CBCS SCHEME

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BCHEM102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Applied Chemistry for ME Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Explain the determination of calorific value of solid fuel using bomb calorimeter.	**07**	**L2**	**CO1**
	b.	Write note on Power Alcohol and Biodiesel.	**06**	**L1**	**CO1**
	c.	Describe the production of hydrogen by electrolysis of water. Mention its advantages.	**07**	**L2 L1**	**CO1**
		OR			
Q.2	**a.**	0.98 g of fuel on complete combustion in excess of oxygen increases the temperature of water in a calorimeter from 13.25 to 19.2°C. The mass of water in a calorimeter is found to be 1450 g. Calculate the GCV and NCV of the fuel, if the water equivalent of calorimeter is 450 g and percentage of hydrogen is 8.	**06**	**L3**	**CO1**
	b.	Explain the construction and working of photovoltaic cell and list its advantages.	**07**	**L2 L1**	**CO1**
	c.	Describe the construction and working of methanol-oxygen fuel cell with acid electrolyte.	**07**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Define Metallic Corrosion. Describe the electrochemical theory of corrosion taking rusting of iron as an example.	**07**	**L1 L2**	**CO2**
	b.	Write the principle and explanation for differential metal and stress corrosion.	**07**	**L1 L2**	**CO2**
	c.	What is Cathodic Protection? Describe sacrificial anode technique and mention its advantages and disadvantages.	**06**	**L1 L2**	**CO2**
		OR			
Q.4	**a.**	What is Metal Finishing? Write the bath composition and reactions involved in electroplating of decorative chromium.	**07**	**L1**	**CO2**
	b.	A steel sheet of area 100 $inch^2$ is exposed to air near ocean. After 1 year period it was found to experience a weight loss of 485 g due to corrosion. If density of steel sheet is 7.9 g/cm^3. Calculate CPR in mpy and in mm/year.	**06**	**L3**	**CO2**
	c.	Define Galvanization. Describe galvanizing of iron and mention its application.	**07**	**L1 L2**	**CO2**

		Module – 3			
Q.5	**a.**	What are Polymers? Explain the preparation, properties and industrial applications of polystyrene.	**07**	**L1 L2**	**CO3**
	b.	In a sample of polymer, 100 molecules have molecular mass 103 g/mol, 250 molecules have molecular mass 104 g/mol and 300 molecules have molecular mass 105 g/mol. Calculate number average and weight average molecular weight of the sample polymer.	**06**	**L3**	**CO3**
	c.	Define Polymer Composite. Explain the synthesis, properties and applications of Kevlar.	**07**	**L1 L2**	**CO3**
		OR			
Q.6	**a.**	Write the properties and applications of lubricants.	**07**	**L1**	**CO3**
	b.	Discuss the synthesis of PMMA. Mention its properties and industrial applications.	**06**	**L1 L2**	**CO3**
	c.	Define Polymer Composite. List out the properties and industrial applications of carbon based reinforced composites.	**07**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	Define the term Phase, Component and Degree of Freedom in phase rule equation.	**06**	**L1**	**CO4**
	b.	Discuss the application of phase rule to two component lead-silver system.	**07**	**L2**	**CO4**
	c.	Explain the principle and instrumentation of potentiometric sensors.	**07**	**L2**	**CO4**
		OR			
Q.8	**a.**	Explain the principle and instrumentation of optical sensors in colorimetry.	**07**	**L2**	**CO4**
	b.	Explain the principle and instrumentation of pH sensors in determination of pH of beverages.	**07**	**L2**	**CO4**
	c.	Explain the process of estimation of iron from a sample solution by using potentiometric sensors.	**06**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Write the composition of any one of the stainless steel alloy. Mention its properties and applications.	**07**	**L1**	**CO5**
	b.	Explain chemical composition , properties and applications of perovskites.	**07**	**L2**	**CO5**
	c.	Discuss the catalytic and thermal properties of nanomaterials.	**06**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the synthesis of nano materials by sol-gel method.	**07**	**L2**	**CO5**
	b.	Define Alloys. Explain the properties and applications of brass alloy.	**07**	**L1 L2**	**CO5**
	c.	Discuss the properties and engineering applications of carbon nanotubes.	**06**	**L2**	**CO5**

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CBCS SCHEME

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BEMEM103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Elements of Mechanical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Steam table is permitted.

		Module – 1	M	L	C
Q.1	a.	Briefly explain role of Mechanical Engineering in Industries and Society.	6	L2	CO1
	b.	Enumerate the benefits of super heated steam over wet steam.	4	L2	CO1
	c.	Explain the working principle of Hydel power plant with sketch.	10	L2	CO1
		OR			
Q.2	a.	A steam at 10 bar and dryness 0.98 receives 140 kJ/kg at the same pressure. What is the final state of the steam?	10	L3	CO4
	b.	Explain the working principle of Tidal power plant with sketch.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain the working principle of Lathe. With sketch, explain the Facing and Knurling operation.	10	L2	CO2
	b.	Explain components of CNC machine with block diagram.	10	L2	CO2
		OR			
Q.4	a.	List Milling Operations. Explain any two with sketch.	8	L2	CO2
	b.	With neat sketch, explain Reaming and Counter sinking operation in Drilling machine.	8	L2	CO2
	c.	What is 3D printing and list different 3D printing process?	4	L1	CO2
		Module – 3			
Q.5	a.	Explain the working of 4 – stroke petrol engine with PV diagram.	10	L2	CO2
	b.	Explain the applications of air conditioner.	10	L2	CO2
		OR			
Q.6	a.	The following are the observations were obtained during a trial on a 4 – stroke diesel engine: Data : Cylinder diameter = 25 cm ; Stroke of the piston = 40 cm Crank shaft speed = 250 rpm ; Brake load = 70 kg Brake drum diameter = 2 m ; Mean effective pressure = 6 bar Diesel oil consumption = 0.1 m^2/min ; Specific gravity of diesel = 0.78 Calorific value of diesel = 43900 kJ/kg. Determine BP , IP , Mechanical efficiency , Brake thermal efficiency , Indicated thermal efficiency.	10	L3	CO4

	b.	Explain the working principle of VCR refrigeration system.	**10**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	Explain Speed ratio expression of simple gear train and compound gear train with suitable sketch.	**10**	**L2**	**CO3**
	b.	Explain the working principle of electric arc welding process with sketch.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	Derive an expression for length of belt in open belt drive system.	**10**	**L3**	**CO3**
	b.	Differentiate between Soldering , Brazing and Welding process.	**10**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Briefly explain the components of Electric Vehicle with suitable sketch.	**10**	**L2**	**CO3**
	b.	Explain the application of the Robots.	**10**	**L2**	**CO3**
		OR			
Q.10	**a.**	Discuss the advantages and disadvantages of Hybrid vehicles.	**10**	**L2**	**CO3**
	b.	With sketch, explain Robot anatomy and Joints.	**10**	**L2**	**CO3**

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BEMEM103/203

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Elements of Mechanical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Steam table is permitted.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Briefly explain role of Mechanical Engineering in Industries and Society.	**6**	**L2**	**CO1**
	b.	Enumerate the benefits of super heated steam over wet steam.	**4**	**L2**	**CO1**
	c.	Explain the working principle of Hydel power plant with sketch.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	A steam at 10 bar and dryness 0.98 receives 140 kJ/kg at the same pressure. What is the final state of the steam?	**10**	**L3**	**CO4**
	b.	Explain the working principle of Tidal power plant with sketch.	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Explain the working principle of Lathe. With sketch, explain the Facing and Knurling operation.	**10**	**L2**	**CO2**
	b.	Explain components of CNC machine with block diagram.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	List Milling Operations. Explain any two with sketch.	**8**	**L2**	**CO2**
	b.	With neat sketch, explain Reaming and Counter sinking operation in Drilling machine.	**8**	**L2**	**CO2**
	c.	What is 3D printing and list different 3D printing process?	**4**	**L1**	**CO2**
		Module – 3			
Q.5	**a.**	Explain the working of 4 – stroke petrol engine with PV diagram.	**10**	**L2**	**CO2**
	b.	Explain the applications of air conditioner.	**10**	**L2**	**CO2**
		OR			
Q.6	**a.**	The following are the observations were obtained during a trial on a 4 – stroke diesel engine: Data : Cylinder diameter = 25 cm ; Stroke of the piston = 40 cm Crank shaft speed = 250 rpm ; Brake load = 70 kg Brake drum diameter = 2 m ; Mean effective pressure = 6 bar Diesel oil consumption = 0.1 m^2/min ; Specific gravity of diesel = 0.78 Calorific value of diesel = 43900 kJ/kg. Determine BP , IP , Mechanical efficiency , Brake thermal efficiency , Indicated thermal efficiency.	**10**	**L3**	**CO4**

	b.	Explain the working principle of VCR refrigeration system.	**10**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	Explain Speed ratio expression of simple gear train and compound gear train with suitable sketch.	**10**	**L2**	**CO3**
	b.	Explain the working principle of electric arc welding process with sketch.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	Derive an expression for length of belt in open belt drive system.	**10**	**L3**	**CO3**
	b.	Differentiate between Soldering , Brazing and Welding process.	**10**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Briefly explain the components of Electric Vehicle with suitable sketch.	**10**	**L2**	**CO3**
	b.	Explain the application of the Robots.	**10**	**L2**	**CO3**
		OR			
Q.10	**a.**	Discuss the advantages and disadvantages of Hybrid vehicles.	**10**	**L2**	**CO3**
	b.	With sketch, explain Robot anatomy and Joints.	**10**	**L2**	**CO3**

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BETCK105E

First Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Renewable Energy Sources

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What is the need of Renewable Energy Sources? Explain by considering solar energy.	8	L2	CO1
	b.	Explain the principles of Renewable Energy in brief.	6	L2	CO1
	c.	Briefly explain energy sustainable development.	6	L2	CO1
		OR			
Q.2	a.	Explain the extraction process of Shale oil.	8	L2	CO1
	b.	Write an explanatory note on geothermal energy.	6	L2	CO1
	c.	What is Internet of Energy (IOE)? Explain how it differs from the traditional grid system.	6	L2	CO1
		Module – 2			
Q.3	a.	Distinguish between Beam and Diffuse radiation. Explain how a typical daily solar radiation is measured both on a clear and cloudy day.	6	L2	CO2
	b.	With a neat sketch, explain the working of an instrument used to measure global beam radiation of solar energy.	7	L2	CO2
	c.	Sketch and explain the working of solar pond electric power generation.	7	L2	CO2
		OR			
Q.4	a.	Define the following terms with neat sketches : i) Inclination angle ii) Incident angle iii) Zenith angle iv) Solar Azimuth angle v) Declination angle.	10	L1	CO2
	b.	Determine the Local Apparent Time (LAT) and declination corresponding to 1430 h (IST) at Mumbai (19° 07′ N , 72° 51′ E) on July 1st. In India , standard time is based on 82.50°E. Equation of time correction is given as -3.5 minutes.	6	L3	CO2
	c.	Explain the principle of photovoltaic power generation.	4	L2	CO2

Module – 3					
Q.5	**a.**	Derive an expression for Wind power and also discuss power co-efficient of wind turbine.	**7**	**L3**	**CO3**
	b.	Explain the major problems associated with wind power.	**5**	**L2**	**CO3**
	c.	With a neat sketch, explain Urban Waste to Energy Conversion Process.	**8**	**L2**	**CO3**
OR					
Q.6	**a.**	Explain basic components of Wind Energy Conversion System (WECS).	**8**	**L2**	**CO3**
	b.	With a neat sketch, explain Darrieus rotor type vertical axis wind mill.	**8**	**L2**	**CO3**
	c.	Explain the process of photosynthesis in biomass production and also list necessary conditions for photosynthesis.	**4**	**L2**	**CO3**
Module – 4					
Q.7	**a.**	With a neat sketch, explain Double basin tidal system.	**7**	**L2**	**CO4**
	b.	With necessary diagram, explain the working principle of closed cycle ocean thermal conversion system.	**8**	**L2**	**CO4**
	c.	Illustrate the major problems associated with OTEC.	**5**	**L2**	**CO4**
OR					
Q.8	**a.**	With a neat sketch, explain Open cycle OTEC system.	**7**	**L2**	**CO4**
	b.	Explain the advantages and limitations of wave energy.	**6**	**L2**	**CO4**
	c.	Sketch and explain Single basic tidal system.	**7**	**L2**	**CO4**
Module – 5					
Q.9	**a.**	Sketch and explain the working principle of Alkaline fuel cell.	**8**	**L2**	**CO5**
	b.	With a neat sketch, explain electrolysis method of hydrogen production.	**8**	**L2**	**CO5**
	c.	Write a note on Zero energy concepts.	**4**	**L2**	**CO5**
OR					
Q.10	**a.**	Explain the different methods of hydrogen storage.	**8**	**L2**	**CO5**
	b.	Discuss the problems associated with hydrogen energy.	**6**	**L2**	**CO5**
	c.	Explain the applications of hydrogen energy.	**6**	**L2**	**CO5**

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BESCK204D

Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Introduction to Mechanical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	What is the role of mechanical engineering in industries and society? Give suitable examples.	**10**	**L2**	**CO1**
	b.	Write about latest trends and new technologies used in energy and automotive sectors.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	List different types of energy sources. Sketch and explain hydel power plant.	**10**	**L2**	**CO1**
	b.	What are global warming and Ozone layer depletion? Mention their causes and effects.	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Sketch and explain following operations in Lathe : i) Turning ii) Knurling.	**10**	**L2**	**CO2**
	b.	With a neat diagram explain CNC system in manufacturing. Write about its advantages.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Describe the working of a drilling machine and explain any two drilling operations.	**10**	**L2**	**CO2**
	b.	What is 3D-printing? Explain its basic working stages and applications.	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Differentiate between 4-stoke petrol engine and 4-stoke diesel engine.	**10**	**L2**	**CO3**
	b.	What are Electric vehicles and Hybrid vehicles? With a block diagram explain components of electric vehicle.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Describe the working of a 4-stroke petrol engine with the help of neat sequence of strokes.	**10**	**L2**	**CO3**
	b.	List advantages and disadvantages of electric and hybrid vehicles.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Classify engineering materials. Explain the application of ferrous and non-ferrous metals.	**10**	**L2**	**CO4**
	b.	What is a shape memory alloy? Explain the working principle and applications.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Explain the working principle of arc welding and gas welding. Sketch the types of flames used in gas welding and their applications.	**10**	**L2**	**CO4**
	b.	Compare soldering, brazing and welding.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	What is Mechatronics? Explain open-loop and closed-loop mechatronic systems with examples.	**10**	**L2**	**CO5**
	b.	Explain polar and Cartesian robot configurations.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain types of automations.	**10**	**L2**	**CO5**
	b.	What do you mean by Internet of Things (IoT)? Explain main characteristics and functional blocks.	**10**	**L2**	**CO5**

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CBCS SCHEME

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BETCK205E

Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Renewable Energy Sources

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the principles of renewable energy and its role in sustainable development.	08	L2	CO1
	b.	Discuss the availability of renewable energy sources in India and their potential for future energy needs.	08	L1	CO1
	c.	Write short notes on the Social implications of renewable energy adoption.	04	L2	CO1
		OR			
Q.2	a.	Write suitable examples, explain solar, wind, tidal and geothermal energy systems.	10	L2	CO3
	b.	Describe the concept of the Internet of Energy (IoE) and its applications in modern energy systems.	06	L2	CO1
	c.	Briefly explain the importance of energy and sustainable development.	04	L2	CO1
		Module – 2			
Q.3	a.	Write a neat sketch and explain the working principle of pyranometer.	08	L1	CO2
	b.	Describe the construction and working of a flat plate collector with a neat sketch.	08	L3	CO2
	c.	Write short notes on Solar Thermal Systems.	04	L2	CO2
		OR			
Q.4	a.	Explain the principle and working of a Solar photovoltaic (PV) cell for electric power generation.	08	L3	CO2
	b.	Discuss the advantages, disadvantages and applications of solar PV systems.	08	L1	CO2
	c.	Write short notes on Solar Pond.	04	L2	CO2
		Module – 3			
Q.5	a.	Describe the components of a Wind Energy Conversion System (WECS) and classify it into horizontal and vertical axis types.	08	L1	CO3
	b.	With a neat sketch explain the working of horizontal axis wind mill.	08	L3	CO3
	c.	Write short notes on major problems associated with wind power.	04	L2	CO3
		OR			
Q.6	a.	Explain the process of photosynthesis and its importance in biomass energy generation.	06	L1	CO4
	b.	Describe with neat sketch fixed dome biogas plants.	08	L3	CO4
	c.	With a neat diagram, explain the working of a down draft biomass gasifier.	06	L3	CO4

		Module – 4			
Q.7	**a.**	Explain the mechanics of tides and their potential as energy sources.	**08**	**L2**	**CO3**
	b.	With a neat sketch, describe the construction and working of a tidal power plant.	**08**	**L3**	**CO3**
	c.	Discuss the advantages and limitations of tidal energy.	**04**	**L1**	**CO3**
		OR			
Q.8	**a.**	Explain the principle of Ocean Thermal Energy Conversion (OTEC) and describe its working cycle.	**08**	**L2**	**CO5**
	b.	Explain with sketch the working of Anderson Cycle OTEC.	**08**	**L3**	**CO5**
	c.	Discuss the problems associated with OTEC systems.	**04**	**L1**	**CO5**
		Module – 5			
Q.9	**a.**	Explain the classification and operating principles of fuel cells.	**08**	**L3**	**CO5**
	b.	Describe the process of hydrogen production by electrolysis with a neat schematic diagram.	**08**	**L3**	**CO5**
	c.	Write short notes on Zero Energy Concepts.	**04**	**L2**	**CO5**
		OR			
Q.10	**a.**	Discuss the benefits, storage methods and applications of hydrogen energy.	**10**	**L3**	**CO5**
	b.	Explain the problems and safety issues associated with hydrogen energy systems.	**06**	**L1**	**CO5**
	c.	Write a short note on the future prospects of green energy technologies.	**04**	**L3**	**CO4**

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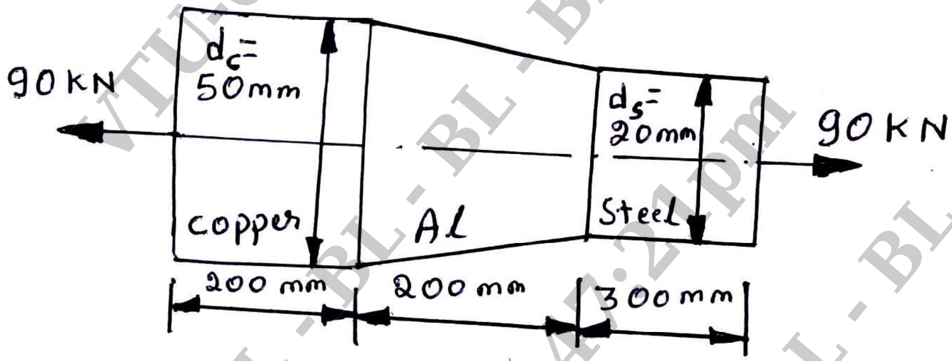
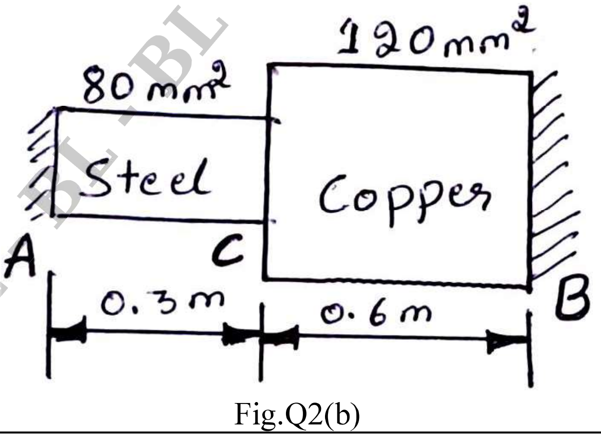
BME301

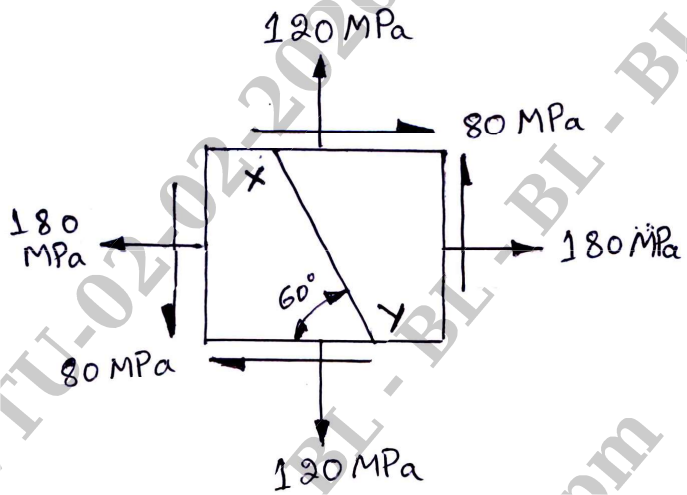
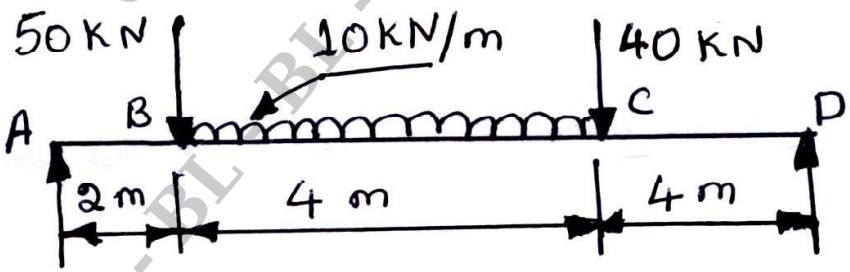
Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

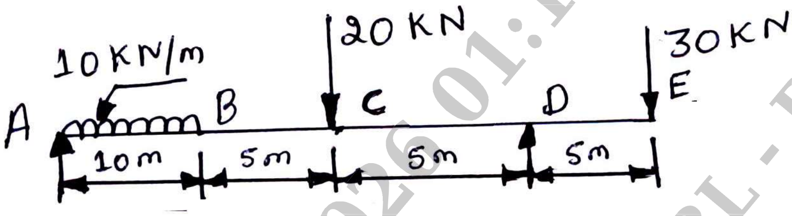
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Define the following : i) Ductility ii) Brittleness iii) Toughness iv) Resilience.	4	L1	CO1
	b.	Derive an expression for the extension of a member subjected to a tensile load P.	6	L2	CO1
	c.	Find the elongation in bar loaded as shown in Fig.Q1(c) take modulus of elasticity for steel E_s = 200 GPa, for copper E_C = 100 GPa and for aluminum E_A = 70 GPa.  Fig.Q1(c)	10	L3	CO1
		OR			
Q.2	**a.**	Define the following : i) Steady load ii) Impact load iii) Sudden load iv) Shock load.	4	L1	CO2
	b.	A stepped bar shown in Fig.Q2(b) is fixed at its two ends rigidly. The bar is free from stresses when its temperature is 30°C. When the temperature of the bar is increased to 90°C determine : i. Stresses induced in steel and copper portions ii. Displacement in the junction at point C. Take : E_C = 100 GPa, $\alpha_C = 1.8 \times 10^{-5}$ /°C E_S = 200 GPa, $\alpha_S = 1.2 \times 10^{-5}$ /°C  Fig.Q2(b)	16	L3	CO1

		Module – 2			
Q.3	**a.**	Define principle planes and principal stresses.	**4**	**L1**	**CO2**
	b.	The state of stress at a point in a strained material is as shown in Fig.Q3(b). Determine : i. Principle stresses and their planes ii. Maximum shear stress and planes of maximum shear stress iii. Normal stress and tangential stress on plane XY Solve by Mohr's circle method.  Fig.Q3(b)	**16**	**L3**	**CO2**
		OR			
Q.4	**a.**	Obtain expression for hoop and longitudinal stresses for a thin cylinder stating clearly the assumptions made.	**8**	**L2**	**CO2**
	b.	A thick walled cylindrical pressure vessel has inner radius of 150 mm and outer radius of 185 mm. Draw a sketch showing the radius pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10 MPa is applied.	**12**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Define the following : i) SFD ii) BMD.	**4**	**L1**	**CO3**
	b.	Draw the SFD and BMD for the simply supported beam as shown in Fig.Q5(b).  Fig.Q5(b)	**16**	**L3**	**CO3**

		OR			
Q.6	**a.**	Draw the SFD and BMD of cantilever of length L carrying UDL = W/meter.	**6**	**L2**	**CO3**
	b.	Draw the SFD and BMD for the overhanging beam shown in Fig.Q6(b).  Fig.Q6(b)	**14**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Derive an expression for the bending and radius of curvature for a straight beam subjected to pure bending.	**10**	**L2**	**CO4**
	b.	A beam having T section with its flanges of (180 mm × 10 mm) and web of (220 mm × 10 mm) is subjected to sagging bending moment 15 KN –m. Determine the maximum tensile stress and maximum compressive stresses, and their locations in the section . Draw a sketch showing bending stress distribution.	**10**	**L3**	**CO4**
		OR			
Q.8		An I – section beam 350 mm × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a sharing force of 200 KN at a section. Sketch the shear stress discretion across the section.	**20**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Derive torsion equation with usual notation. State the assumption in the theory of pure torsion.	**10**	**L2**	**CO5**
	b.	A hollow circular steel shaft has to transmit 60 KW at 210 rpm such that the maximum shear stress does not exceed 60 MPa. If the ratio of internal to external diameter is equal to 0.75 and the value of rigidity modulus is 84 GPa, find the dimensions of the shaft and angle of twist in length of 3 m.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive an expression for the critical load in a column subjected to compressive load, when both end is fixed.	**10**	**L2**	**CO5**
	b.	A 2.5 meter long column with hollow circular section is hinged at both ends. External diameter is 140 mm and thickness of wall is 20 mm. Taking E = 80 GPa. $\alpha = \frac{1}{1600}$ and σ_C = 550 MPA, Compare the buckling loads obtained using : i. Euler's formula ii.Rankine's formula Also find the length of column for which both formulae given same load.	**10**	**L3**	**CO5**

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CBCS SCHEME

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BME302

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Manufacturing Process

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain various pattern allowances and their importance.	10	L2	CO1
	b.	Sketch and explain Jolt type moulding machine.	06	L1	CO1
	c.	Define the following terms with reference to the moulding sand: (i) Permeability (ii) Green Strength (iii) Dry Strength (iv) Hot Strength	04	L1	CO1
		OR			
Q.2	a.	Sketch and explain Shell moulding process.	10	L2	CO1
	b.	Give the functions of a riser in a casting. Also, differentiate between open and blind risers.	06	L1	CO1
	c.	Explain the terms 'Core' and 'Chaplet'.	04	L1	CO1
		Module – 2			
Q.3	a.	With a neat sketch explain the constructional features of a Cupola.	10	L2	CO2
	b.	Sketch and explain resistance furnace.	10	L2	CO2
		OR			
Q.4	a.	With a neat labelled diagram explain continuous casting process.	10	L2	CO2
	b.	Explain with neat sketches following casting defects: (i) Hot tears (ii) Cold shut and Misrun	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the following yield criteria : (i) Tresca Criterion (ii) Von Mises Criterion	10	L2	CO3
	b.	Sketch and explain wire drawing. Also list the characteristics of cold working process.	10	L2	CO3
		OR			
Q.6	a.	With a neat sketch explain explosive forming process.	10	L2	CO3
	b.	With a neat sketch explain die-punch assembly used in sheet metal work. Also explain blanking and punching operations.	10	L2	CO3
		Module – 4			
Q.7	a.	Sketch and explain the types of oxy-acetylene welding flames.	10	L2	CO4
	b.	Explain briefly the principle of gas welding. Also list its advantages, disadvantages and applications.	10	L2	CO4
		OR			
Q.8	a.	Sketch and explain submerged arc welding process.	10	L2	CO4
	b.	With a neat sketch explain Tungsten Inert Gas welding process. Mention its advantages and disadvantages.	10	L2	CO4
		Module – 5			
Q.9	a.	With a neat sketch explain various zones in welded structure.	10	L2	CO5
	b.	With neat sketches explain welding defects.	10	L2	CO5
		OR			
Q.10	a.	Write short notes on : (i) Soldering (ii) Brazing	10	L2	CO5
	b.	Explain the following resistance welding processes: (i) Butt Welding (ii) Seam welding	10	L2	CO5

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BMEL305/BRIL305

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.		Marks
	Module - 1	
1	Draw the profile of SELLER thread of pitch 20mm and diameter d=20mm.Show at least two threads.	20
	Module - 2	
2	The detail parts of the knuckle joint are shown in Fig Q2. Assemble all the parts and draw the following views. 1. Sectional front views. 2. Top view	30
	Module – 3	
3	Figure Q3 shows the details of a CONNECTING ROD. Assemble ALL the parts and show the half sectional front view and End view.	50

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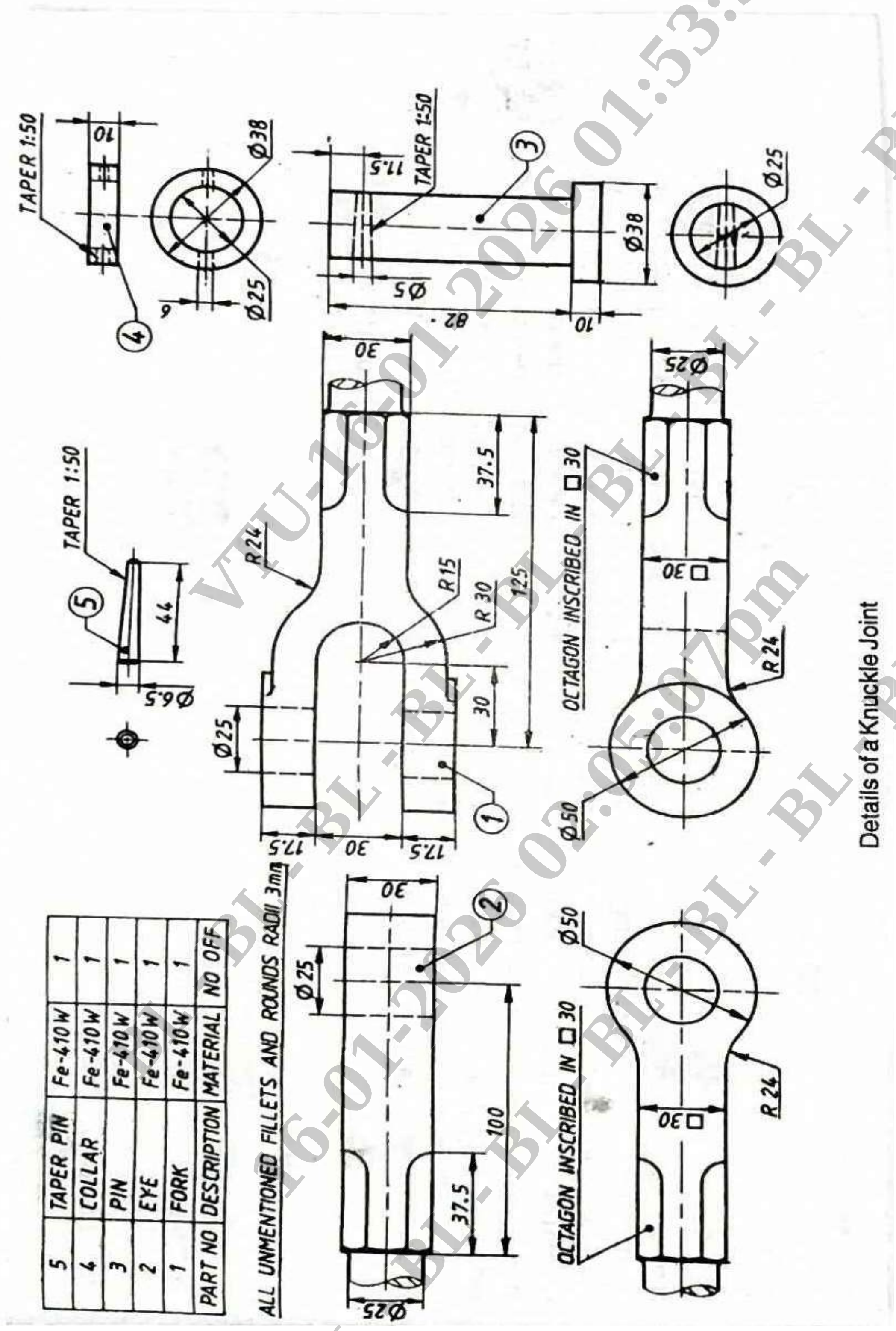

Fig. Q2

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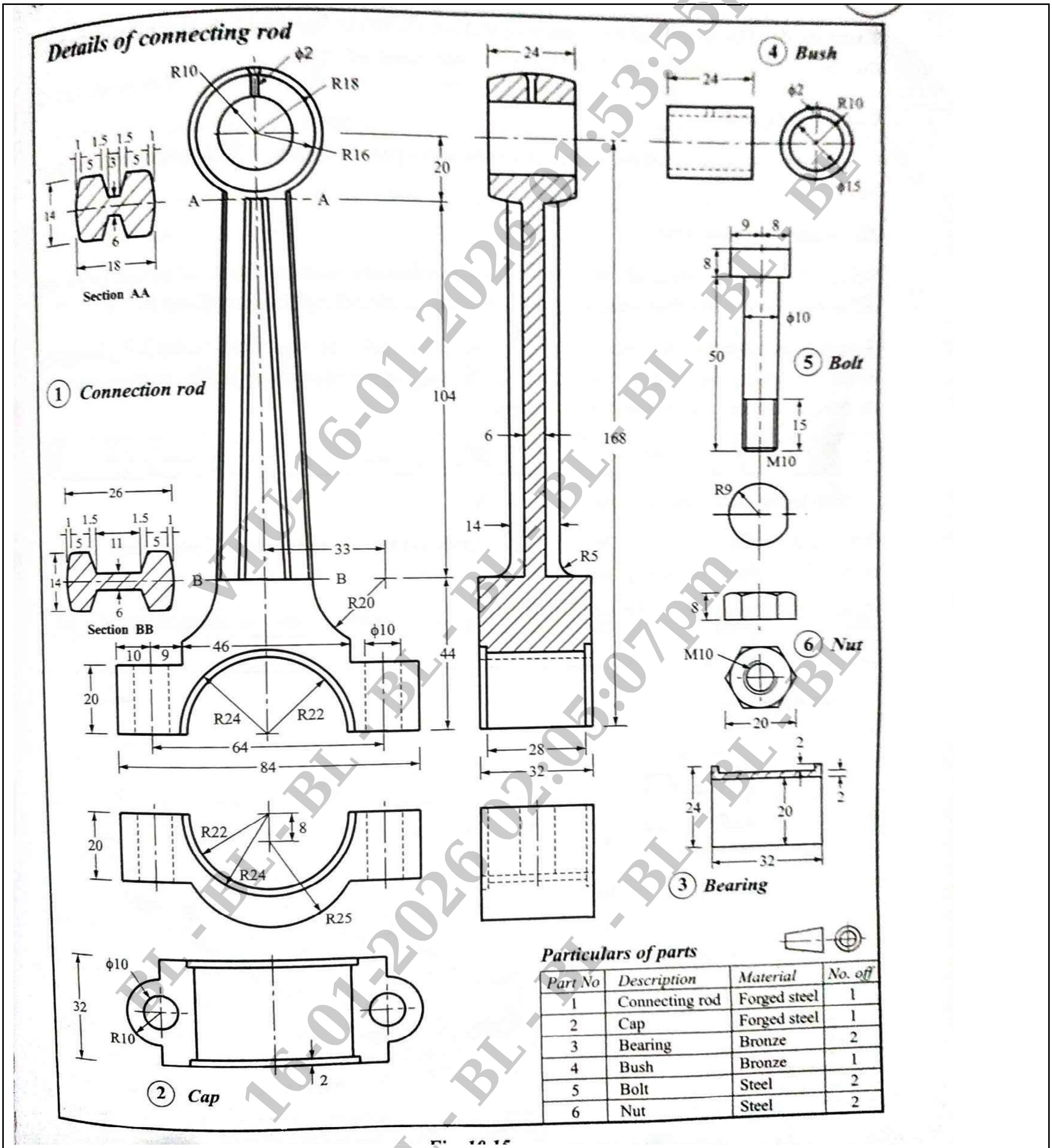
BMEL305/BRIL305



Part No	Description	Material	No. off
1	Connecting rod	Forged steel	1
2	Cap	Forged steel	1
3	Bearing	Bronze	2
4	Bush	Bronze	1
5	Bolt	Steel	2
6	Nut	Steel	2

Fig. Q3

Examiner 1:
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BMEL305/BRIL305

Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.	Module - 1	Marks
1	Draw the profile of SELLER thread of pitch 20mm and diameter d=20mm.Show at least two threads.	20
	Module - 2	
2	The detail parts of the knuckle joint are shown in Fig Q2. Assemble all the parts and draw the following views. 1. Sectional front views. 2. Top view	30
	Module – 3	
3	Figure Q3 shows the details of a CONNECTING ROD. Assemble ALL the parts and show the half sectional front view and End view.	50

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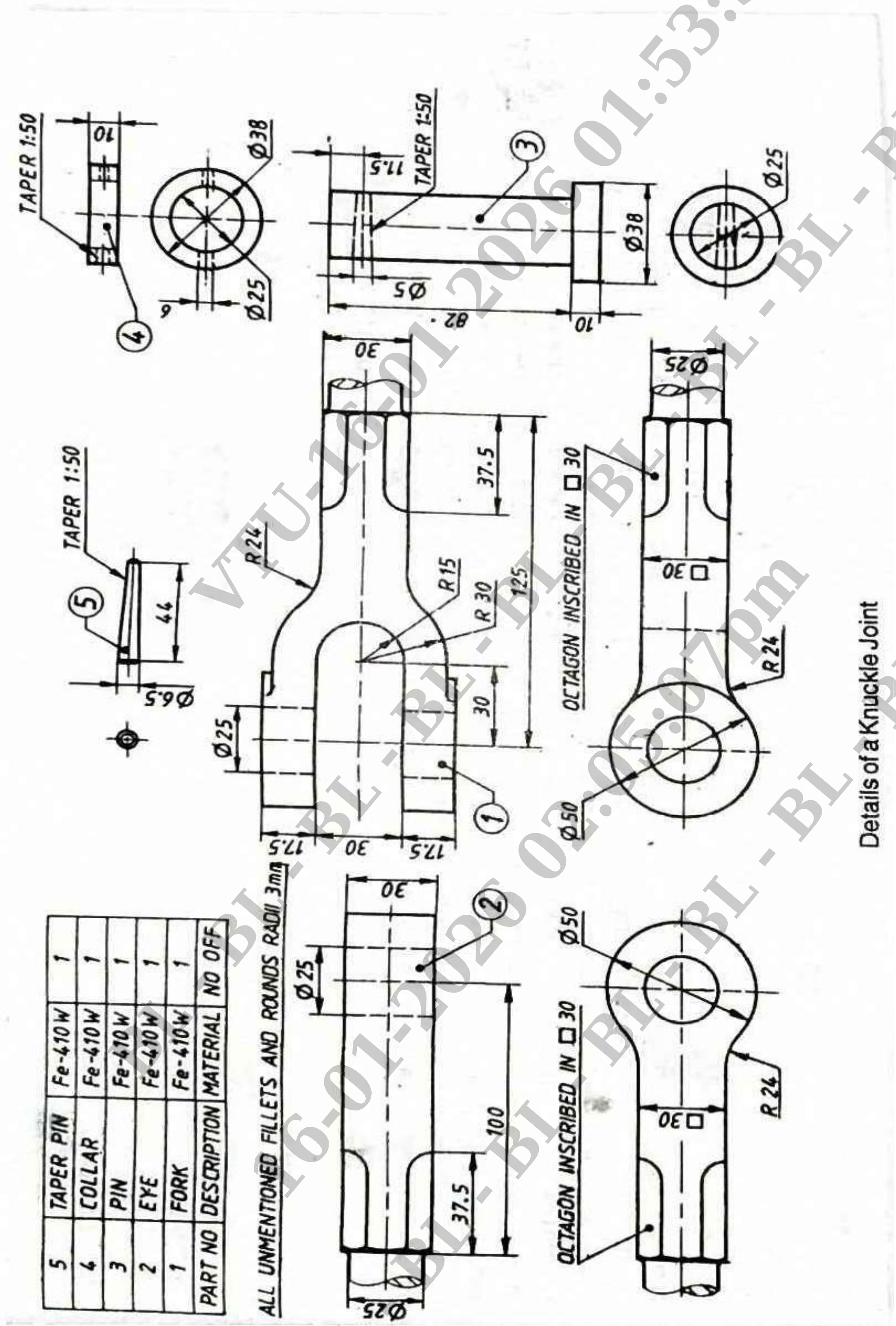

Fig. Q2

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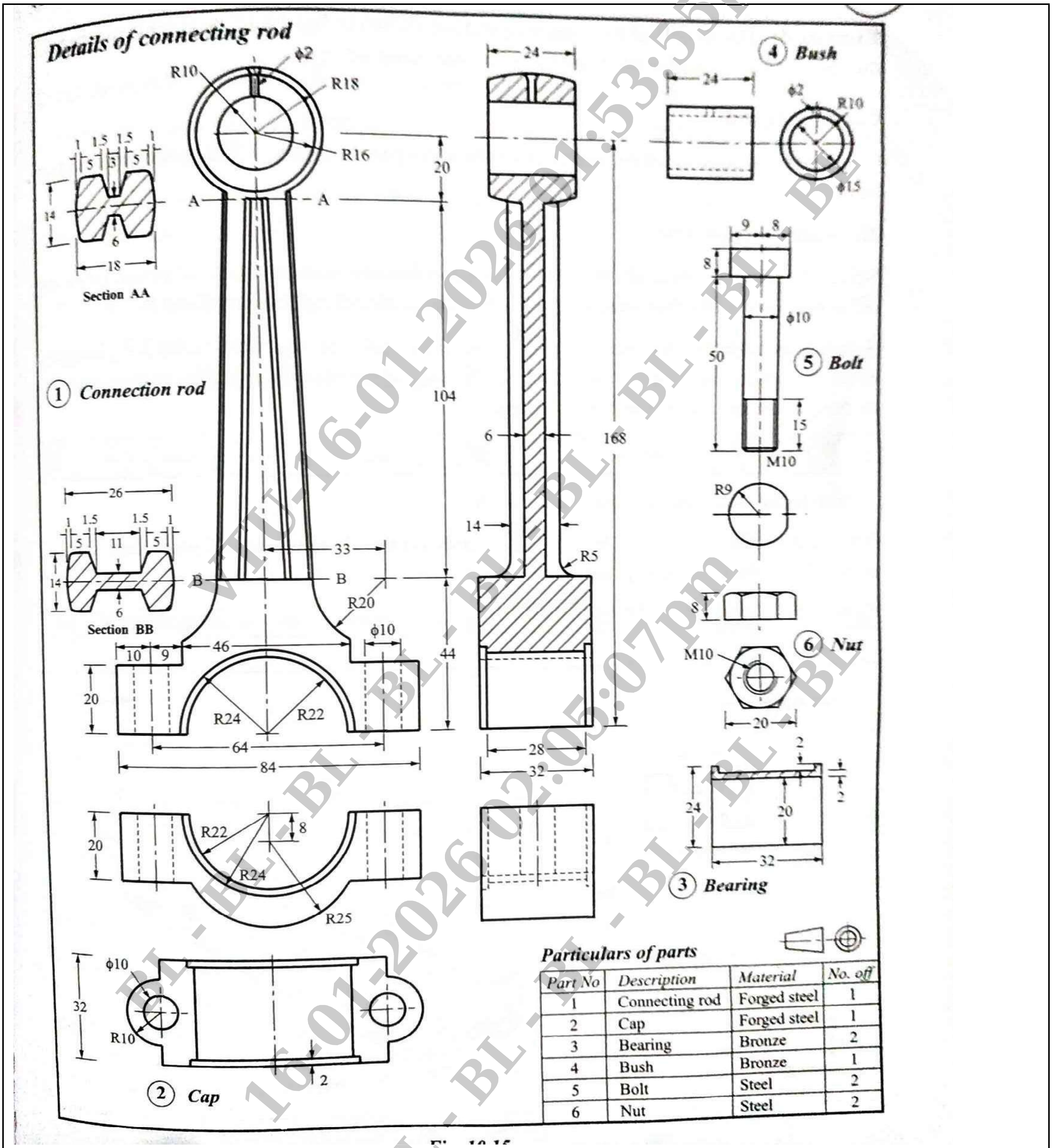

Fig. Q3

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.	Module - 1	Marks
1	Draw the dimensioned sketch of the square thread and ACME thread for a pitch of 30 mm	20
	Module - 2	
2	Draw the assembled sectional view and side view of an universal coupling to connect two shafts of 20mm diameter. The detail parts are shown in Fig Q2. Mark all the dimensions.	30
	Module – 3	
3	Figure shows the details of a CONNECTING ROD. Assemble ALL the parts and show the half sectional front view and End View.	50

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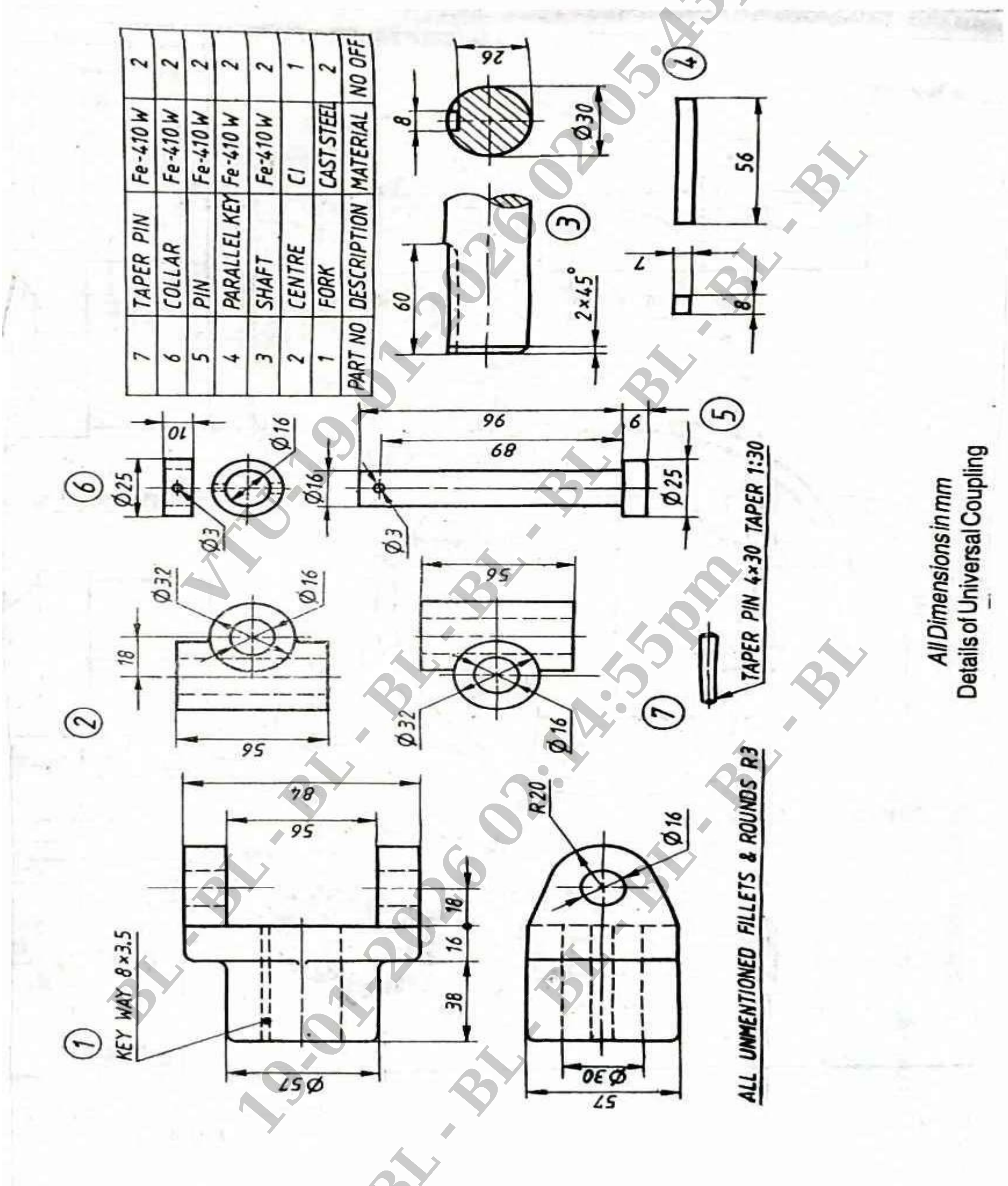

Fig. Q2

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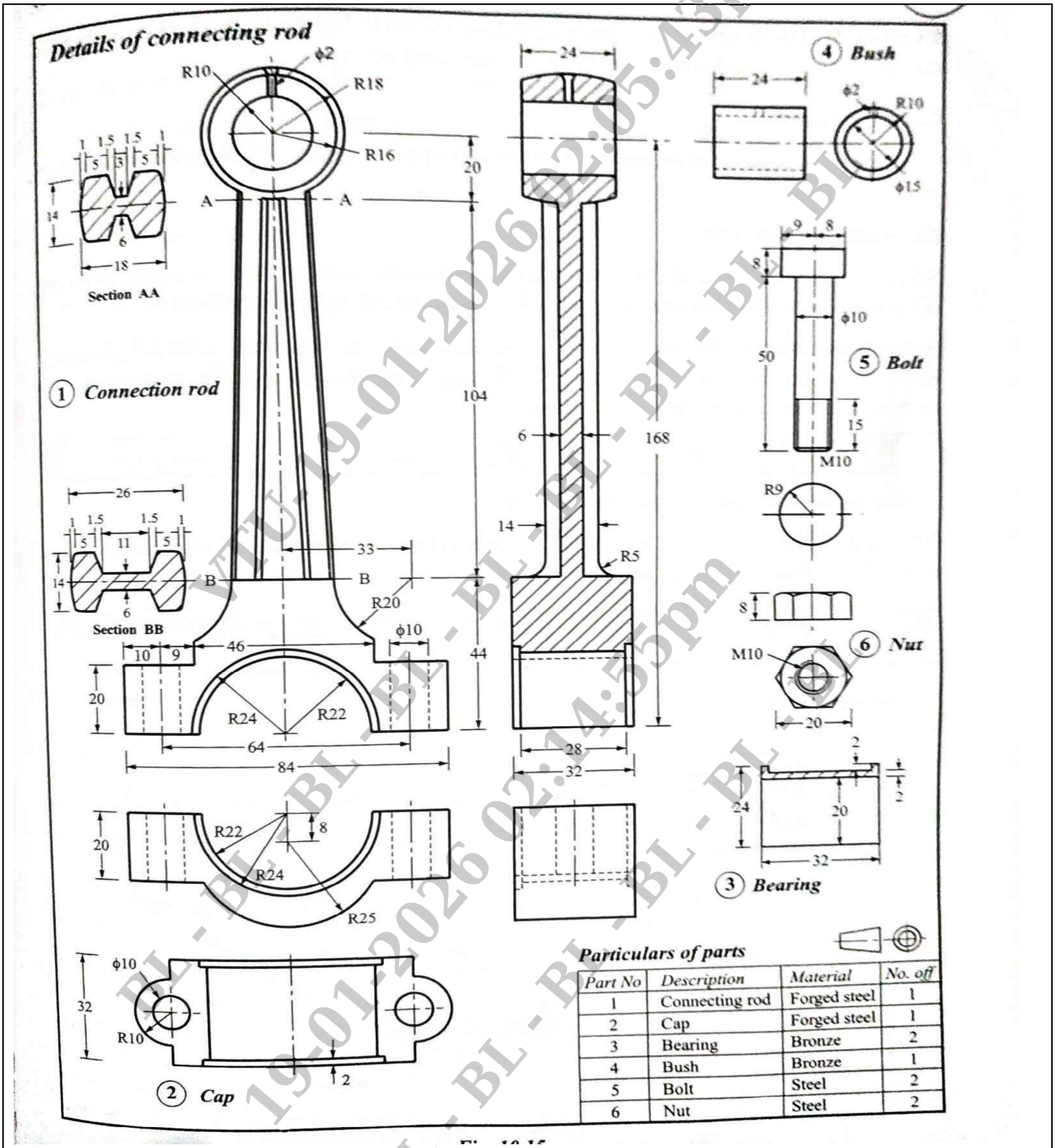

Particulars of parts

Part No	Description	Material	No. off
1	Connecting rod	Forged steel	1
2	Cap	Forged steel	1
3	Bearing	Bronze	2
4	Bush	Bronze	1
5	Bolt	Steel	2
6	Nut	Steel	2

Fig. Q3

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Module - 1		
Q. No.		**Marks**
1	Draw the dimensioned sketch of the square thread and ACME thread for a pitch of 30 mm	**20**
Module - 2		
2	Draw the assembled sectional view and side view of an universal coupling to connect two shafts of 20mm diameter. The detail parts are shown in Fig Q2. Mark all the dimensions.	**30**
Module – 3		
3	Figure shows the details of a CONNECTING ROD. Assemble ALL the parts and show the half sectional front view and End View.	**50**

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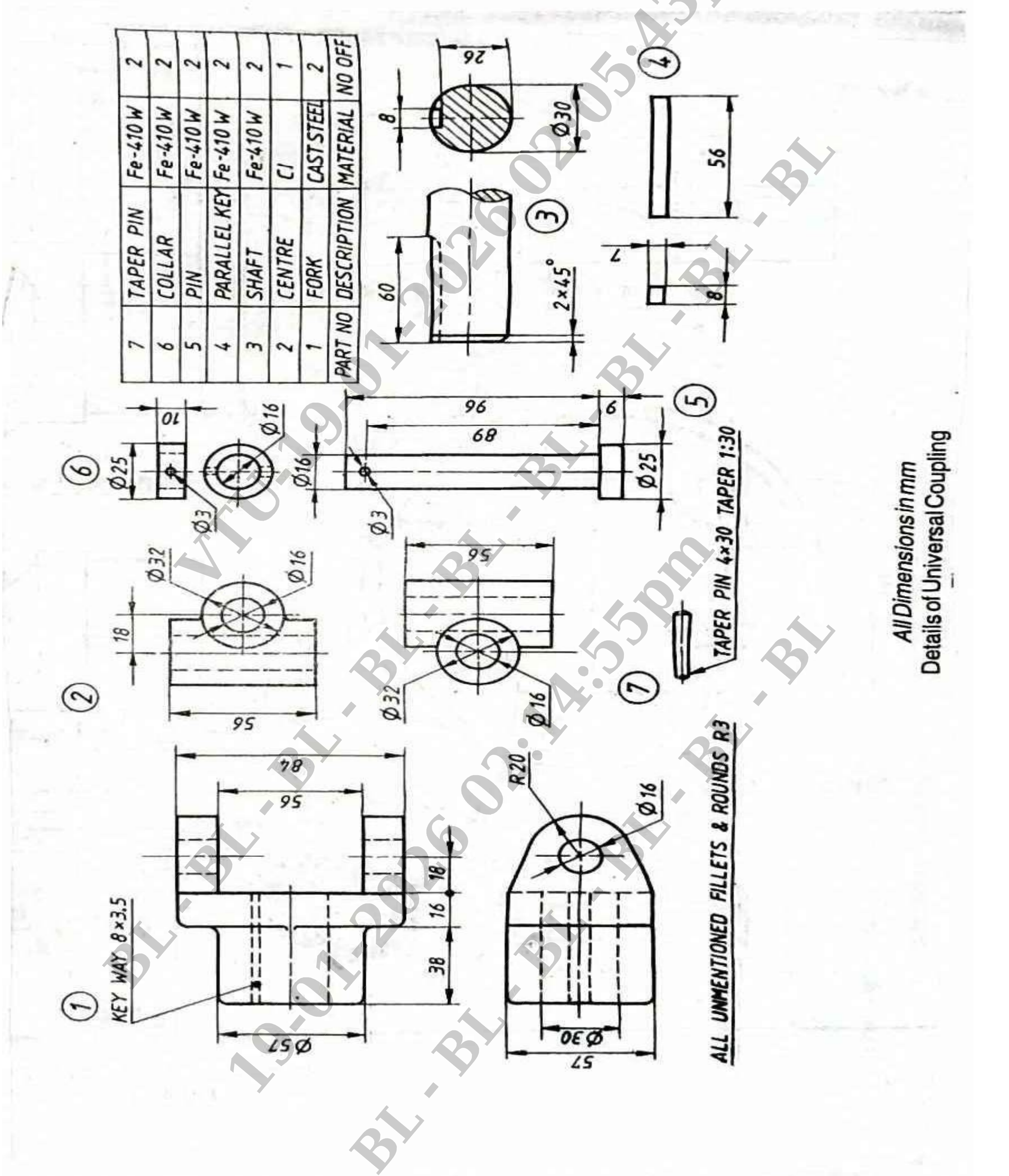

Fig. Q2

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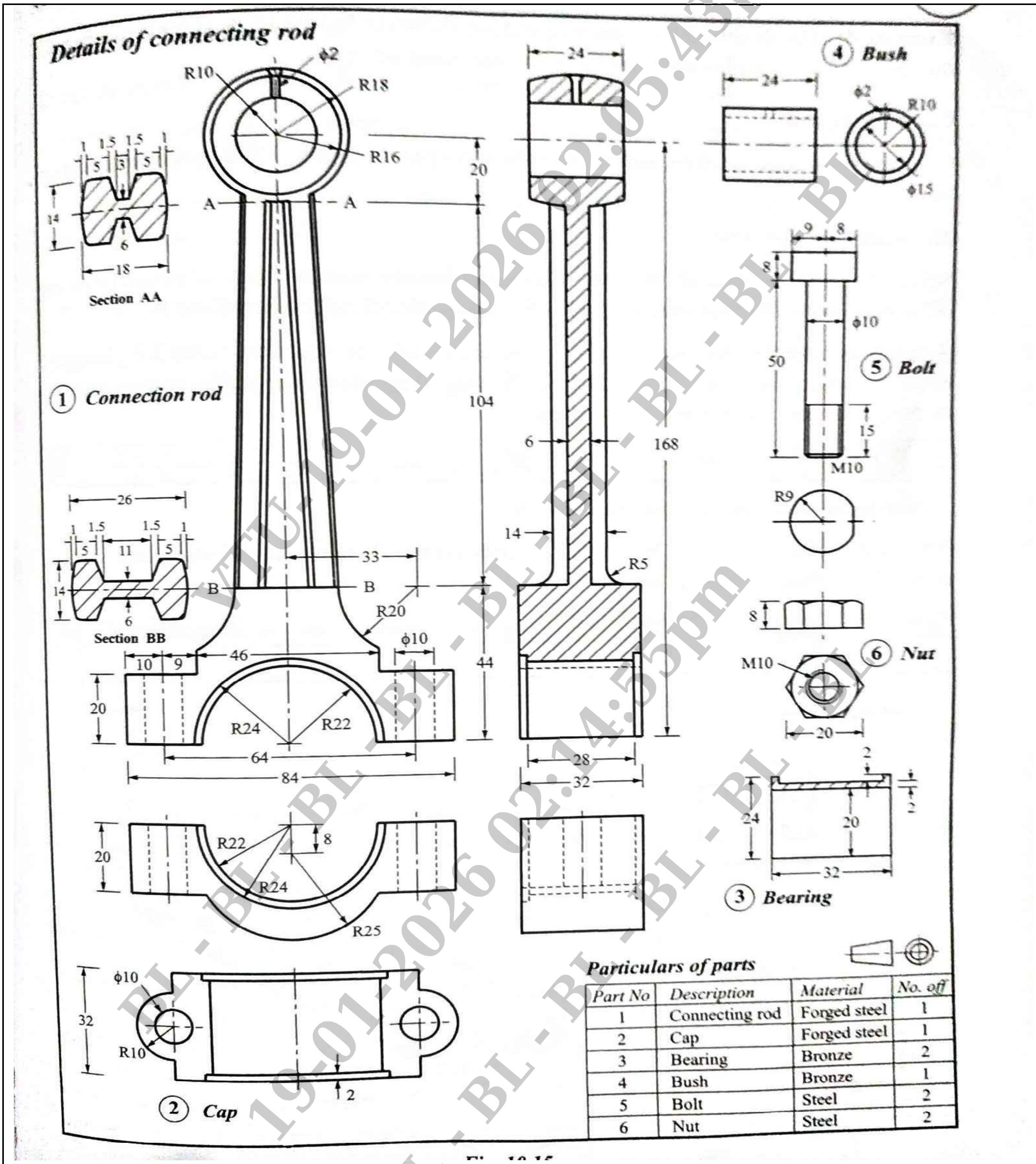

Part No	Description	Material	No. off
1	Connecting rod	Forged steel	1
2	Cap	Forged steel	1
3	Bearing	Bronze	2
4	Bush	Bronze	1
5	Bolt	Steel	2
6	Nut	Steel	2

Fig. Q3

Examiner 1:
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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.		Marks
	Module - 1	
1	Draw the dimensioned sketch of the square thread and ACME thread for a pitch of 30 mm	20
	Module - 2	
2	Draw the assembled sectional view and side view of an universal coupling to connect two shafts of 20mm diameter. The detail parts are shown in Fig Q2. Mark all the dimensions	30
	Module – 3	
3	The details parts of Plumber Block are shown in Fig Q3. Assemble the parts and show the following views: 1. Half sectional front view. 2. Top view	50

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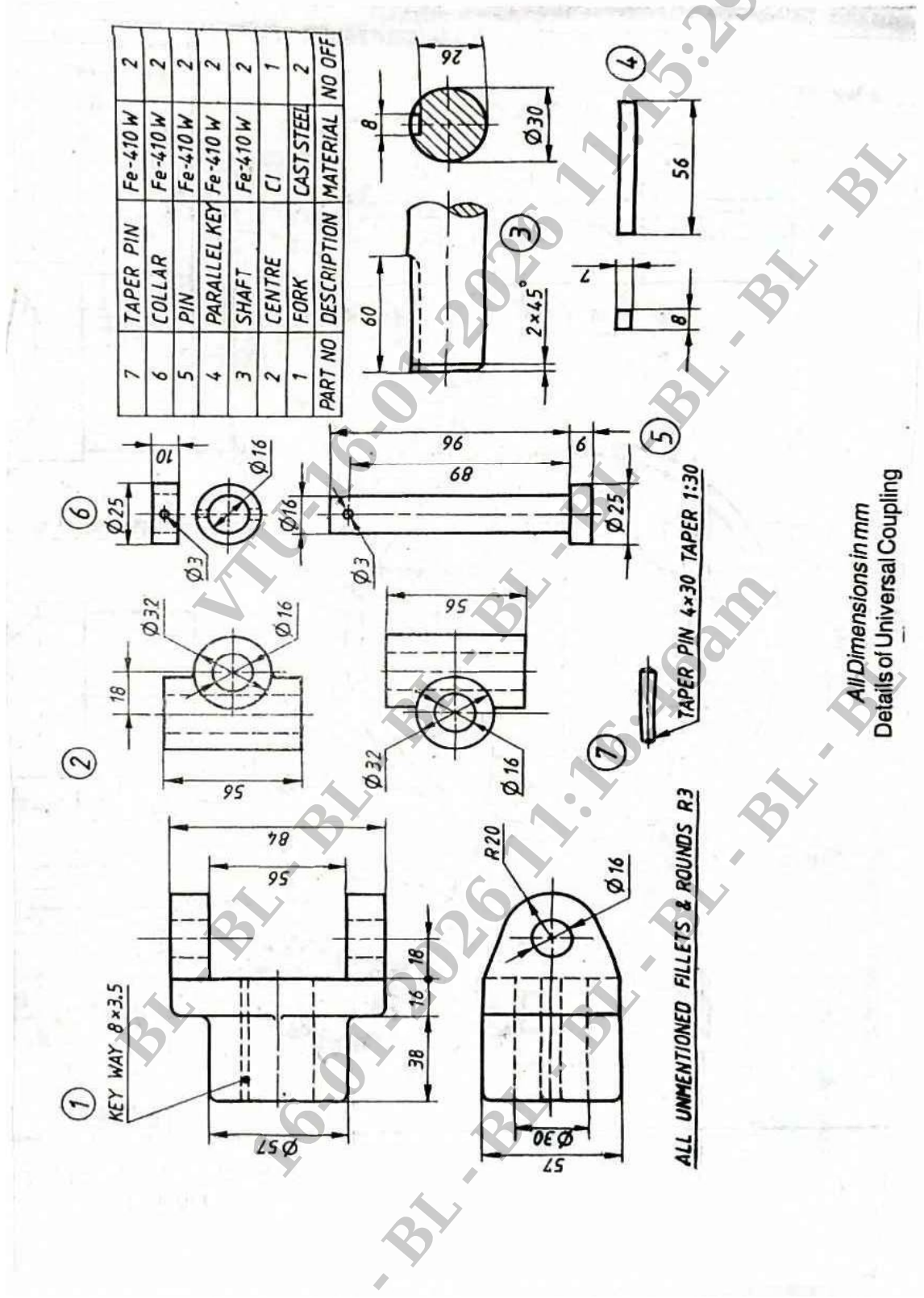

Fig. Q2

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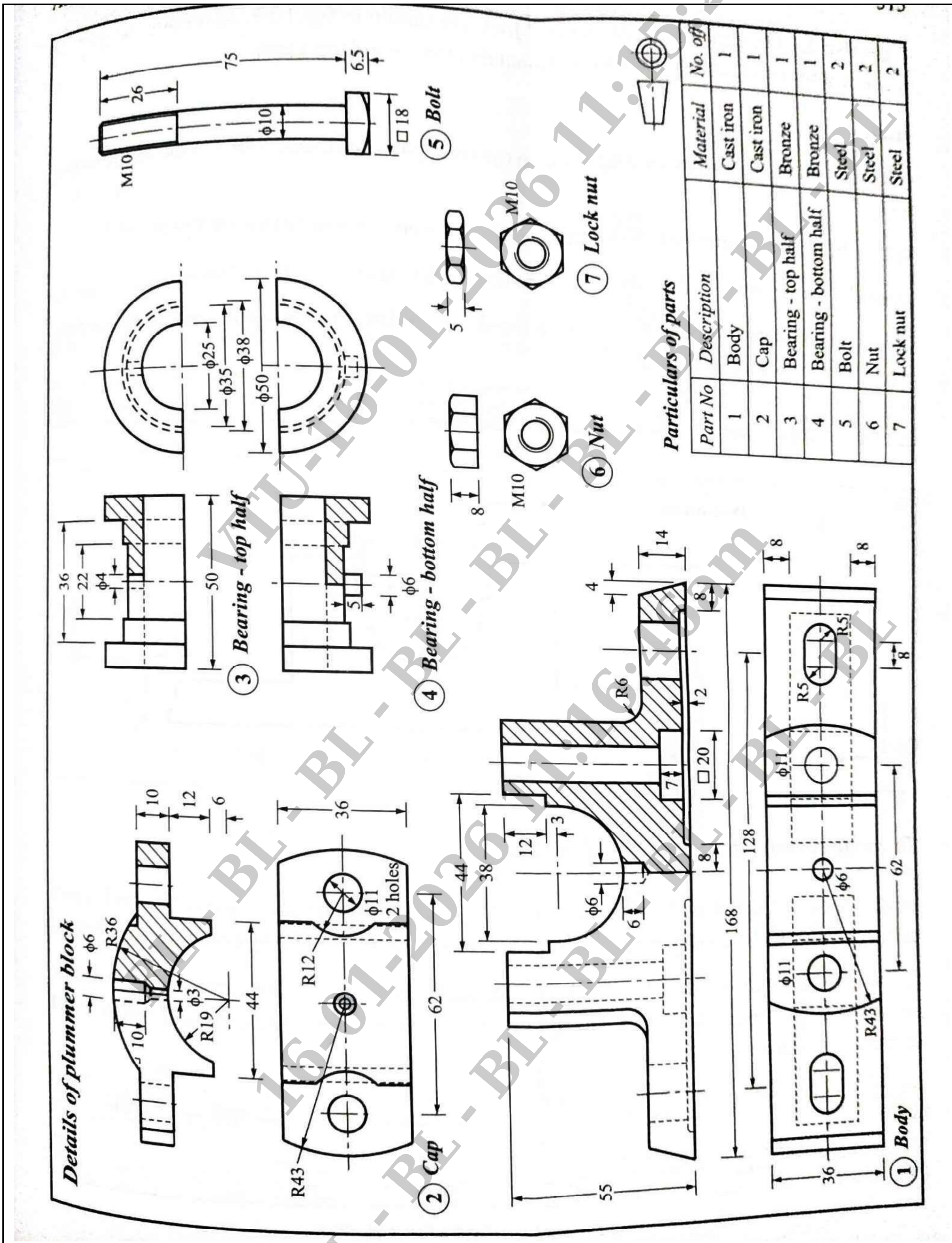

Part No	Description	Material	No. off
1	Body	Cast iron	1
2	Cap	Cast iron	1
3	Bearing - top half	Bronze	1
4	Bearing - bottom half	Bronze	1
5	Bolt	Steel	2
6	Nut	Steel	2
7	Lock nut	Steel	2

Fig. Q3

Examiner 1:
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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.		Marks
	Module - 1	
1	Create and assemble a square headed bolt, nut and washer. Take diameter of bolt d=20mm and Length L = 60mm.	**20**
	Module - 2	
2	A protected type flange coupling is used to connect the two shaft of 30mm diameter. Draw the half sectional front view and side view. Take number of bolts as 4.	**30**
	Module – 3	
3	The details parts of Plumber Block are shown in Fig Q3. Assemble the parts and show the following views: 1. Half sectional front view. 2. Top view	**50**

Examiner 1:
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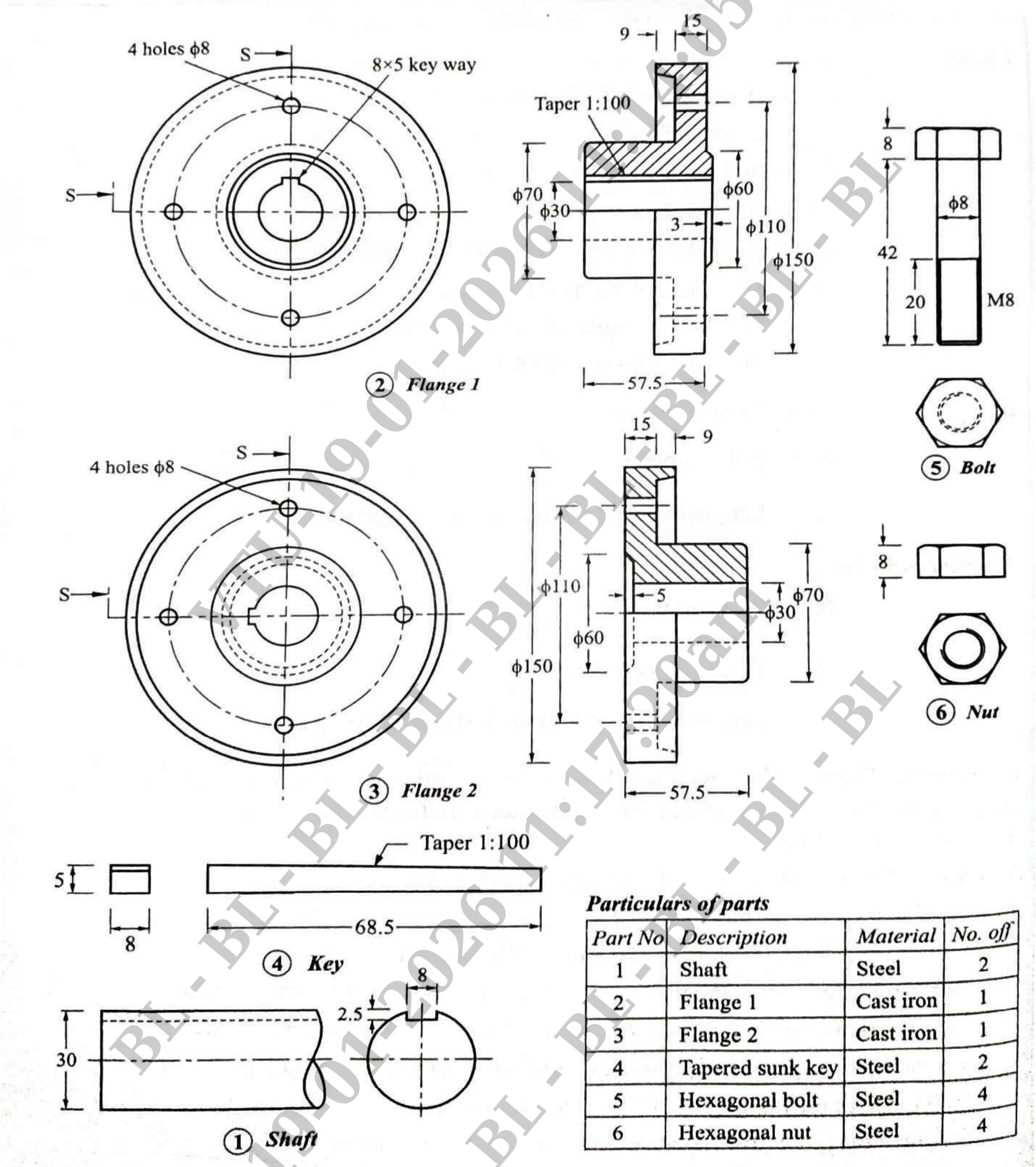

Particulars of parts

Part No	Description	Material	No. off
1	Shaft	Steel	2
2	Flange 1	Cast iron	1
3	Flange 2	Cast iron	1
4	Tapered sunk key	Steel	2
5	Hexagonal bolt	Steel	4
6	Hexagonal nut	Steel	4

Details of protected type flange coupling

Fig. Q2

Examiner 1:
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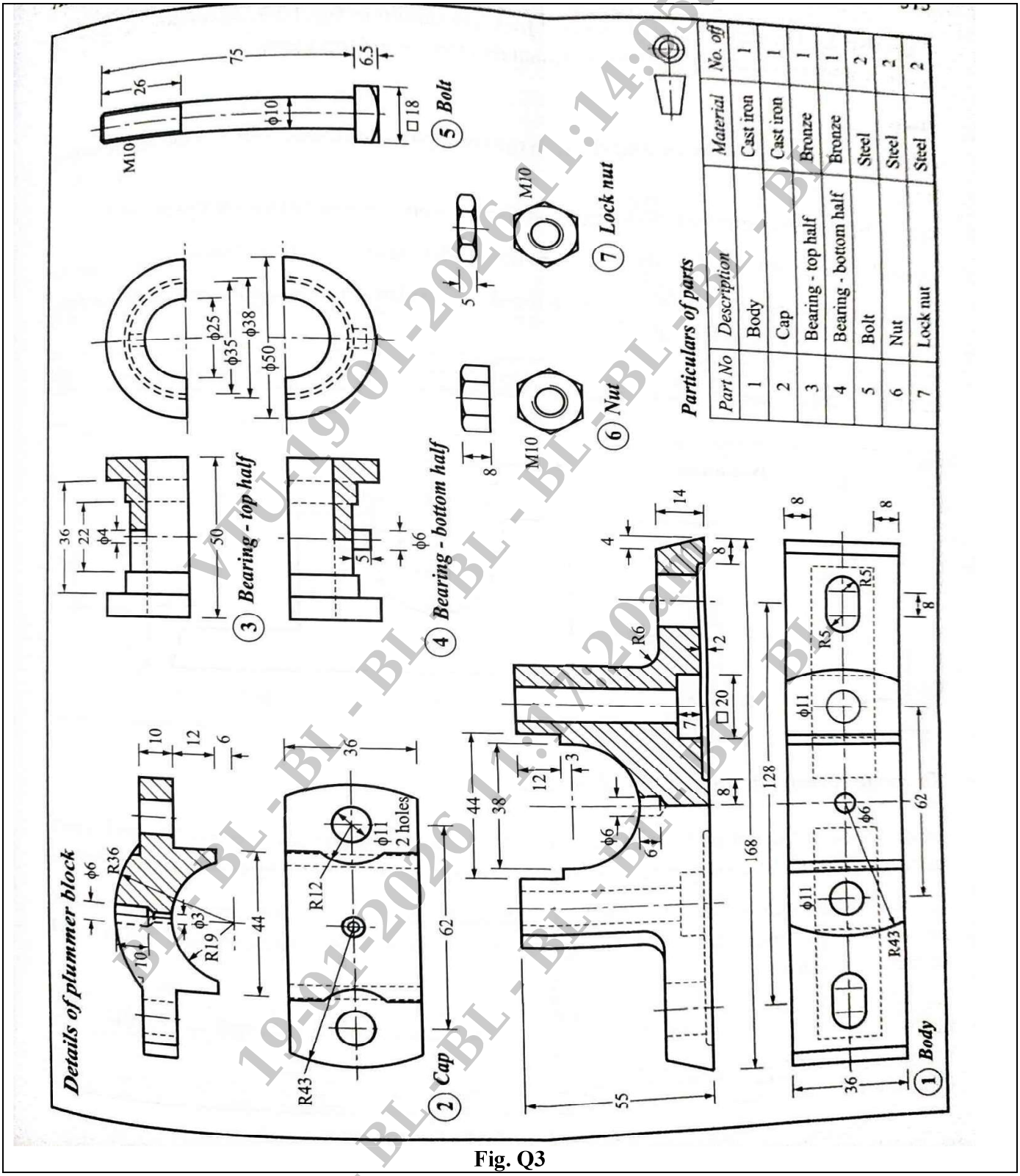

Fig. Q3

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions

2. Use first angle projections only

3. All the dimensions are in mm

4. If any data is missing, it may be suitably assumed and mentioned.

Module - 1		
Q. No.		**Marks**
1	Create and assemble a hexagonal headed bolt, nut and washer. Take diameter of bolt d=20mm and Length L = 60mm.	**20**
Module - 2		
2	A protected type flange coupling is used to connect the two shaft of 30mm diameter. Draw the half sectional front view and side view. The detail parts are shown in Fig. Q2 Take number of bolts as 4.	**30**
Module – 3		
3	Figure Q 3 shows the part details of a " Machine Vice ".Assemble the parts and show the sectional front view and top view.	**50**

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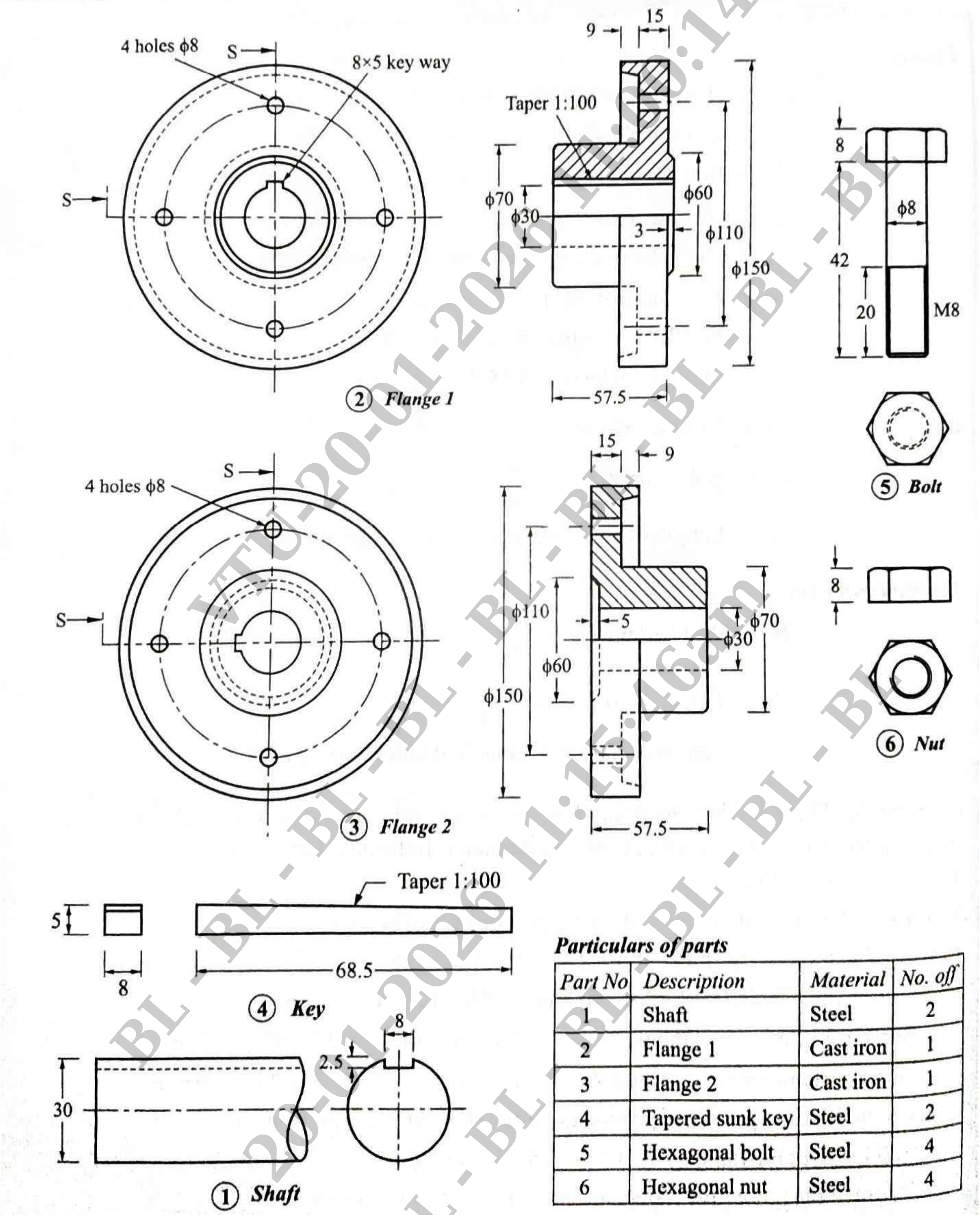

Particulars of parts

Part No	Description	Material	No. off
1	Shaft	Steel	2
2	Flange 1	Cast iron	1
3	Flange 2	Cast iron	1
4	Tapered sunk key	Steel	2
5	Hexagonal bolt	Steel	4
6	Hexagonal nut	Steel	4

Details of protected type flange coupling

Fig. Q2

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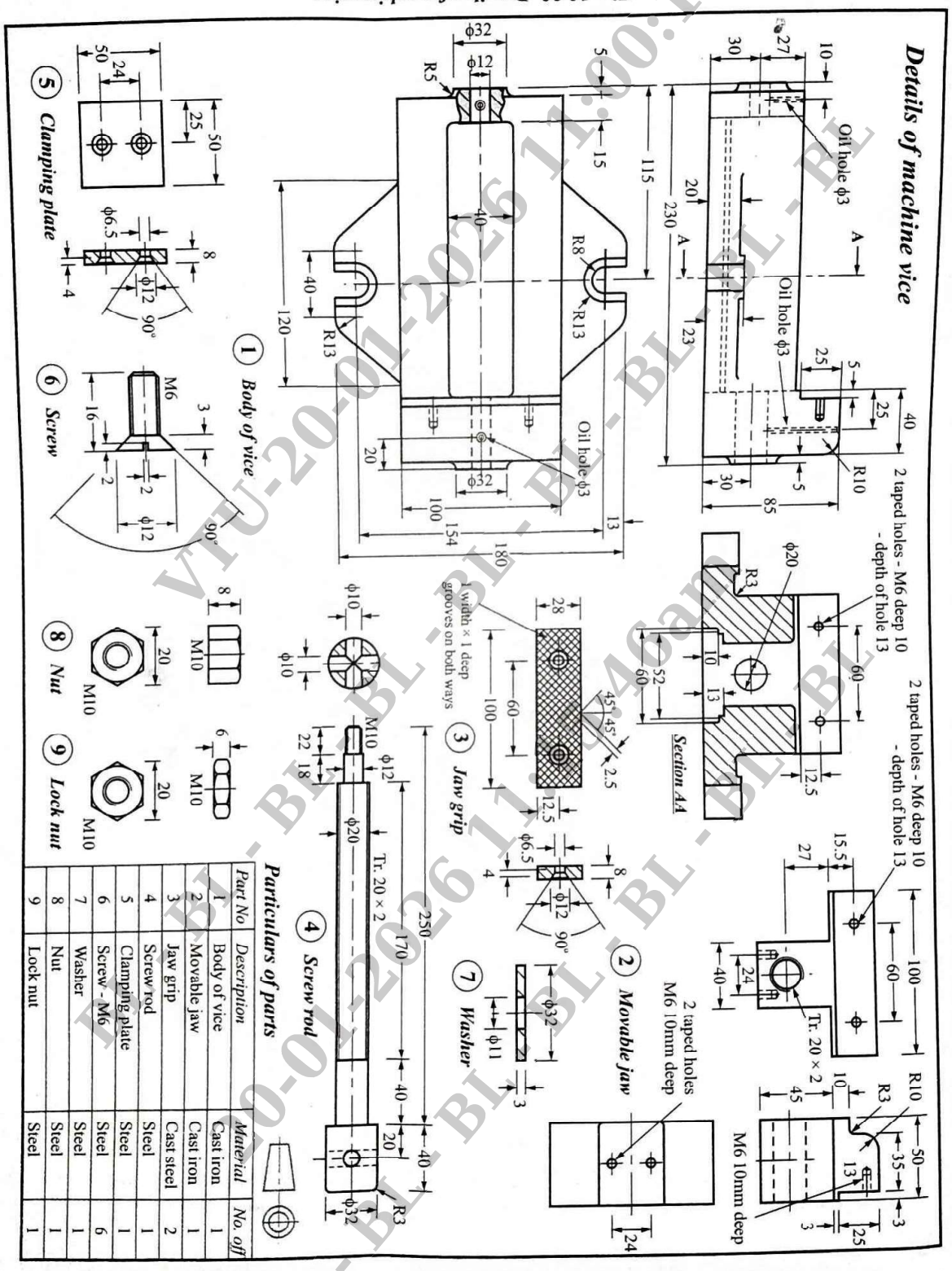

Fig. Q3

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Q. No.		Marks
	Module - 1	
1	Draw the dimensioned sketch of the square thread and ACME thread for a pitch of 30 mm	**20**
	Module - 2	
2	Draw the assembled sectional view and side view of an universal coupling to connect two shafts of 20mm diameter. The detail parts are shown in Fig Q2. Mark all the dimensions	**30**
	Module – 3	
3	The details parts of Plumber Block are shown in Fig Q3. Assemble the parts and show the following views: 1. Half sectional front view. 2. Top view	**50**

Examiner 1:
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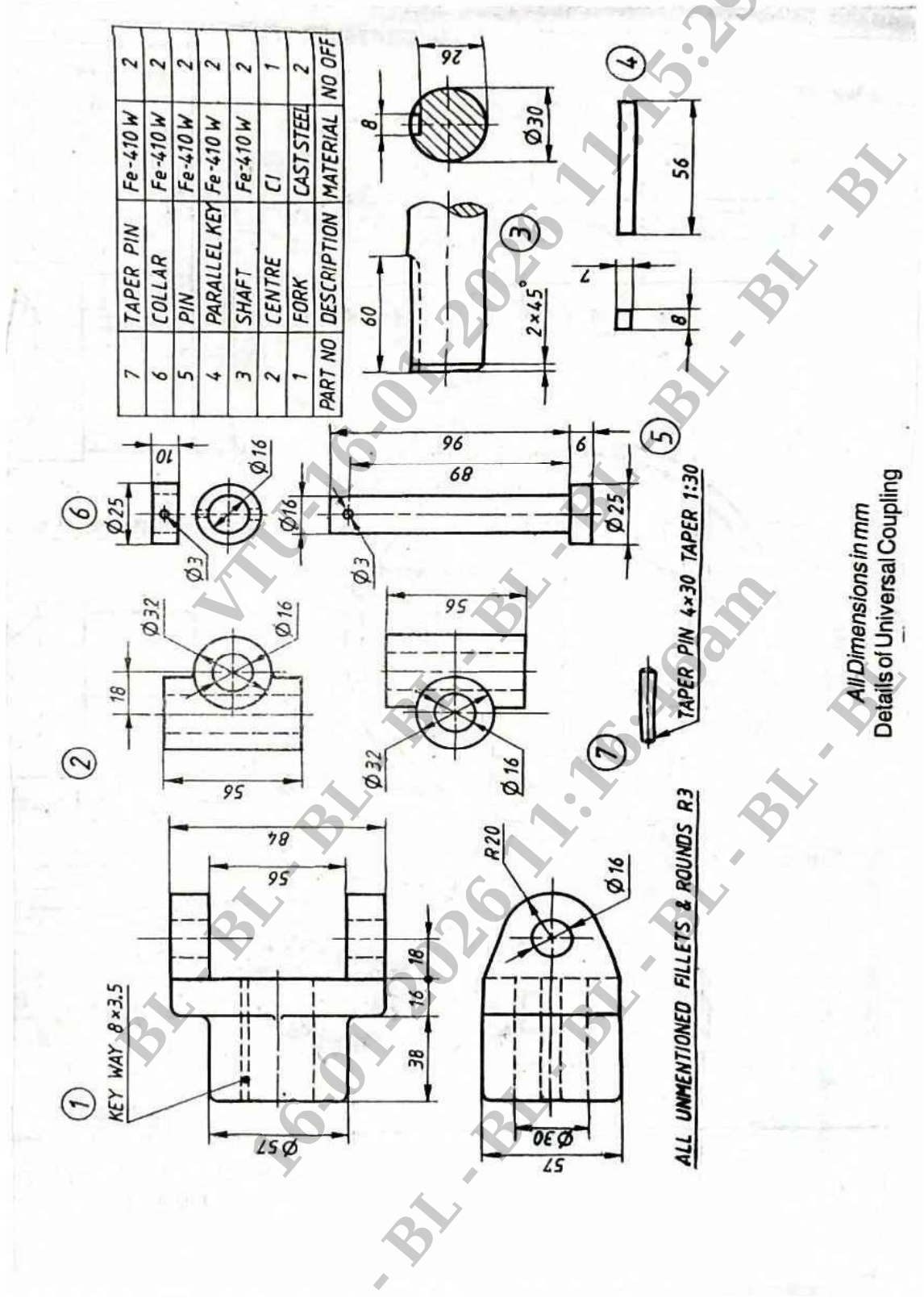

Fig. Q2

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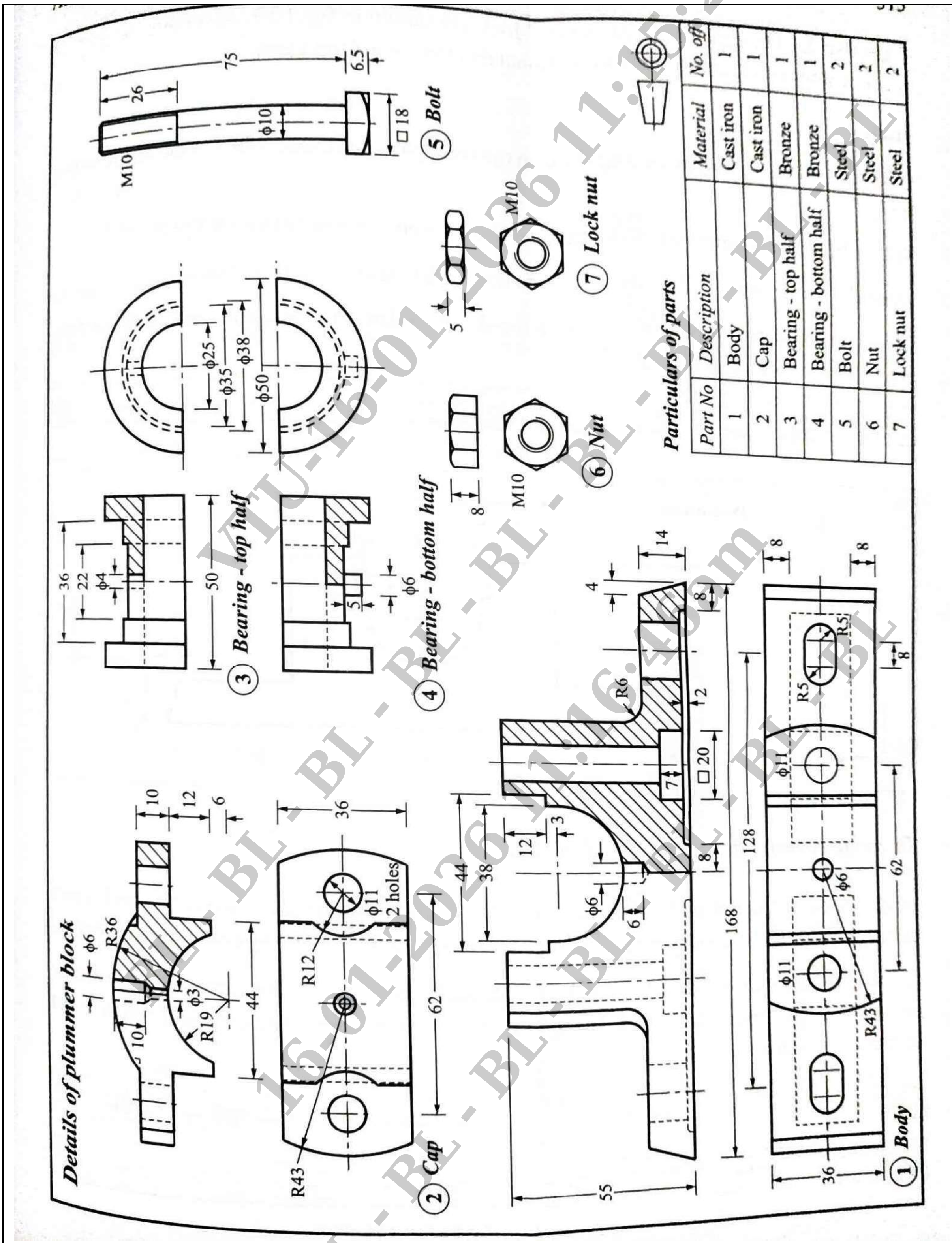

Fig. Q3

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026

INTRODUCTION TO MODELLING AND DESIGN FOR MANUFACTURING

Time: 3 Hours **Max.Marks:100**

Note: 1. Answer all questions
2. Use first angle projections only
3. All the dimensions are in mm
4. If any data is missing, it may be suitably assumed and mentioned.

Module - 1		
Q. No.		**Marks**
1	Create and assemble a square headed bolt, nut and washer. Take diameter of bolt d=20mm and Length L = 60mm.	**20**
Module - 2		
2	A protected type flange coupling is used to connect the two shaft of 30mm diameter. Draw the half sectional front view and side view. Take number of bolts as 4.	**30**
Module – 3		
3	The details parts of Plumber Block are shown in Fig Q3. Assemble the parts and show the following views: 1. Half sectional front view. 2. Top view	**50**

Examiner 1:
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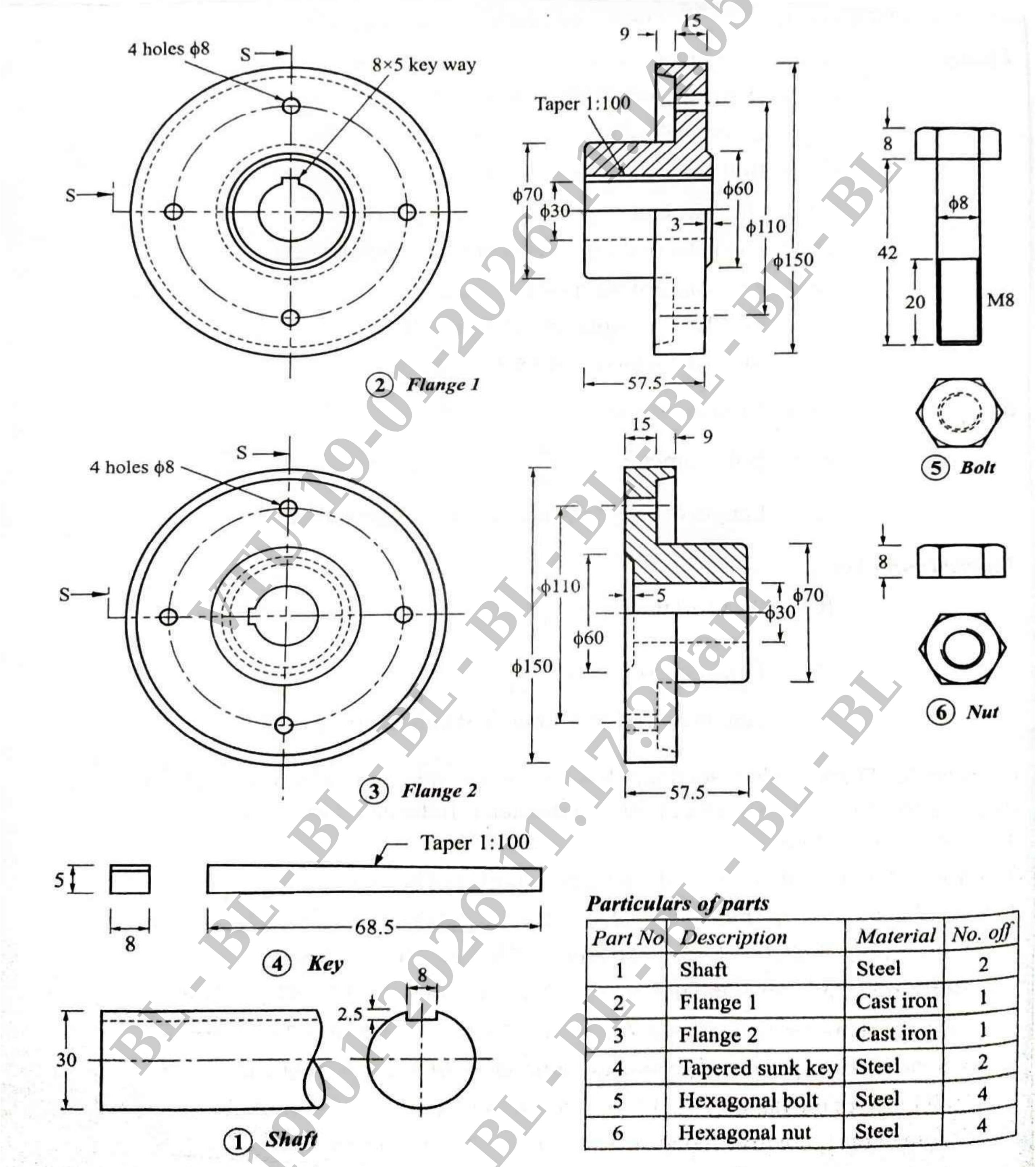

Particulars of parts

Part No	*Description*	*Material*	*No. off*
1	Shaft	Steel	2
2	Flange 1	Cast iron	1
3	Flange 2	Cast iron	1
4	Tapered sunk key	Steel	2
5	Hexagonal bolt	Steel	4
6	Hexagonal nut	Steel	4

Details of protected type flange coupling

Fig. Q2

Examiner 1:
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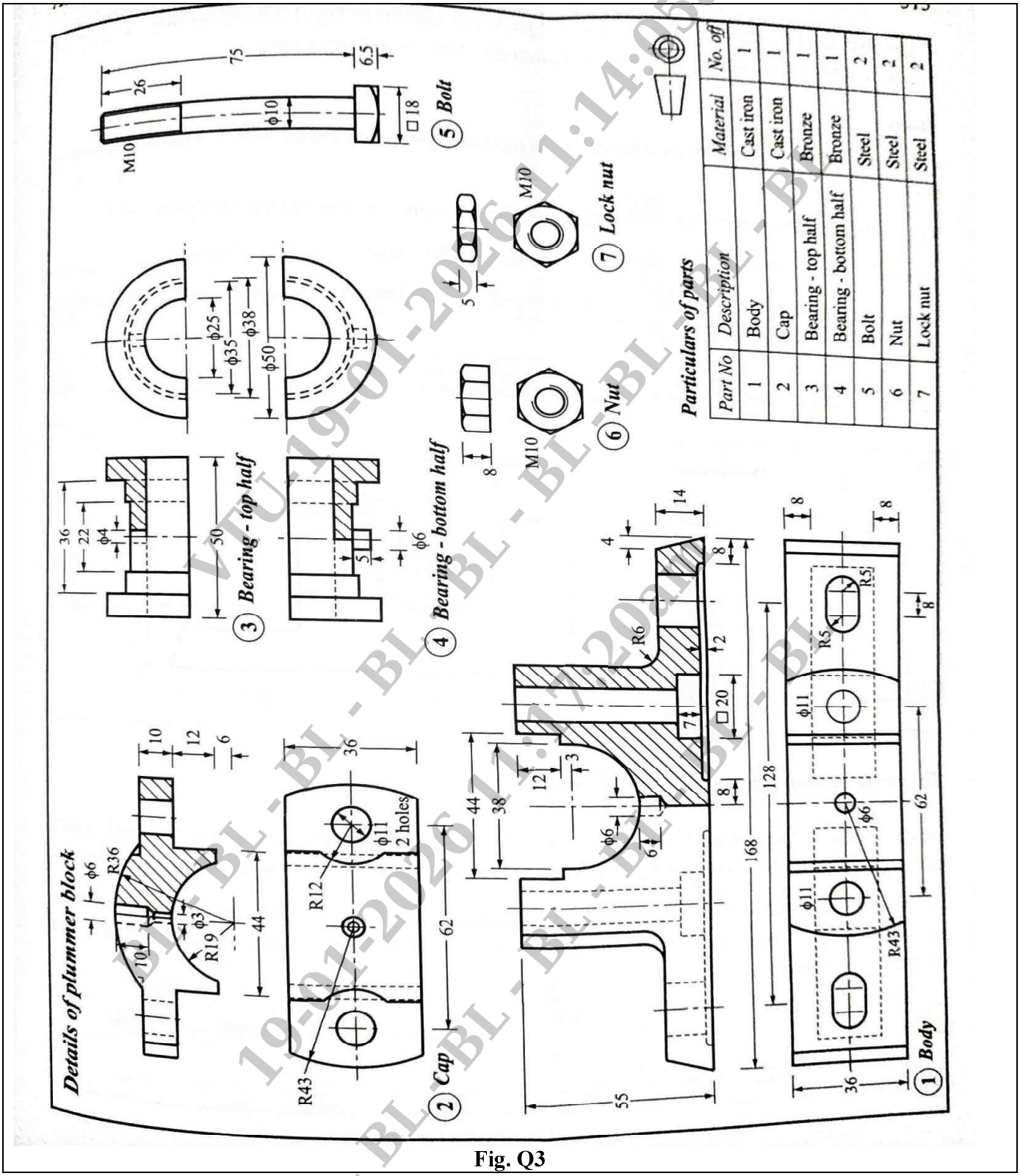

Fig. Q3

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BME401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Steam Tables and Thermodynamic Data hand book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Define cut off ratio and Air standard efficiency.	**04**	**L1**	**CO1**
	b.	With usual notations obtain Air Standard efficiency of otto cycle.	**06**	**L2**	**CO1**
	c.	The compression ratio of Diesel cycle is 14, and cut-off ratio is 2.2. At the beginning of the cycle, air is at 0.98 bar and 100° C. Find : i) Temperature and pressure at salient points. ii) Air standard efficiency.	**10**	**L3**	**CO1**
		OR			
Q.2	**a.**	Define the following : i) Indicated power ii) Brake power iii) Friction power iv) Mechanical efficiency	**04**	**L1**	**CO1**
	b.	Explain the process of combustion in SI engine.	**06**	**L2**	**CO1**
	c.	The following data were obtained from a Morse test on a 4 – cylinder, 4 – stroke, S.I engine, coupled to a hydraulic dynamometers operating at constant speed of 1500 rpm. Brake load with all the four cylinders firing = 296 N. Brake load with cylinder No. 1 not firing = 201 N. Brake load with cylinder No. 2 not firing = 206 N. Brake load with cylinder No. 3 not firing = 192 N. Brake load with cylinder No. 4 not firing = 200 N. The brake power in 'KW' is calculated using BP = $\frac{WN}{42300}$ Where, W = Brake load in Newtone. N = Engine speed in rpm. Calculate : i) Brake power ii) Indicated power iii) Friction power iv) Mechanical efficiency	**10**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Derive an expression for the efficiency of a Brayton cycle.	**06**	**L2**	**CO2**
	b.	Explain the difference between open cycle and closed cycle gas turbine.	**04**	**L1**	**CO2**
	c.	Air enters the compressor of an ideal air standard Brayton cycle at 100 kpa, 300 k with a volumetric flow rate of 6 m^3/s. The compressor work ratio is 10. The turbine inlet temperature is 1500 k. Determine: i) The thermal efficiency ii) Work ratio iii) Power. Take γ = 1.4 C_p = 1.005 KJ/KgK	**10**	**L3**	**CO2**

		OR			
Q.4	**a.**	With a neat sketch explain the working of Ram jet.	**10**	**L2**	**CO2**
	b.	Discuss the working principle of Rocket propulsion with neat sketch.	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	List the drawbacks of Carnot vapour power cycle.	**04**	**L1**	**CO3**
	b.	Discuss the effect of i) Boiler pressure ii) Condenser pressure on the performance of a Rankine cycle.	**06**	**L2**	**CO3**
	c.	In a steam power cycle, the steam supply is at 15 bar, and dry saturated. The condenser pressure is 0.4 bar. Calculate the thermal efficiency for i) Carnot vapour power cycle ii) Rankine vapour power cycle Neglect pump work.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	With help of neat sketch, explain the working of Reheat Rankine cycle.	**08**	**L2**	**CO3**
	b.	A turbine is supplied with steam at a pressure of 20 bar and Temperature 350° C, The steam is then expands to a condenser pressure of 0.04 bar. Calculate its thermal efficiency. It is desired to improve the efficiency by regenerative feed heating by bleeding steam at 2 bar and heating in an open feed heater. Calculate the percentage improvement in thermal efficiency. Neglect pump work in the above calculation.	**12**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	List out the desirable properties of refrigerant.	**04**	**L1**	**CO4**
	b.	With help of neat sketch, explain the working principle of vapour compression Refrigeration System.	**06**	**L2**	**CO4**
	c.	A simple vapour compression refrigeration plant produces 5 Tonnes of refrigeration. The enthalpies of the working fluid at inlet to the compressor = 183.19 kJ/kg at exit of compressor = 209.41 kJ/Kg , at exit of the condenser = 74.59 kJ/kg. Estimate : i) The refrigerant flow rate ii) COP of the plant iii)Power required to drive the compressor iv) The rate of heat rejection in the condenser	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Define : i) Sensible heating ii) Sensible coding	**04**	**L1**	**CO4**
	b.	With a neat sketch, explain a summer air conditioning system.	**06**	**L2**	**CO4**
	c.	An air conditioning system is designed under the following conditions. Out door conditions: 30° C DBT, 75% RH Required indoor conditions: 22°C DBT, 70% RH. Amount of free air circulated 3.33 m^3 / s. Coil dew point temperature (DPT) = 14°C. The required conditions is achieved first by cooling and dehumidification and then by heating. Estimate : i) The capacity of the cooling coil in Tonnes of refrigeration ii) The capacity of heating coil in KW iii) The amount of water vapour removed in kg /hr.	**10**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Define the following with respect to a reciprocating air compressor. i) Volumetric efficiency ii) Adibatic efficiency iii) Isothermal efficiency iv) Mechanical efficiency	**06**	**L1**	**CO5**
	b.	Explain the advantages of multistage compression.	**04**	**L2**	**CO5**
	c.	A 2 – stage air compressor with complete inter cooling delivers air to the mains at a pressure of 30 bar suction conditions are 1 bar of 15°C. If both cylinders have same stroke. Find the ration of cylinder diameter for maximum efficiency. The index of compression is 1.3.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	With usual notations derive the expression for critical pressure ratio.	**10**	**L2**	**CO5**
	b.	A turbine having a set of 16 nozzles receives steam at 20bar and 400°C. The pressure of steam at the nozzle exit is 12 bar. If the discharge rate is 260 kg/mm and nozzle efficiency is 90%. Calculate the cross – sectional area at the nozzle exit. If the steam has a velocity of 80 m/s at entry to the nozzle. Fine the percentage increase in discharge.	**10**	**L4**	**CO5**

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CBCS SCHEME

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21ME51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Theory of Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Kinematic Pair. Classify different types of Kinematic Pairs. **(10 Marks)**

b. Explain Inversions of double slider crank chain with neat sketches. **(10 Marks)**

OR

2 The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine :

i) Velocity of piston
ii) Angular velocity of connecting rod
iii) Velocity of point 'E' on the connecting rod 0.5 m from the crank end
iv) Velocities of rubbing at the pins of the crank shaft, crank and cross head when the diameter of their pins are 50 mm, 60 mm and 30 mm respectively.
v) Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. **(20 Marks)**

Module-2

3 a. State the condition of equilibrium of a body subjected to a system of :
(i) two force (ii) two forces and a torque (iii) three force member **(06 Marks)**

b. In Fig.Q3(b) a slider crank mechanism is shown, the values of forces applied on slider 4 is 3000 N. Determine the forces on various links. Also calculate the driving torque T_2.

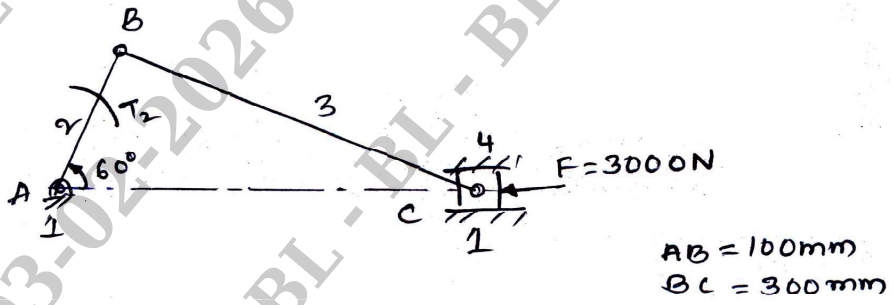

Fig.Q3(b) **(14 Marks)**

OR

4 a. Derive an expression for size of flywheel. **(06 Marks)**

b. A punching press is driven by a constant torque electric rotor. The press is provided with a flywheel that rotates at a maximum speed of 225 rpm. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour, each punching operation takes two seconds and requires 15 KN.m energy. Find the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 rpm. **(14 Marks)**

Module-3

5 a. Derive the equation for length of path of contact of a spur gear. **(08 Marks)**

b. Two mating gears have 30 and 50 teeth of involute form, module is 12 mm and pressure angle 20°. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height, for each gear wheel, length of path of contact, arc of contact and contact ratio. **(12 Marks)**

OR

6 a. Explain with neat sketch :
i) Simple gear train ii) Compound gear train iii) Epicyclic gear train **(08 Marks)**

b. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm of the gear train rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of the gear B. If the gear A instead of using fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B. Arrangement is shown in Fig.Q6(b). **(12 Marks)**

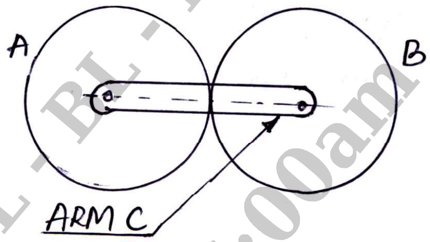

Fig.Q6(b)

Module-4

7 a. What do you mean by Static and Dynamic Balancing? **(04 Marks)**

b. A, B, C and D are 4 masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the 4 masses so that the shaft shall be in complete balance. **(16 Marks)**

OR

8 a. Explain the following terms relative to governors :
i) Stability ii) Sensitiveness iii) Isochronism iv) Hunting v) Effort **(10 Marks)**

b. A porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 15 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and the range of speed of the governor. **(10 Marks)**

Module-5

9 a. Define the following with respect to vibration :
i) Natural frequency ii) Resonance iii) Damping factor
iv) Logarithmic decrement v) Amplitude **(10 Marks)**

b. A vibrating system having a mass of 3 kg, spring stiffness of 100 N/mm and damping coefficient of 3 N-s/m. Determine damping ratio, damped natural frequency, logarithmic decrement, ratio of two consecutive amplitudes and number of cycles after which the original amplitude is reduced to 20%. **(10 Marks)**

OR

10 a. Derive an equation for steady state amplitude for forced vibration with rotating unbalance. **(10 Marks)**

b. A mass of 10 kg suspended from one end of helical spring, the other end is fixed. The stiffness of spring is 10 N/mm. The viscous damping causes the amplitude to decrease $1/10^{th}$ of initial value in four complete oscillations. If a periodic force of 150 cos5t N is applied at the mass with vertical direction. Find the amplitude of forced vibration. What is its value at resonance? **(10 Marks)**

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CBCS SCHEME

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BME515D

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Energy Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	With a neat sketch, explain the working principle of Benson Boiler.	**10**	**L2**	**CO1**
	b.	With a neat sketch, explain forced draught and induced draught cooling towers.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	With a neat diagram , explain the general layout of diesel power plants.	**10**	**L2**	**CO1**
	b.	Explain the different methods of starting diesel engines.	**6**	**L2**	**CO1**
	c.	Write any 4 applications of diesel power plants.	**4**	**L1**	**CO1**
		Module – 2			
Q.3	**a.**	With a neat sketch, explain Pyranometers.	**6**	**L2**	**CO2**
	b.	With a neat sketch, explain the flat plate collectors.	**6**	**L2**	**CO2**
	c.	With a neat diagram, explain the electric power generation from solar ponds.	**8**	**L2**	**CO2**
		OR			
Q.4	**a.**	Write the difference between Biomass and Biogas.	**5**	**L4**	**CO3**
	b.	Explain the working of down draft gasifier, with neat sketch.	**10**	**L2**	**CO3**
	c.	What are the factors affecting biogas generation.	**5**	**L1**	**CO3**
		Module – 3			
Q.5	**a.**	Explain the advantages and disadvantages of Tidal plants.	**10**	**L1**	**CO3**
	b.	Explain the Hot dry rock energy system, with a neat sketch.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Explain the working of Horizontal axis wind mill.	**10**	**L2**	**CO3**
	b.	List the advantages and disadvantages of wind energy.	**10**	**L1**	**CO3**

Module – 4					
Q.7	**a.**	With a neat sketch, explain the general layout of a hydel power plant.	**10**	**L2**	**CO3**
	b.	Write a note on : i) Hydrographs ii) Flow duration curves iii) Spill ways iv) Surge tank v) Water hammer	**10**	**L1**	**CO3**
OR					
Q.8	**a.**	List the advantages of hydel power plants.	**5**	**L1**	**CO3**
	b.	What are the problems encountered in harnessing OTE?	**7**	**L1**	**CO3**
	c.	Explain the working of Rankine cycle in OTEC system.	**8**	**L2**	**CO3**
Module – 5					
Q.9	**a.**	Write the advantages and disadvantages of nuclear power plants.	**10**	**L1**	**CO3**
	b.	Explain the layout of a nuclear power plant.	**10**	**L2**	**CO3**
OR					
Q.10	**a.**	With a neat sketch, explain boiling water reactor.	**10**	**L2**	**CO3**
	b.	Write a note on : i) Structure of an atom ii) Disposal of nuclear wastes.	**10**	**L1**	**CO3**

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CBCS SCHEME

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21ME61

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Production and Operations Management

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Productivity. Explain the factors affecting the productivity. **(08 Marks)**

b. Explain the steps involved in decision making process. **(09 Marks)**

c. Explain a decision tree. **(03 Marks)**

OR

2 a. A glass factory specializing in crystal is experiencing a substantial backlog, and the firm's management is considering three courses of action :
i) arrange for subcontracting
ii) Begin overtime production or
iii) Construct new facilities. The correct choice depends largely upon future demand, which may be low, medium or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon profits that is shown in Table 1.

Table 1, Q. 2(a) [Profit in Rs. thousands]

	Profit (Rs.000) If Demand is		
	Low (P = 0.10	Medium (P= 0.50)	High (P= 0.40
A – Arrange subcontracting	10	50	50
B – Begin overtime	- 20	60	100
C = Construct facilities	-150	20	200

i) State which course of action would be taken under a criterion of
1) Maximax 2) Maximin 3) Maximum probability 4) Maximum expected value
ii) Show this decision situation schematically in the form of a decision tree. **(10 Marks)**

b. Explain the important differences between goods production and service operations. **(10 Marks)**

Module-2

3 a. Explain the steps in the forecasting process. **(06 Marks)**

b. Write a short note on concurrent Engineering. **(05 Marks)**

c. Explain various sources of idea generation in product design and development. **(09 Marks)**

OR

4 a. The general manager of a building materials production plant feels that the demand for plasterboard shipments may be related to the number of construction permits issued in the country during the previous quarter.
The manager has collected the data as shown in Table 2

Table2, Q. 4(a)

Construction permits	15	9	40	20	25	25	15	35
Plaster board Shipments	6	4	16	6	13	9	10	16

i) Develop a linear regression equation.
ii) Determine a point estimate for plasterboard shipments when the number of construction permits is 30. Also, compute correlation coefficient. **(10 Marks)**

b. Write a short note on controlling the forecast. **(05 Marks)**

c. Explain the role of Computer Aided Design (CAD) in designing the products. **(05 Marks)**

Module-3

5 a. Mention the steps involved in the general procedure for making location decisions. **(04 Marks)**

b. Explain the factors that determine effective capacity. **(10 Marks)**

c. With sketches explain i) A product layout ii) A process layout. **(06 Marks)**

OR

6 a. Explain Design Capacity and System Capacity. Silver valley smelting is considering the expansion of a production process by adding more 1 – ton – capacity curing furnaces. Each batch (1 ton) of ore must undergo 30 minutes of furnace time, including load and unload operations. However, the furnace is used only 80% of the time due to power restrictions in other parts of the system. The required output for the new layout is to be 16 tons per shift. Each shift is of eight hours. Plant (system) efficiency is estimated at 50% of system capacity.

i) Determine the number of furnaces required
ii) Estimate the percentage of time the furnaces will be idle. **(10 Marks)**

b. Explain Break even Analysis with a neat sketch. For an existing product that sells for Rs. 650 per unit, Fixed costs is Rs. 82000 and variable cost is Rs. 240 per unit.

i) What is the BEP?
ii) What volume is needed to generate a profit of Rs. 10250? **(10 Marks)**

Module-4

7 a. List and explain the pure strategies used in the aggregate planning for meeting uneven demand. **(07 Marks)**

b. Write a short note on " Disaggregating the Aggregate Plan". **(05 Marks)**

c. Given the accompanying supply, demand and inventory data (Table 3 and Table 4) for a firm that has a constant workforce and wishes to meet all demand with no back orders, allocate production capacity to satisfy demand at minimum cost.

Table 3, Q. 7(c), Supply, (units)

Period	Regular time	Overtime	Subcontract
1	60	18	1000
2	50	15	1000
3	60	18	1000
4	65	20	1000

(08 Marks)

Table 4, Q. 7 (c) Demand

Period	Units
1	100
2	50
3	70
4	80

i) Initial Inventory = 20
ii)Final inventory = 25

Regular time cost per unit = Rs. 100, out of which 50% of cost is labour.
Overtime cost per unit = Rs. 125.
Subcontract cost per unit = Rs. 130
Inventory carrying cost = Rs. 2 per unit – period
Use the transportation linear programming approach to develop an aggregate plan based on the 4 periods.

OR

8 a. What do you mean by Master Scheduling? Explain the inputs and outputs of Master Scheduling. **(08 Marks)**

b. Explain the concept of time fences in MPs (Master Production Schedule) with a block diagram. **(06 Marks)**

c. Find the ATP (Available – to – Promise) inventory values for the master schedule shown in Table 5.

Table 5, Q.8(c), Master Schedule

On hand =23 Lot size = 25 Planning time Fence 6						
Period	1	2	3	4	5	6
Forecast	10	10	10	10	20	20
Customer Orders (booked)	13	5	3	1		

(06 Marks)

Module-5

9 a. Define (i) MRP (ii) CRP (iii) ERP. Also list the essential inputs and outputs in an MRP System? **(10 Marks)**

b. List the benefits and requirements of MRP. **(04 Marks)**

c. The product structure tree for X is as shown in figure Q.9(c), with the number of units required shown in brackets. What quantities of E, J and K are required to complete 500 units of X?

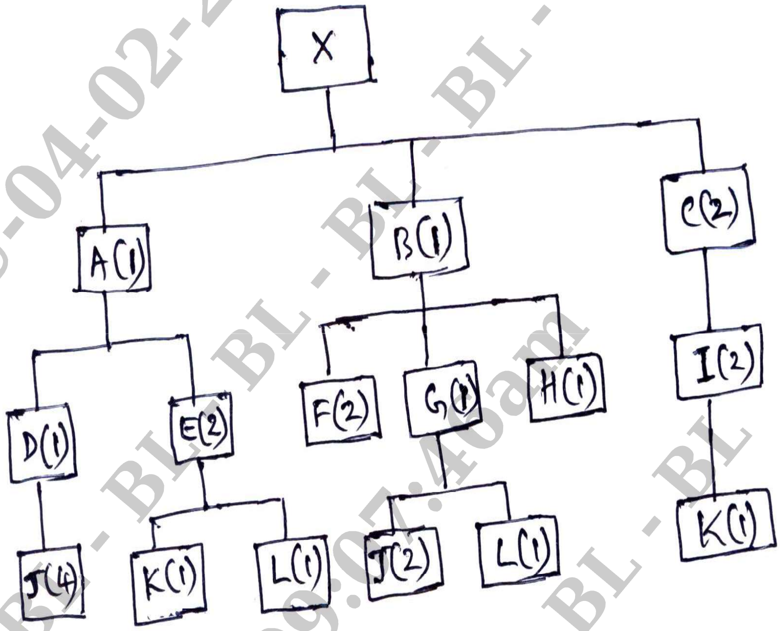

Fig. Q 9 (c) Product Structure tree for X

(06 Marks)

OR

10 a. Explain the procurement process with a block diagram. **(10 Marks)**

b. Explain the stages in vendor development with a block diagram. **(10 Marks)**

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CBCS SCHEME

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21ME753

Seventh Semester B.E. Degree Examination, Dec.2025/Jan.2026
Operation Research

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Briefly explain the phases of OR study. **(06 Marks)**

b. A company produces two products A and B which possess raw material of 500 quintals and 550 labour hours. It is known that 1 unit of product 'A' requires 6 quintals of materials and 11 man hours and yields profit of Rs 55. Product 'B' requires 30 quintals of materials, 25 man hours and yields a profit of Rs 85. Formulate the LPP and find the number of products to be produced. **(14 Marks)**

OR

2 a. What is Operation Research? What are its characteristics? **(06 Marks)**

b. A person has to provide 10 ,12 and 12 units of chemicals A, B and C respectively to his garden. A liquid product contains 5 , 2 and 1 unit of chemical A , B and C respectively per jar and cost Rs 3 per jar. A dry product contains 1 , 2 and 4 units of chemicals A , B , C respectively per packet and cost Rs 2 per packet. How many of these the person should purchase to meet the requirements at least cost? Formulate as an LPP and solve graphically. **(14 Marks)**

Module-2

3 a. Define Slack , Surplus variable used in Simplex method. **(06 Marks)**

b. Solve the below LPP by Simplex Method.

$Z_{MAX} = 5x_1 + 3x_2$

Subjected to $x_1 + x_2 \leq 2$

$5x_1 + 2x_2 \leq 10$

$3x_1 + 8x_2 \leq 12$

$x_1 , x_2 \geq 0.$ **(14 Marks)**

OR

4 a. What is degeneracy in Simplex method? How to overcome it? **(06 Marks)**

b. Solve the below problem (LPP) by BIG – M method.

$Z_{max} = 2x_1 + 3x_2 + 4x_3$

Sub. to $x_1 + x_2 + x_3 \leq 1$

$x_1 + x_2 + 2x_3 = 2$

$3x_1 + 2x_2 + x_3 \geq 4$

$x_1 , x_2 , x_3 \geq 0.$ **(14 Marks)**

Module-3

5 a. What are the characteristics of assignment technique / model / problems? **(06 Marks)**

b. A company has 5 jobs to be done on 5 machines. Any job can be done on any machine. The cost of doing the jobs on different machines is given below. Assign the jobs for different machines so as to minimize the total cost **(14 Marks)**

		MACHINES				
		A	B	C	D	E
JOBS	1	13	8	16	18	19
	2	9	15	24	9	12
	3	12	9	4	4	4
	4	6	12	10	8	13
	5	15	17	18	12	20

OR

6 a. What is the nature of Transportation problem? **(06 Marks)**

b. A company has 3 plants and 4 destinations , unit transportation cost is shown below. Find the optimum cost. **(14 Marks)**

		TO				
		P	Q	R	S	SUPPLY
FROM	A	21	16	25	13	11
	B	17	18	14	23	13
	C	32	17	18	41	19
	DEMAND	6	10	12	15	

Module-4

7 a. Explain the significance of PERT & CPM technique. **(06 Marks)**

b. A project has 9 activities. Below table shows the time in days for each activity and predecessor relation between activities. Find

i) Draw the network diagram
ii) Project completion time
iii) What is the critical path **(14 Marks)**

Activity	A	B	C	D	E	F	G	H	I
Predessor	-	-	-	A	A	BD	C	BD	FG
Time	23	8	20	16	24	18	19	4	10

OR

8 a. How Que's are distinguished using KENDAL rotation? **(06 Marks)**

b. Customer arrive to a bank with mean of 10 per hour in Poission distribution. The customers are served with a mean of 5 minutes. Determine

i) What is the probability that customer directly served?
ii) How many customers are waiting in the bank?
iii) What is the time a customer need to come out of the bank?
iv) What is the probability that there are 10 customers in the queue? **(14 Marks)**

Module-5

9 a. Define the term i) PURE strategy ii) MAX – MIN Criteria. **(06 Marks)**

b. Solve the below game by Dominance rule. Player A's pay off matrix is given below :

		PLAYER - B			
		I	II	III	IV
PLAYER - A	1	1	-2	1	2
	2	-1	3	2	0
	3	-1	-2	3	4
	4	-4	-2	2	3

(14 Marks)

OR

10 a. What is Sequencing? What are the assumptions to be made in sequencing technique? **(06 Marks)**

b. A garments manufacturing has 7 jobs to be processed on cutting , sewing , pressing machines. The time for each stages is shown below. Find the sequence with total elapsed time and idle time. **(14 Marks)**

JOBS →	1	2	3	4	5	6	7
Cutting	5	7	3	4	6	7	12
Sewing	2	6	7	5	9	5	8
Pressing	10	12	11	13	12	10	11

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CBCS SCHEME

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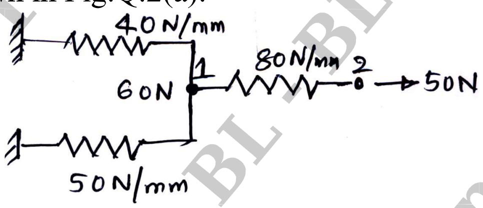
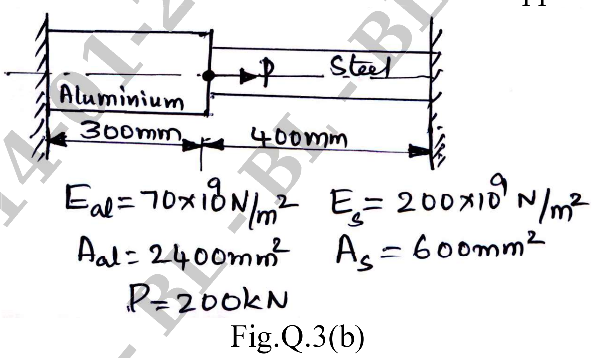
BME701

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

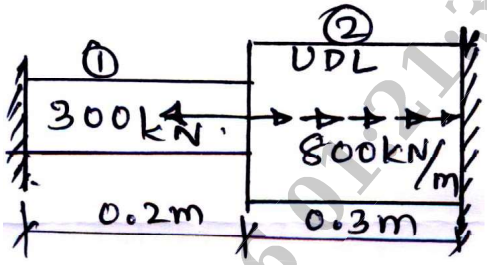
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	Define FEM. Explain the basic steps in the finite element methods.	**10**	**L2**	**CO1**
	b.	Explain the plane stress and plane strain problems with examples, write the relation between stress and strain.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	Using minimum potential energy determine the nodal displacement of a spring system shown in Fig.Q.2(a).  Fig.Q.2(a)	**8**	**L3**	**CO1 CO2**
	b.	A simply supported beam subjected to point load at the centre. Derive an equation for maximum deflection using trigonometric function by Rayleigh Ritz method.	**12**	**L3**	**CO1 CO2**
		Module – 2			
Q.3	**a.**	Derive shape functions (interpolation polynomial) for a 1-D bar element in natural coordinates.	**8**	**L2**	**CO3**
	b.	For the stepped bar shown in Fig.Q.3(b). Determine the nodal displacements, stress in each element and reaction at supports.  Fig.Q.3(b)	**12**	**L3**	**CO4 CO5**
		OR			
Q.4	**a.**	Derive element stiffness matrix of a 1-D bar element. List the properties of stiffness matrix.	**10**	**L2**	**CO3**

	b.	Find the nodal displacements, stress and reaction for the bar subjected to load as shown in Fig.Q.4(b). Take E_1 = 70 GPa, E_2 = 200 GPa.	**10**	**L3**	**CO4 CO5**



$A_1 = 7.85 \times 10^{-8} m^2$

$A_2 = 3.14 \times 10^{-7} m^2$

Fig.Q.4(b)

Module – 3

Q.5	**a.**	For the two-bar truss shown in Fig.Q.5(a) determine the displacements stress in each elements and reactions at the support.	**10**	**L3**	**CO4 CO5**

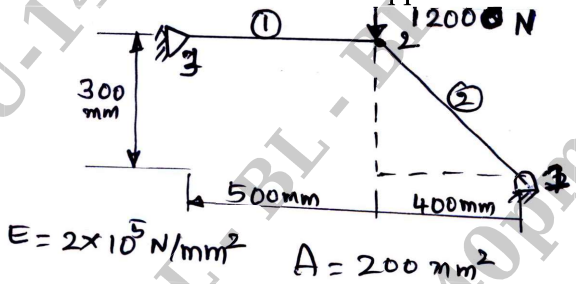


Fig.Q.5(a)

	b.	For the two bar truss shown in Fig.Q.5(b). Determine the nodal displacements and stress in each member. Also find support reaction. Take E = 200GPa	**10**	**L3**	**CO4 CO5**

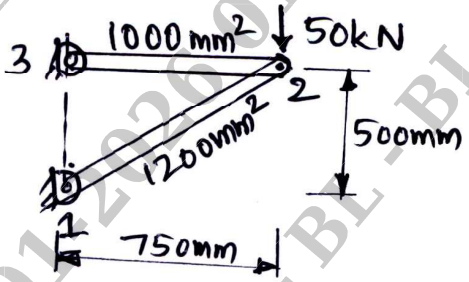


Fig.Q.5(b)

OR

Q.6	**a.**	Derive Hermite shape function for a beam element.	**10**	**L2**	**CO3**
	b.	Find the deflection at the free end and the support reaction of a cantilever beam shown in Fig.Q.6(b).	**10**	**L3**	**CO4 CO5**

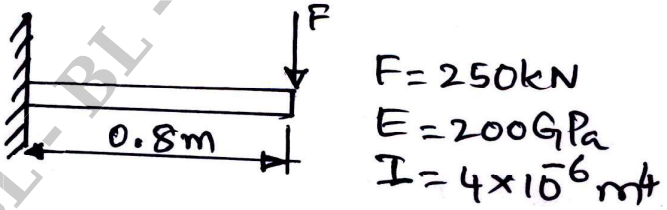
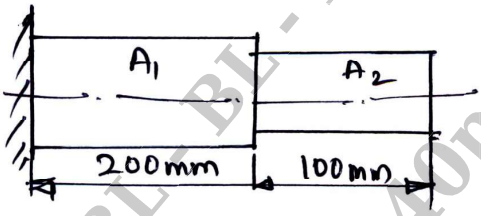
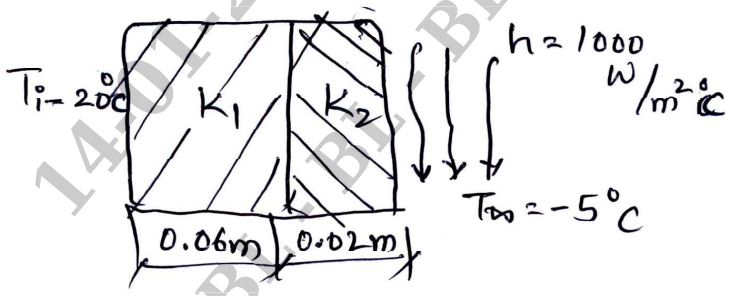


Fig.Q.6(b)

		Module – 4			
Q.7	**a.**	Derive shape functions of Constant Strain Triangular (CST) element in natural coordinates.	**10**	**L2**	**CO3**
	b.	Obtain the shape functions of 4 noded rectangular (quadrilateral) element in Lagrangian-in natural coordinates.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	Explain the concept of isoparametric, sub parametric, super parametric elements, with sketches.	**10**	**L2**	**CO2**
	b.	Obtain the shape functions of nine (9) noded rectangular element in Lagrangian.	**10**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Derive an expression of element mass matrix for a bar element.	**6**	**L2**	**CO3**
	b.	For the stepped bar shown in Fig.Q.9(b) determine the eigen values and eigen vector. Take A_1 = 400 mm^2, A_2 = 200 mm^2, ρ = 7850 kg/m^3, E = 200 GPa.  Fig.Q.9(b)	**14**	**L3**	**CO4** **CO5**
		OR			
Q.10	**a.**	Briefly describe rate equations and boundary conditions in heat transfer analysis.	**6**	**L2**	**CO2**
	b.	Determine the temperature distribution through composite wall shown in Fig.Q.10(b), when the convective heat loss occurs on the right surface. Take K_1 = 6 W/m°C, and K_2 = 20 W/m°C.  Fig.Q.10(b)	**14**	**L3**	**CO4** **CO5**

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CBCS SCHEME

USN | | | | | | | | | | |

BME702

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Hydraulics and Pneumatics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define fluid power system and explain the structure of basic hydraulic system with a block diagram.	10	L1	CO1
	b.	List and explain the difference between hydraulics and pneumatics focusing on the advantages, disadvantages and applications.	10	L1	CO1
		OR			
Q.2	a.	Define hydraulic fluid and explain the necessary properties of a good hydraulic fluid.	10	L2	CO1
	b.	Identify and describe various filter locations in a hydraulic system with a neat sketch.	10	L2	CO1
		Module – 2			
Q.3	a.	Classify fixed displacement pumps.	5	L2	CO2
	b.	Describe the pumping theory of positive displacement pumps.	5	L2	CO2
	c.	With a neat sketch, explain the working of an unbalanced vane pump.	10	L2	CO2
		OR			
Q.4	a.	Explain the working of single-acting and double acting hydraulic cylinder with neat sketch.	10	L3	CO2
	b.	Write short notes on : i) Cylinder cushioning ii) Accumulator	10	L2	CO2
		Module – 3			
Q.5	a.	With a neat sketch, explain the working of a 4/3 solenoid – operated Directional Control Valve (DCV)	10	L3	CO3
	b.	With a neat sketch, explain the functions and applications of shuttle valve. Also, mention the truth table of the same.	10	L2	CO3
		OR			
Q.6	a.	With a neat sketch, explain the working of meter – in hydraulic circuit. Mention its advantages and applications.	10	L3	CO3
	b.	With a neat hydraulic circuit, explain the working and applications of a regenerative circuit.	10	L3	CO3

Module – 4					
Q.7	**a.**	With a block diagram, explain the working of a pneumatic control system.	**10**	**L2**	**CO4**
	b.	Write short notes on : i) Characteristics of compressed air ii) FRL unit.	**10**	**L2**	**CO4**
OR					
Q.8	**a.**	With a neat circuit diagram, explain the working and applications of a quick exhaust valve.	**10**	**L3**	**CO4**
	b.	Write short notes on : i) Rod-less pneumatic cylinder ii) Mounting methods in pneumatic	**10**	**L2**	**CO4**
Module – 5					
Q.9	**a.**	Explain two types of throttling methods in pneumatic systems. Also mention their advantages and applications.	**10**	**L2**	**CO5**
	b.	Explain the direct and indirect actuation methods using neat pneumatic circuits.	**10**	**L3**	**CO5**
OR					
Q.10	**a.**	Construct and explain a pneumatic circuit to achieve the sequence $A^+ B^+ B^- A^-$ of the pneumatic cylinders. Mention its applications.	**10**	**L3**	**CO5**
	b.	Write short notes on : i) Time delay valve ii) Signal overlapping in pneumatics	**10**	**L2**	**CO5**

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CBCS SCHEME

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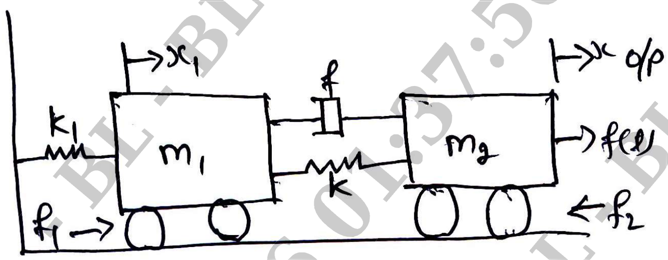
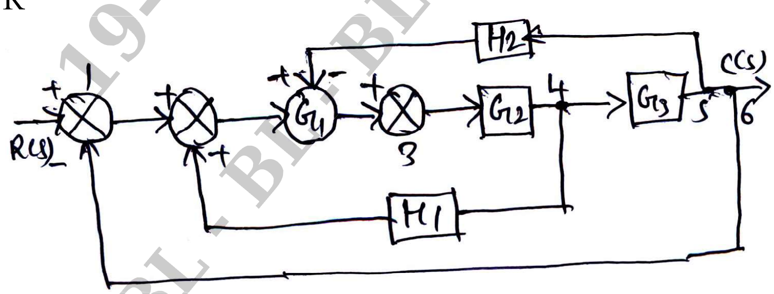
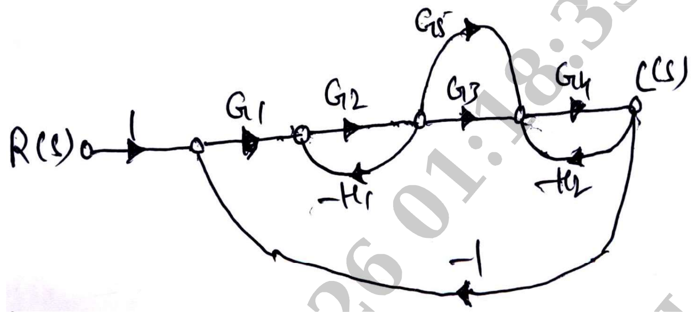
Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Control System. List out the comparison between open loop and closed loop control system.	6	L1	CO1
	b.	Elaborate the concept of feedback control system with an example.	6	L1	CO1
	c.	Describe the requirements of an ideal control system.	8	L1	CO1
		OR			
Q.2	a.	Explain proportional plus integral controller action with the characteristics.	10	L1	CO1
	b.	Obtain the transfer function of the mechanical system shown in Fig.Q.2(b) writing the physical system equations.  Fig.Q.2(b)	10	L2	CO1
		Module – 2			
Q.3	a.	For the system shown in Fig.Q.3(a), use block diagram reduction technique to find $\frac{C}{R}$ equation.  Fig.Q.3(a)	10	L2	CO1

	b.	Find the overall transfer function by using Mason's gain formula for the signal flow graph shown in Fig.Q.3(b).  Fig.Q.3(b)	10	L3	CO2
OR					
Q.4	a.	Explain in detail the types of system compensation with a neat sketch.	10	L3	CO2
	b.	Explain the following: i) Lag compensator ii) Lead compensator	10	L3	CO2
Module – 3					
Q.5	a.	Elaborate the following terms with graph and equations: i) Step ii) Ramp input iii) Parabolic input iv) Impulse input	10	L2	CO3
	b.	Derive the expression for error constant and steady state errors and also define the steady state error.	10	L3	CO3
OR					
Q.6	a.	Derive the expression for transient response of second order system for unit step input.	10	L2	CO5
	b.	For with feedback control system having open-loop transfer function: $G(s) = \frac{K(s+2)}{s(s^3+7s^2+12s)}$ Find: i) Type of system ii) Error coefficients iii) Steady state error for input of $\frac{R}{2}t^2$	10	L2	CO3
Module – 4					
Q.7	a.	The characteristics equation of a system is given by $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$ Determine the stability using RH criteria.	8	L2	CO4

	b.	By applying Routh criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function. $$G(s)H(s) = \frac{k(s+1)}{s(s-1)(s^2+4s+16)}$$	12	L2	CO4
		OR			
Q.8		The loop transfer function of a unity feedback control system is $$G(s) = \frac{k(s+6)}{s(s+1)(s+2)}$$ Draw the root locus diagram for all values of K ranging from 0 to ∞ and mark the salient points on the root locus.	20	L2	CO4
		Module – 5			
Q.9	a.	Sketch the polar plot for the transfer function $$G(s) = \frac{1}{(1+s)(1+2s)}$$	6	L2	CO4
	b.	Using Nyquist criterion, investigate the stability of a system whose open loop transfer function is $$G(s)H(s) = \frac{K}{(s+1)(s+2)(s+3)}$$	14	L2	CO4
		OR			
Q.10		Construct the bode plot for a unity feedback system whose open loop transfer function is given by: $$G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$$ From Bode plot determine: i) Gain and phase cross over frequencies ii) Gain and phase margin iii) Stability of the closed loop system	20	L2	CO4

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CBCS SCHEME

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BME755A

Seventh Semester B.E/B.Tech. Degree Examination, Dec.2025/Jan.2026
Non-Traditional Machining

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
1	a.	Define Non-Traditional Machining (NTM) and explain its need.	5	L1	CO1
	b.	Classify NTM processes based on the type of energy used, giving one example each.	5	L2	CO1
	c.	Discuss the selection criteria for choosing on NTM process for a given job.	10	L3	CO1
		OR			
2	a.	Compare traditional and non-traditional machining processes.	10	L1	CO1
	b.	List advantages, limitations and applications of NTM processes.	10	L2	CO1
		Module – 2			
3	a.	Explain with neat sketch the construction and working of Ultrasonic Machining (USM).	8	L2	CO2
	b.	Describe process parameters affecting MRR and surface finish in USM.	8	L3	CO2
	c.	List advantages, limitations and applications of USM.	4	L1	CO2
		OR			
4	a.	Explain the working principle and construction of Abrasive Jet Machining (AJM) with neat sketch.	8	L2	CO2
	b.	Discuss the effect of process parameters such as carrier gas pressure, abrasive type and stand – off distance.	8	L3	CO2
	c.	State advantages and applications of AJM.	4	L1	CO2
		Module – 3			
5	a.	Explain with neat sketch the construction and working of Electro Chemical Machining (ECM).	8	L2	CO3
	b.	Discuss process parameters affecting performance of ECM.	8	L3	CO3
	c.	Differentiate between Electrochemical Grinding (ECG) and Electrochemical Honing (ECH).	4	L2	CO3

		OR			
6	a.	Explain with neat sketch the working of Chemical Machining (CHM) process.	**8**	**L2**	**CO3**
	b.	Describe Maskants and Etchants used in CHM.	**6**	**L3**	**CO3**
	c.	Write advantages, limitations and applications of CHM.	**6**	**L1**	**CO3**
		Module – 4			
7	a.	Explain the construction and working of Electrical Discharge Machining (EDM).	**8**	**L2**	**CO4**
	b.	Describe functions of dielectric fluid and flushing methods in EDM.	**6**	**L3**	**CO4**
	c.	Explain the principle and working of Wire EDM (WEDM).	**6**	**L2**	**CO4**
		OR			
8	a.	Explain the set up and working of Plasma Arc Machining (PAM) with neat sketch.	**8**	**L2**	**CO4**
	b.	Discuss process parameters and safety precautions in PAM.	**8**	**L3**	**CO4**
	c.	Mention advantages and limitations of PAM.	**4**	**L1**	**CO4**
		Module – 5			
9	a.	Explain the principle, setup, working of Laser Beam Machining (LBM).	**10**	**L2**	**CO5**
	b.	Write advantages, limitations and applications of LBM.	**5**	**L1**	**CO5**
	c.	Explain how laser parameters influence machining accuracy and surface quality.	**5**	**L2**	**CO5**
		OR			
10	a.	Explain the principle and working of Electron Beam Machining (EBM).	**10**	**L2**	**CO5**
	b.	Compare LBM and EBM based on principle, Equipment and applications.	**5**	**L2**	**CO5**
	c.	Write advantages, limitations and applications of EBM.	**5**	**L1**	**CO5**

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CBCS SCHEME

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BME755D

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Non Conventional Energy Resources

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Briefly explain the need for Non-Conventional Energy Sources.	**05**	**L2**	**CO1**
	b.	Illustrate and describe the principle of operation of a Water Power Plant.	**07**	**L2**	**CO1**
	c.	Discuss tar sands and oil shale as alternative sources of energy.	**08**	**L2**	**CO1**
		OR			
Q.2	**a.**	What are beam, diffuse and global radiations? How does the atmosphere influence solar radiation?	**10**	**L2**	**CO2**
	b.	With a neat sketch, describe the structure and operation of a pyranometer in measuring global and diffuse radiation.	**10**	**L2**	**CO2**
		Module – 2			
Q.3	**a.**	Define the following terms with respect to solar radiation: i) Latitude angle ii) Declination angle iii) Surface azimuth angle iv) Hour angle v) Zenith angle	**10**	**L1**	**CO2**
	b.	Determine the Local Solar time, declination and day length at a location with latitude 23° 15' N, longitude 77° 30' E at 12:30 IST on June 19. Consider the equation of time correction as - (1' 01")	**10**	**L3**	**CO2**
		OR			
Q.4	**a.**	Describe the working principles of cylindrical parabolic concentrators and paraboloidal dish collectors with neat sketches.	**10**	**L2**	**CO2**
	b.	With a neat sketch, explain the working principle and operation of a solar pond.	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	With a neat sketch, explain the main components of a Liquid flat plate collector.	**08**	**L2**	**CO2**
	b.	Briefly explain the basic energy balance equation.	**05**	**L1**	**CO2**
	c.	Discuss the significance of the transmissivity - absorptivity product in the performance of a Liquid flat plate collector.	**07**	**L1**	**CO2**
		OR			
Q.6	**a.**	List and explain the various parameters that affect the performance of a solar collector.	**10**	**L2**	**CO2**
	b.	Explain the working principle of a solar PV cell and list its applications.	**10**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	Discuss the major problems associated with wind power generation.	**04**	**L2**	**CO3**
	b.	Briefly explain the working of a Vertical axis Windmill with a neat sketch.	**06**	**L2**	**CO3**
	c.	The following data were measured for a HAWT : Speed of wind = 20 m/s at 1 atm and 27°C Diameter of rotor = 80 m Speed of rotor = 40 rpm Given that Coefficient for a Maximum output = 0.593 and specific Gas Constant R = 287 J/kg K Calculate the torque produced at the shaft for maximum output of the turbine.	**10**	**L3**	**CO3**

		OR			
Q.8	**a.**	With a neat sketch, describe the closed-cycle OTEC System.	**08**	**L2**	**CO5**
	b.	Explain the method of harnessing tidal energy with a neat sketch.	**08**	**L2**	**CO5**
	c.	List the limitations of tidal power generation.	**04**	**L1**	**CO5**
		Module – 5			
Q.9	**a.**	With a neat sketch, describe the production of hydrogen by electrolysis of water.	**07**	**L2**	**CO5**
	b.	Briefly explain : i) Safe Utilization of hydrogen ii) Storage methods of hydrogen	**08**	**L2**	**CO5**
	c.	List the problems associated with geothermal energy conversion.	**05**	**L1**	**CO5**
		OR			
Q.10	**a.**	Explain with a neat sketch the construction details of a floating drum-type (KVIC) biogas plant.	**10**	**L2**	**CO4**
	b.	Discuss the applications of bio-gas in engines.	**06**	**L2**	**CO4**
	c.	List the advantages of bio-gas energy.	**04**	**L1**	**CO4**

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