APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code:BE100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100		Duration: 3 Hours

PART A (ANSWER ALL QUESTIONS: 8 X 5 = 40 MARKS)

1		Statement Proof	(2) (3)	(5)
2		Work done (equation) Position vector 2i+9j+2k Result 42 units	(2) (2) (1)	(5)
3		Sketches (2) Analysis showing equations (3).		(5)
4	a)	Two theorems	(2x1.5)	(3)
	b)	Volume generated is sphere Volume = $(\pi r^2/2)x\ 2\pi y$ where $y = 4r/3\pi$ $V = (4/3)\pi r^3$	(1) (1)	(2)
5		Definition of SHM Equation Derivation for acceleration= $\omega^2 x$	(3) (1) (1)	(5)
6		Statement (2 marks) Explanation with sketches (3)		(5)
7		Stiffness(1.5 mark)and equivalent stiffness of spring (1.5). Expression for equivalent stiffness of spring in series (1) and parallel (1)		(5)
8		When the lift moves upward, R=W[1 + a/g] R= 841.74 N When the lift moves downward, R=W[1 - a/g] R= 658.26 N	(2) (0.5) (2) (0.5)	(5)

PART B

SET 1

(ANSWER ANY 2 QUESTIONS : 2 X 10 = 20 MARKS

9	a)	Free Body Diagram Lamis theorem or resolution method R_A=26.9 N; R_B=21.96 N	(1) (1) (1)	(3)
	b)	∑Fx= 106.07 N ∑Fy=93.93 N ∑M about A=424.26Nm Resultant R=141.68 N angle with hor =41.52° Perpendicular distance from A = 2.99m or	(3) (2)	(7)

		horizontal distance from A to resultant = 3.99m Shown in figure	(1) (1)	
10		Co ordinates of A(0,0,-4), B(0,2,0) C(0,0,4) O(3,0,0) Unit vector in the direction of OA,OB,OC Force vectors in the direction of OA,OB,OC Force along OA= 12.5 KN(C) along OB=18.03 kN(T) along OC =12.5 kN (C)	(1) (3) (3) (1) (1) (1)	(10)
11	a)	Equations of Equilibrium R_B=153.75 N; R_A=161.25 N	(2) (2)	(4)
	b)	Definition(1) characteristics (3) Resolution (2)		(6)
		SET II **(ANSWER ANY 2 QUESTIONS : 2 X 10 = 20 MARKS**		
12		Sketch with forces acting --- Equations ∑H, ∑V(1 each) and ∑M (2) Reaction between wall and ladder= 501 N Reaction between floor and ladder = 955N Least force ..= 167 N	(2) (4) (1) (1) (2)	(10)
13	a)	Principal axes and principal moment of inertia		(4)
	b)	Centroid from bottom and left end (X,Y) =(2.91, 5.09) cms I_{GXX}= 273.23cm^4……	(3) (3)	(6)
14	a)	Product of inertia of rectangle = 12.96x10^6 mm^4 Product of inertia of triangle = 10.8x10^6 mm^4 Product of inertia of trapezium = 23.76x10^6 mm^4	(2) (2) (1)	(5)
	b)	Sketch showing the virtual work concept – Equations Reactions at the left support = 6.83 kN Reaction at right support =6.16kN	(2) (2) (0.5) (0.5)	(5)
		SET 111 **(ANSWER ANY 2 QUESTIONS : 2 X 10 = 20 MARKS**		

15	a)	Translation Rotation	(2) (2)	(4)
	b)	sketch- Equation for V_P- Equation for V_Q- V_Q = 8.66 m/s ω= 10 rad/s, V_M = 5 m/s (When 'M' is midpoint of link PQ), *Marks may be given for selecting any position of 'M' in the link*	(1) (1) (1) (1) (1) (1)	(6)
16		n= 86400 dn/n = - ½ dL/L L=994 mm dL=3.68 mm When g= 9.81 m/s^2, dg= 0.02 m/s^2 (1) dn/n = ½ dg/g dn= 88.06 s pendulum will lose 88.06 seconds a day	(1) (1) (2) (2) (1) (1) (1)	(10)
17		Stiffness=66.67 N/mm Period=0.205 s Frequency=4.87 vib/s Angular velocity=30.55 rad/s Velocity=-24.62 cm/s	(2) (2) (2) (2) (2)	(10)
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