Scheme of Valuation/Answer Key

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

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

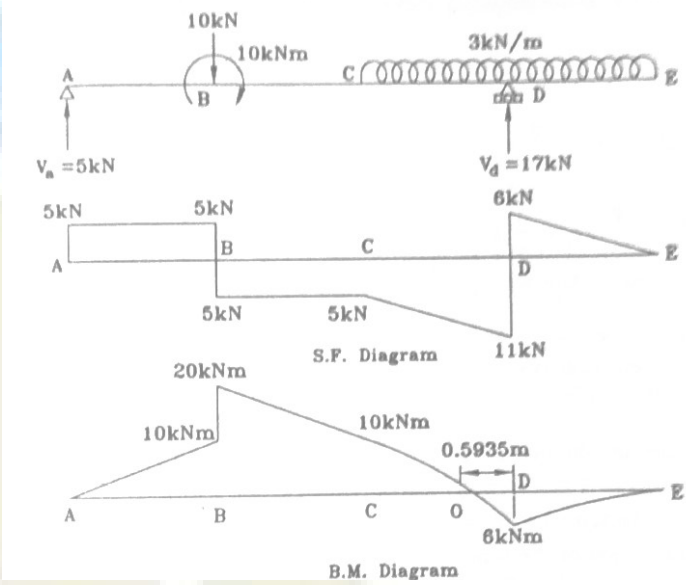
Course Code: ME201

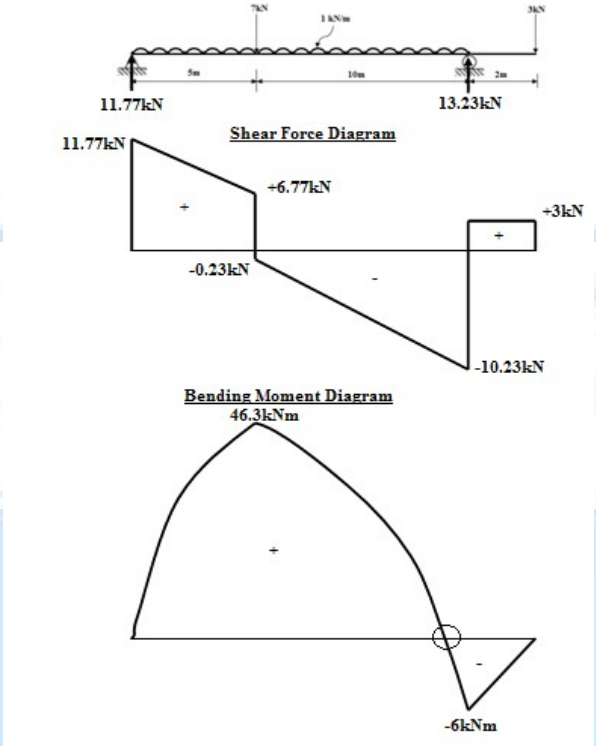
Course Name: MECHANICS OF SOLIDS (ME,MP,MA,MT,AU,PE,SF)

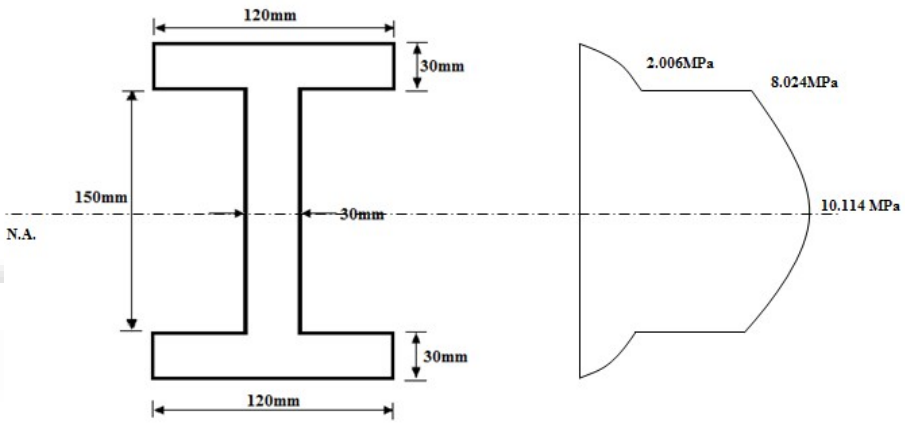
Max. Marks: 100 | Duration: 3 Hours

PART A

		Answer any three full questions, each carries 10marks	Marks
1	a)	Stress-strain diagram for mild steel ----- 2 Marks Explanation of salient points ---------- 3 Marks	(5)
	b)	Total Load = 15000N ---------- 1 Mark $P = 2P_b + P_s$ ---------- 1 Mark $P_s = 2P_b$ ---------- 1 Mark $P_b = 3750N$; $P_s = 7500N$ ------- 1 Mark $\delta l_s = \delta l_b = \frac{PL}{AE} = 1.125mm$ -------1 Mark	(5)
2	a)	Definition of Strain Energy ---------- 2 Marks Explanation ---------- 1 Marks	(3)
	b)	Determination of Stresses (i) $\sigma_s = 352$ MPa; $\sigma_b = 88$ MPa ----------3 Marks	(7)

		(ii) σ_s = 259.7 MPa; σ_b = 64.92 MPa ----------4 Marks	
3		Determination of stress values (80MPa, -160MPa,128MPa) ---------- 3 Marks Determination of Volumetric Strain 0.0000923 ---------- 2 Marks Change in Volume =14.423mm^3 ---------- 1 Mark New load to replace 1MN = 1.3MN (compressive) ---------- 2 Marks Change in load required = 0.3MN ---------- 2 Marks	(10)
4	a)	Definition of Torsional Rigidity ----------2 Marks	(2)
	b)	θ=0.087 radians ----------1 Mark T = 119.36 Nm ----------2 Marks Estimation of d from $\frac{T}{J} = \frac{G\theta}{L}$; d = 26.9mm ----------2 Marks $\frac{T}{J} = \frac{\tau_{max}}{\frac{d}{2}}$; d = 29mm ----------2 Marks Finalisation of diameter, d = 29mm ----------1 Marks	(8)
		PART B	
		Answer any three full questions, each carries 10marks	
5		 Estimation of support Reactions ----------1 Mark Shear Force Diagram ----------4 Marks Bending Moment Diagram ----------4 Marks Maximum Bendign Moment = 20kNm(sagging) ---------1 Mark	(10)
6	a)	Definition of Point of Contra flexure -------- 2 Marks	(2)

	b)	 Determination of Reaction forces ----------1 Mark Shear Force Diagram ----------3 Marks Bending Moment Diagram ----------3 Marks Point of contraflexure =0.604m left of roller support ----------1 Mark	(8)
7	a)	Derivation of Equation for Theory of Pure Bending $(\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R})$----- 6 Marks	(6)
	b)	Breadth , b = 288.68mm --------2 Marks Height, h = 408.25 mm----------2 Marks	(4)
8	a)	Derivation of equation for shear stress distribution of Rectangular cross-section $(\tau = \frac{3F(d^2-4y^2)}{2bd^3})$---------- 2 Marks Derivation of equation for maximum shear stress of Rectangular cross-section $(\tau_{max} = \frac{3F}{2bd})$---------- 2 Marks	(4)

	b)	 Finding Values of Shear stresses ----------3 Marks Shear stress distribution diagram ----------3 Marks	(6)
		PART C	
		Answer any four full questions, each carries 10marks.	
9		Moment Equation ---------- 1 Mark Slope Equation ---------- 1 Mark Deflection Equation ------- 1 Mark Determination of integration constant ----------2 Marks Deflection under 5kN load = 17.1mm ----------1 Mark Deflection under 15kN load = 26.85mm ----------1 Mark Position of maximum deflection = 2.327m from left end----------2 Marks Maximum deflection = 27.49mm ------1 Mark	(10)
10	a)	Moment Equation ---------- 1 Mark Slope Equation ---------- 1 Mark Deflection Equation ------- 1 Mark Slope at supports, $\theta = \frac{Wl^2}{16EI}$ ---------- 1.5 Marks Deflection at midspan, $y_{max} = \frac{Wl^3}{48EI}$ ----------1.5 Marks	(6)
	b)	Plane stress condition (definition) ----------1 Mark Example for plane stress problem ----------1 Mark Plane strain condition (definition) ----------1 Mark Example for plane strain problem ----------1 Mark	(4)
11		Maximum Principal stress =66.177MPa (tensile) ---------- 2 Marks Minimum Principal stress =41.177MPa (compressive) ---------- 2 Marks Maximum shear stress = 53.677 MPa ---------- 2 Marks	(10)

		Principal Planes = 13.879°, 103.879° ----------2 Marks Planes of maximum shear = 58.879°, 148.879°----------2 Marks	
12		Mohr's Circle ----------7 Marks Maximum Principal stress =132.6MPa (tensile) ---------- 1 Mark Minimum Principal stress =47.4MPa (tensile) ---------- 1 Mark Maximum shear stress = 42.6MPa ---------- 1 Mark	(10)
13	a)	Derivation for equivalent bending moment $M_e = \frac{M}{2} + \frac{1}{2}\sqrt{M^2 + T^2}$ ----------4 Marks Derivation for equivalent Torque $T_e = \sqrt{M^2 + T^2}$ ----------4 Marks	(8)
	b)	Slenderness ratio definition ----------2 Marks	(2)
14		Determination of centroid = 60mm,95mm ---------- 1 Mark Determination of $I_{min} = I_{yy} = 2960000mm^4$----------4 Marks Effective length = 4000mm ----------1 Mark Euler's crippling load, $P_{cr} = \frac{\pi^2 E I_{min}}{l_e^2}$= 365175.36 N ----------4 Marks	(10)
Note:- Marks maybe awarded accordingly to other alternative methods/approaches unless a particular method is specified. ****			

Question Paper Pattern

Total marks: 100, Time: 3 hrs
The question paper should consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.