



# MANIPAL INSTITUTE OF TECHNOLOGY

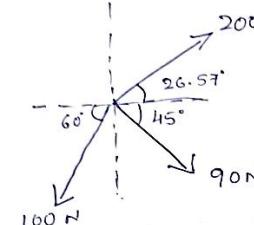
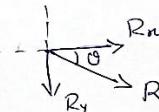
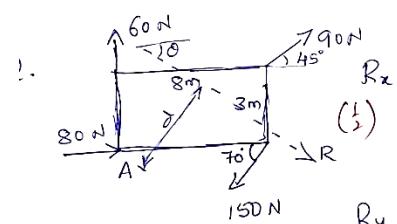
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## DEPARTMENT OF CIVIL ENGINEERING

MID-TERM EXAMINATION		MARCH 2025	
Level	B.Tech	Curriculum	2024
Program Name		Course Type	CORE
Course Name	ENGINEERING MECHANICS AND SMART BUILDINGS	Course Code	[CIE 1072]
Semester	II	Max Marks	30
Date	06/03/2025	Duration	90 MIN

### Answer Scheme

Q. No.	Answer/solution	Marks
Q1	 $R_x = 200 \cos 26.57^\circ + 90 \cos 45^\circ + (-100 \cos 60^\circ)$ $= 192.52 \text{ N } (\rightarrow) (1)$ $R_y = 200 \sin 26.57^\circ - 90 \sin 45^\circ - 100 \sin 60^\circ$ $= 60.78 \text{ N } (\downarrow) (1)$ $R = \sqrt{R_x^2 + R_y^2}$ $\theta = \tan^{-1} \frac{R_y}{R_x}$ 	3
Q2	 $R_x = 90 \cos 45^\circ - 150 \cos 70^\circ + 80$ $= 92.34 \text{ N } (\rightarrow) (1/2)$ $R_y = 90 \sin 45^\circ - 150 \sin 70^\circ + 60$ $= 17.31 \text{ N } (\downarrow) (1/2)$ $R = \sqrt{R_x^2 + R_y^2}$ $\theta = \tan^{-1} \frac{R_y}{R_x}$ $M_n = 90 \cos 45^\circ (3) - 90 \sin 45^\circ (8) + 150 \sin 70^\circ (8)$ $= 809.43 \text{ N-m} (2) \quad (1)$ $d = 8.62 \text{ m}$	3



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	<p>3.</p> $\sum F_x = 0; F \cos \theta + 200 \cos 60^\circ - 800 \sin 30^\circ + 400 \sin 75^\circ = 0$ $F \cos \theta = -86.37 \text{ kN} \quad (1)$	
Q3	$\sum F_y = 0; F \sin \theta + 200 \sin 60^\circ + 800 \cos 30^\circ - 400 \cos 75^\circ = 0$ $F \sin \theta = -762.5 \text{ kN} \quad (1)$ $\theta = \frac{83.54^\circ}{(1/2)} \quad \& \quad F = \frac{762.5}{(1/2)} \text{ kN}$	3
Q4	$H_B = 2 \cos 50^\circ = 1.29 \text{ kN} \quad (\leftarrow) \quad (1/2)$ $V_B = 4(2) + 2 \sin 50^\circ = 9.53 \text{ kN} \quad (\uparrow) \quad (1)$ $M_B = 4(2)(2) + \frac{2(4)}{\sin 50^\circ} = 22.13 \text{ kNm} \quad (2) \quad (1)$	3
Q5	<p>5.</p> <p>FBD for block</p> <p>FBD for wedge</p>	3
Q6	<p>(i) Air dampers: Allow or curtail the flow either from exhaust, outside air, or return air. It is required to control the mixing of outside air or to send the inside air through exhaust.</p>	3



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	<p>(ii) Temperature and Humidity Sensors: These sensors are used to check the concerned parameters of return air from room to re-processing at AHU or after processing of the air, just before supply of chilled/hot air to room as per requirement.</p> <p>(iii) Return fan: This helps in clearing the inside air at variable speeds. In the case of the temperature to be changed quickly (lowered or raised) inside the room, this fan helps to clear the inside air through suction and allows processed air for circulation.</p> <p>(iv) Mixing Chamber: Mixing chamber generally has cooling of heating coils so that mixing of return air/outside air is done before delivered into the room with the set temperature.</p> <p>(v) Supply fan: This is also important fan just like return fan. This fan with its variable speed can deliver the required temperature air through its varied air flow.</p> <p>(vi) Filters: Filters play an important role in supplying clean air to mixing unit when is drawn from outside as well as the return air from room, thereby maintaining the clean air environment inside.</p>	0.5 Marks each
<b>Q7</b>	<p>The smart lighting and fire alarm system are interlinked and plays a major role in the case of fire incident.</p> <p>When the power is cut-off for safety, the smart lighting should ensure the emergency lighting through other circuit.</p> <p>It should ensure and activate this parallel system in case fire alarm from a zone is activated.</p> <p>It should also ensure the lighting of other zones without disturbing the operation. Hence, all exit boards and floor lighting lines should be connected to fire alarm system.</p>	3
<b>Q8</b>	<p>Figure 1 mark</p>	3



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	<p>The server or host computer <b>houses the operating parameters</b> and the <b>database</b> for the access control system. The host computer is networked and <b>communicates</b> with the <b>control panels</b> which collect data on events and alarms from peripheral devices.</p> <p>Control panels are usually <b>enclosed with printed circuit boards</b> with connections to all peripheral devices in their area. These peripheral devices may include door hardware (such as a card reader, door position switch, or door strike) and other inputs and relays as required.</p> <p>The control panel manages the peripheral devices and communicates between the host computer and the peripheral devices.</p>	Explanation 2 marks
<b>Q9</b>	<p>The traditional TV has broadcasting only. Whereas the IPTV's major facility like VoD, live TV and time shifted media makes it unique.</p> <p>VoD supplies the content to the user from the already stored media library on an individual view basis.</p> <p>Time shifted media allows the user to pause, replay and rewind the LIVE content at the user's pace.</p> <p>Live TV is similar to broadcast TV, but it is on IPTV through the internet. The user can watch live shows/ sports through the internet even in mobile handsets.</p>	3
<b>Q10</b>	<p>A Venn diagram illustrating the overlap between Green Buildings and Smart Buildings. The left circle, labeled "Green Buildings", contains: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation and Design Process. The right circle, labeled "Smart Buildings", contains: Data Network, VoIP, Video Distribution, Audio Visual Systems, Video Surveillance, Access Control, HVAC Control, Power Management, Programmable Lighting Control, Facilities Management, Cabling Infrastructure, Wireless Systems. The intersection of the two circles contains: Optimize Energy Performance, Additional Commissioning, Measurement and Verification, Carbon Dioxide (CO<sub>2</sub>) Monitoring, Controllability of Systems, Permanent Monitoring Systems, Innovation in Design.</p> <p>Refer: <i>Smart building systems for Architects, owners and builders</i>, Elsevier, Butterworth-Heinemann Publications, 2010</p>	3