity between the surfaces in contact. **ANS 60**

STATICS
2016 QUESTS.

UNITS 4 QUEST.

VECT 4 QUEST.

KINE 7 QUEST.

PROJ 2 QUEST.

DYN 9 QUEST.

WORK 6 QUEST.

EQUI 5 QUEST.

MOM 9 QUEST.

CIRC 8 QUEST.

SHM 1 QUEST.

TEMP 4 QUEST