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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Thermal Engineering

(Department of Mechanical Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) Write one difference between SI and CI engine.	1M	1	2
	ii) What is compression ratio?	1M	1	1
	iii) Write the function of carburetor.	1M	2	2
	iv) What is ignition delay in a CI engine?	1M	2	1
	v) Define specific fuel consumption.	1M	3	2
	vi) What is heat balance sheet?	1M	3	1
	vii) State the use of compressed air in engineering	1M	4	1
	viii) Describe intercooling.	1M	4	2
	ix) What is a convergent-divergent nozzle?	1M	5	1
	x) Draw the P-V diagram of Brayton cycle	1M	5	1
2(A)	(i) Sketch and explain the working for four stroke SI Engine.	6M	1	2
	(ii) Sketch and explain the valve timing diagram for 4 stroke CI engine.	6M	1	2
OR				
2(B)	Summarize the important basic components of an IC engine? Explain them briefly.	12M	1	2
3(A)	Describe with suitable sketches the combustion phenomenon in S.I engines.	12M	2	2
OR				
3(B)	Explain the Battery ignition system with a neat sketch. List out its advantages and disadvantages.	12M	2	2
4(A)	Following observations were made during the test on a single cylinder oil engine Bore = 300mm, I.M.E.P = 6 bar, brake rope dia = 2cm, Stroke = 450mm, Net brake load = 1.5KN, speed = 300rpm, Brake drum dia = 1.8m calculate a) I.P b) B.P c) Mech. Efficiency	12M	3	3
OR				
4(B)	Explain the methods used to measure fuel consumption, air intake, and exhaust gas composition during engine performance testing.	12M	3	2
5(A)	(i) With neat sketch, explain the working of Roots blower compressor.	6M	4	2
	(ii) Explain multi stage compression.	6M	4	2
OR				
5(B)	A single stage, single acting reciprocating air compressor has a bore of 0.2 m and stroke of 0.3 m. It receives air at 1 bar and 293 K and delivers it at 5.5 bar. If the compression follows the law $pV^{1.3} = \text{constant}$ and clearance volume is 5% of the stroke volume, Determine the mean effective pressure and the power required to drive the compressor, if it runs at 500 rpm	12M	4	3
6(A)	In a steam nozzle steam expands from 4 bar to 1 bar. The initial velocity of steam is 60 m/s and the initial temperature is 200°C. Determine the exit velocity if the nozzle efficiency is 92%.	12M	5	3
OR				
6(B)	Describe briefly with the help of neat sketches about various methods employed for improvement of thermal efficiency of an open cycle gas turbine plant.	12M	5	2

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026**CAD/CAM**

(Department of Mechanical Engineering)

Time: 3Hrs**Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) Mention any two basic techniques used in computer graphics.	1	1	1
	ii) Write about CAD/CAM application in industries	1	1	2
	iii) Define parametric curve.	1	2	1
	iv) In what way ruled surface is helpful in modelling	1	2	2
	v) State one advantage of CNC.	1	3	1
	vi) Write the full form of ATC and APC in CNC	1	3	1
	vii) What is CNC programming?	1	4	1
	viii) Define Manual and computer aided Part programming	1	4	1
	ix) Write the scopes of Industry 4.0	1	5	2
	x) Define JIT.	1	5	1
2(A)	(i) Explain geometric transformations used in computer graphics.(Any three)	6	1	2
	(ii) Describe raster scan and random scan techniques.	6	1	2
OR				
2(B)	Detailed the importance of CAD/CAM in Industries and its hardware	12	1	2
3(A)	(i) Describe Bezier curves with properties.	6	2	2
	(ii) Compare CSG and B-Rep methods of solid modeling.	6	2	4
OR				
3(B)	Sketch and explain Hermite cubic spline.	12	2	3
4(A)	(i) Explain Automatic Tool Changer (ATC).	6	3	2
	(ii) Explain the basic components of a CNC machine.	6	3	2
OR				
4(B)	Discuss on NC, CNC and DNC system. Explain briefly with suitable diagram.	12	3	2
5(A)	(i) Write short notes on Machine zero home position	6	4	2
	(ii) Explain manual CNC part programming.	6	4	3
OR				
5(B)	Discuss the miscellaneous functions codes in part programing. Explain minimum 10 codes along with their function.	12	4	3
6(A)	(i) Discuss lean, agile, and sustainable manufacturing.	6	5	2
	(ii) Explain about group technology in FMS.	6	5	2
OR				
6(B)	Write a short note on	12	5	2
	• Industry 1.0			
	• Industry 2.0			
	• Industry 3.0			
	• Industry 4.0			

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Design of Machine Elements
(Department of Mechanical Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) Define machine design.	1	1	1
	ii) What are the different factors affecting the selection of engineering materials?	1	1	1
	iii) State the Maximum Normal Stress Theory.	1	2	1
	iv) Explain the endurance limit.	1	2	1
	v) List the different types of lap joint in terms of rivets.	1	3	1
	vi) Mention the three failure modes while designing the sleeve and cotter joint.	1	3	1
	vii) What is a welded joint?	1	4	1
	viii) Mention the different criteria to design a shaft.	1	4	1
	ix) List different types of springs.	1	5	1
	x) Write the expression for deflection of a helical spring.	1	5	1
2(A)	Explain the different steps involved in the design process with a neat flow diagram.	12	1	2
OR				
2(B)	A solid shaft of 32 mm diameter is subjected to a twisting moment of 123 N-m; simultaneously, it is subjected to an axial thrust of 11 kN and a bending moment of 79 N-m. Calculate the maximum compressive stress and maximum shear stress.	12	1	3
3(A)	Utilize the concept of failure theories to explain the following with neat diagrams: (1) Maximum principal stress theory (2) Maximum shear stress theory (3) Maximum principal strain theory (4) Distortion energy theory.	12	2	3
OR				
3(B)	A machine component is subjected to a flexural stress which fluctuates between +250 MN/m ² and -125 MN/m ² . Determine the value of minimum ultimate strength according to: (1) Goodman relation (2) Soderberg relation. Take yield strength = 0.55 × ultimate strength; endurance strength = 0.5 × ultimate strength; factor of safety = 2.	12	2	3
4(A)	Apply the concept of failure mechanisms to design a riveted joint for each failure mode with neat diagrams and mathematical expressions.	12	3	3
OR				
4(B)	A single riveted lap joint of 5 mm thickness plate with 18 mm diameter rivets having a pitch of 40 mm. Find the efficiency of the riveted joint. Given: permissible tensile stress in plate = 110 MPa,	12	3	3

permissible shearing stress in rivets = 85 MPa, permissible crushing stress in rivets = 170 MPa.

5(A)	Analyze the welded joint and describe the advantages and disadvantages over riveted joints. Also, explain the different types of welded joints with neat diagrams.	12	4	4
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OR

5(B)	A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of steel with ultimate tensile stress of 700 MPa and ultimate shear stress of 500 MPa. Assuming a factor of safety of 6, determine the diameter of the shaft.	12	4	4
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6(A)	Examine the factors associated with design considerations for a gear drive. Also, describe the selection criteria for gear materials with suitable examples.	12	5	4
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OR

6(B)	Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using a spring index of 5. The maximum permissible shear stress is 420 MPa and modulus of rigidity is 84 kN/mm ² . Take Wahl's correction factor $K = (4C-1)/(4C-4) + 0.615/C$, where C = spring index.	12	5	4
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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026**Metrology and Measurements**

(Department of Mechanical Engineering)

Time: 3Hrs**Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) Define measurand and comparator	1	1	1
	ii) Discuss the need for inspection	1	1	1
	iii) Give a classification of callipers	1	2	1
	iv) Why slip gauges are called 'Johansson gauges'?	1	2	1
	v) Differentiate between two- and three-wire methods.	1	3	1
	vi) Give the classification of thread gauges.	1	3	1
	vii) What is meant by gauge factor?	1	4	1
	viii) Define Mechanical strain gauges.	1	4	1
	ix) What are the limitations of a thermistor?	1	5	1
	x) Classify pressure measuring devices	1	5	1
2(A)	Explain the working principle of a Sigma electronic comparator.	12	1	2
	OR			
2(B)	Discuss the functional and metrological features of pneumatic comparators	12	1	1
3(A)	Distinguish between primary, secondary, tertiary, and working standards.	12	2	1
	OR			
3(B)	Define the following terms: (a) Basic size (b) Zeroline (c) Tolerance zone	12	2	2
4(A)	With the help of an illustration, explain the following terms: roughness, waviness, lay, and flaws.	12	3	2
	OR			
4(B)	Discuss the important applications of a toolmakers microscope.	12	3	2
5(A)	Distinguish between the following: (a) Active and passive transducers (b) Transducers and inverse transducers	12	4	2
	OR			
5(B)	Explain the determination of force using a load cell with a neat sketch for industrial applications.	12	4	2
6(A)	With a neat diagram, explain the relationship between absolute, gauge, and barometric pressures.	12	5	2
	OR			
6(B)	Explain the construction and working of an optical pyrometer with a suitable diagram.	12	5	2

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Renewable Energy Systems
(Department of Mechanical Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) State one advantage of a renewable energy source.	1	1	1
	ii) Define primary energy source.	1	1	1
	iii) What is the role of absorber plate in solar thermal collector.	1	2	1
	iv) Mention one application of a flat plate collector.	1	2	1
	v) Write any one Wind characteristics.	1	3	1
	vi) Name any one component in HAWT.	1	3	1
	vii) What is one common challenge in storing hydrogen safely?	1	4	1
	viii) What does PEMFC stand for?	1	4	1
	ix) State one advantages of OTEC system.	1	5	1
	x) Write one application of MHD power generation.	1	5	1
2(A)	(i) Briefly explain working of a binary cycle power generation system with the help of a neat schematic diagram.	8	1	2
	(ii) Mention different characteristics of renewable energy sources.	4	1	2
OR				
2(B)	Describe the role of government policies, incentives and international cooperation in promoting renewable energy.	12	1	2
3(A)	(i) Discuss the working of a flat plate collector with the help of a neat sketch.	6	2	2
	(ii) With neat sketch of Solar Photovoltaic (PV) systems, explain its working principle.	6	2	3
OR				
3(B)	Analyse the working of a solar thermal energy conversion system using concentrated solar collectors for power generation with the help of a neat sketch.	12	2	3
4(A)	(i) Discuss the wind resource assessment methodology.	6	3	2
	(ii) Draw with neat sketch mini hydropower system and explain its working principle.	6	3	2
OR				
4(B)	Illustrate the working principle of a HAWT and describe its main components involved with the help of neat sketch.	12	3	3
5(A)	(i) Discuss few methods implemented for production of hydrogen.	6	4	2
	(ii) Write short notes on various types of fuel cells based on their operating temperatures.	6	4	2
OR				
5(B)	Discuss the working of a typical proton exchange membrane fuel cell with the help of neat sketch, clearly mentioning the electrochemical reactions involved.	12	4	2
6(A)	(i) Discuss the major components of a tidal power plant.	6	5	2
	(ii) Mention the advantages and limitations of Oscillating Water Column wave energy system	6	5	2
OR				
6(B)	Analyse the basic working principle of Ocean Thermal Energy Conversion (OTEC) with the help of a schematic and write the expression for its Carnot efficiency.	12	5	3

END

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Automation and Robotics
(Department of Mechanical Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No.	Question	Marks	CO	BL
1.	i) What is an actuator in an automated system?	1	1	1
	ii) Define station time in an assembly line.	1	1	2
	iii) What is starving in a transfer line?	1	2	1
	iv) Define degree of freedom in robotics.	1	2	2
	v) What is teach pendant used for?	1	3	1
	vi) What is a gripper?	1	3	1
	vii) What is leadthrough programming?	1	4	1
	viii) State the applications of Cartesian robot.	1	4	2
	ix) What is meant by feedback control?	1	5	1
	x) List out the function of an encoder.	1	5	2
2(A)	(i) Discuss the different types of automation (Fixed, Programmable, Flexible) with suitable examples.	6	1	2
	(ii) Discuss about the various hardware elements of the parts delivery system at an assembly work station.	6	1	2
OR				
2(B)	Explain the hardware components of an automated system, including sensors, actuators, and controllers.	12	1	2
3(A)	(i) Using the Largest Candidate Rule (LCR) and the Ranked Positional Weight (RPW) method , determine the number of workstations for the given assembly line. Assume cycle time = 12 min. Also calculate and compare <ul style="list-style-type: none"> Line efficiency Balance delay Further, analyze how task precedence constraints influence workstation assignment.	12	2	3

Work Element	Time (in min)	Precedence work element
1	6	-
2	5	1
3	9	1
4	3	2
5	2	2
6	7	3
7	5	4,5
8	6	3,5
9	4	7,8
10	7	6,9

OR				
3(B)	Explain the role of buffers in automated flow lines. How do they reduce starvation and blocking?	12	2	3
4(A)	(i) Derive the forward kinematic equations for a 2-DOF planar robotic arm with two revolute joints. Also compute the end-effector position for: <ul style="list-style-type: none"> $L_1 = 1 \text{ m}$, $L_2 = 0.8 \text{ m}$ $\theta_1 = 45^\circ$, $\theta_2 = 30^\circ$ (ii) Explain the concept of forward kinematics in robotic manipulators.	6	3	4
OR				
4(B)	Discuss the working principles and applications of the following sensors: a) Proximity sensors b) Encoders	12	3	2
5(A)	Derive the Jacobian matrix for a 2-DOF planar manipulator and explain its physical significance in velocity analysis.	12	4	3
OR				
5(B)	Explain trajectory planning in robotics. How is obstacle avoidance incorporated into robot motion?	12	4	3
6(A)	(i) Explain the application of robots in arc welding. Discuss the features required for efficient robotic welding systems.	6	5	2
	(ii) Explain the application of robots in spray painting/coating operations, highlighting the requirements that a robot must meet for this process.	6	5	2
OR				
6(B)	Discuss different types of industrial robots (Cartesian, Articulated, SCARA) and compare their applications.	12	5	3

*****END*****

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS)**B. Tech III Year II Semester (R23) Regular End Semester Examinations, May- 2026****UNIVERSAL HUMAN VALUES**

(Common to All)

Time: 3Hrs**Max Marks: 70**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S. No	Question	Marks	CO	BL
Q.1	i. Mention the basic guidelines of value education?	1M	1	1
	ii. Write a difference between happiness and temporary happiness.	1M	1	2
	iii. Name two activities of the body.	1M	2	1
	iv. _____ is instrument for the self.	1M	2	1
	v. Relationship is between _____ and _____.	1M	3	1
	vi. What is a society?	1M	3	1
	vii. Quote the inheritance of Bio order.	1M	4	1
	viii. Which unit is continuous in time?	1M	4	1
	ix. What is meant by professional ethics?	1M	5	1
	x. Quote one best practice that you do as a professional student.	1M	5	1
Q.2(A)	What are the basic human aspirations and what are the requirements to fulfil them? Indicate their correct priority. Support your answer with two examples.	12M	1	2
OR				
Q.2(B)	Write the proposals of happiness and unhappiness and discuss with relevant examples. Discuss prevailing notions related to happiness in detail	12M	1	2
Q.3(A)	Discuss program for staying healthy and identify the correct priority.	12M	2	2
OR				
Q.3(B)	List the various sources of imagination in the self. Elaborate with a few examples and explain how the harmony in the self is ensured in continuity.	12M	2	2
Q.4(A)	Define excellence. Distinguish between collaboration and competition with relevant examples.	12M	3	2
OR				
Q.4(B)	Discuss the common human goal in the society and explain how the five systems/dimensions help to realize it.	12M	3	2
Q.5(A)	Discuss the mutual fulfillment amongst the four orders of nature in detail v sketch,	12M	4	2
OR				
Q.5(B)	Draw a chart showing all the different categories of units of nature in space.	12M	4	2
Q.6(A)	As per the prevailing world-view what are usually the expectations from a good professional career? Evaluate these in the context of right understanding.	12M	5	2
OR				
Q.6(B)	Discuss the holistic criteria for evaluation of technologies, production systems and management models?	12 M	5	2

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