



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058



END SEMESTER - January 2020 Re-Examinations

Program: B. Tech. (Mechanical Engineering)

Duration: 03 Hrs

Course Code: PC-BTM503

Maximum Points: 100

Course Name: Mechatronics

Semester: V

Notes:

1. Question Number 1 is compulsory
2. Attempt any four questions from remaining (Q. No. 2 to Q. No. 7)
3. If necessary assume suitable data with justification
4. Draw neat labeled sketches wherever required.

Q. No.	Questions	Points	CO	BL	PI
1 (A)	Draw Bode plot and comment on stability for $G(s)H(s) = \frac{200(S + 5)}{S(S + 1)(S + 100)}$	10	4	4	3.3.2
1 (B)	Using Routh's Criteria find stability of the control system having characteristics equation $S^6 + 4S^5 + 3S^4 - 16S^2 - 64S - 48 = 0$	10	3	3	1.3.1
2 (A)	Find root locus for $G(s)H(s) = \frac{K(S + 5)}{S(S + 20)}$	10	4	1	2.3.1
2 (B)	Explain architecture of 8051 microcontroller with neat block and pin diagram	10	1	2	1.3.2
3 (A)	Two double acting pneumatic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below— A+ Delay B+ B- A- Design pure pneumatic circuit considering 4/2 air-air operated final directional control valves for cylinder A and B.	10	3	4	3.2.2
3 (B)	Explain execution of cloth washing on automatic washing Machine system in the form of (i) Information Systems (ii) Mechanical Systems (iii) Electrical systems (iv) Sensors and Actuators	10	1	3	1.3.1
4 (A)	Draw Polar plot and comment on stability of system for $G(s)H(s) = \frac{100}{S(S + 2)(S + 4)}$	10	4	5	3.3.1
4 (B)	Draw programmable logic diagram for the following sequence of operation A+ Delay A-	10	2	5	2.3.3
5 (A)	Two double acting hydraulic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below— A+B+ B- Delay A- Draw the electrohydraulic circuit using 4/3 double solenoid as	10	3	4	3.3.1



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END SEMESTER - January 2020 Re-Examinations

	final directional Control valves.				
5(B)	<p>A second order system has unity feedback and open loop transfer function</p> $G(S) = \frac{500}{S(S + 15)}$ <p>(i) Draw the block diagram for closed loop system. (ii) What is characteristic equation? (iii) What is damping ratio and natural frequency values? (iv) Calculate peak time, peak overshoot and settling time for the system output when excited by unit step input. (v) Rough sketch of transient response for unit step input. If input is ramp of 0.5 rad/s, calculate steady state error.</p>	10	4	3	2.3.2
6 (A)	<p>Find transfer function for the following control system</p>	10	2	3	2.3.1
6 (B)	Write short note on (a) Servo motor (b) Stepper motor	10			
7 (A)	<p>Two double acting pneumatic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below—</p> <p style="text-align: center;">A- B+ A+ Delay B-</p> <p>Draw the electro-pneumatic circuit using grouping technique. Further use 4/2 and 5/2 double solenoid as final directional Control valves for cylinder A and B respectively.</p>	10	3	3	3.3.1
7 (B)	<p>Open loop transfer function of unity feedback system is</p> $G(s) = \frac{K}{(1+\tau S)S}$ <p>where K and T are constants. Determine factor by which gain 'K' should be multiplied so that overshoot of unit step response reduced from 75% to 25%.</p>	10	4	5	3.3.2



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Re-Examinations – January 2020

Program: B.Tech

Course Code: PC-BTM514 / PCC-BTM504/BTM504

Course Name: Thermal Systems

Duration: 3 Hours

Maximum Points: 100

Semester: V

Notes:

1. Question number ONE is compulsory and solve any FOUR questions out of remaining SIX.
2. Steam table and Mollier diagram is allowed to use.
3. All sub questions to be grouped together.
4. Assume suitable assumptions wherever necessary and justify the same.

Q.No.	Questions	Points	CO	BL	PI
1(a)	Discuss applications of reciprocating air compressors.	5	1,3	1	1.3.1
1(b)	Differentiate between high and low pressure boiler.	5	1,3	1	1.3.1
1(c)	Differentiate between impulse and reaction turbine.	5	1,3	1	1.3.1
1(d)	Describe all the elements of condensing plant with its use.	5	1,3	1	1.3.1
2(a)	Explain in detail working of evaporative condenser with its neat sketch.	8	1	1	1.3.1
(b)	A two stage double acting air compressor delivers air at a rate of 1.35 kg/sec. The suction pressure is 1 bar and interstate pressure is 7 bar and delivery pressure 42 bar. Air enters the low pressure cylinder at 17°C and cooled in the intercooler to 32°C. The clearances in L.P. and H.P. cylinders are 6% and 8% of respective strokes. The law of compression and re-expansion is $p v^{1.21} = C$ in both cylinders. Speed of the compressor is 500 RPM. Find (i) The amount of cooling water required per minute in intercooler, if rise in temperature of water is limited to 20°C (ii) Power required (iii) Diameter and Stroke of L.P. cylinder if $L=D$.	12	2	3	2.4.1
3(a)	Derive equation for general relationship between area, velocity and pressure in a nozzle flow and explain when flow will be subsonic and supersonic for accelerated and decelerated flow.	10	3	1	1.3.1
(b)	Steam at a pressure of 20 bar with 100°C of superheat is allowed to expand through a convergent-divergent nozzle. The exit pressure is 1 bar. If the nozzle is required to supply 2 kg/sec of steam to the turbine, then calculate (i) velocities at throat and exit (ii) areas at throat and exit.	10	4	3	2.4.1
4(a)	Draw a neat sketch of Cochran boiler and explain it in detail stating its main features.	10	3	1	1.3.1



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Re-Examinations – January 2020

(b)	A steam turbine develops 160 kW with a consumption of 19.4 kg/kWh. The pressure and temperature of the steam entering the nozzle are 12 bar and 220°C. The steam leaves the nozzles at 1.2 bar. If the diameter of the nozzle at throat is 7 mm, find the number of nozzles required. If 8 % of the total enthalpy drop is used up in frictional reheating in the diverging part of the nozzle, determine the diameter at the exit of nozzle and quality of steam leaving the nozzle.	10	3	1	1.3.1
5(a)	Explain the phenomenon of surging and choking in centrifugal compressors.	10	3	1	1.3.1
(b)	In a single stage impulse turbine, the diameter of the blade ring is 1m and speed is 3000 RPM. The steam is issued from a nozzle at 300 m/sec and the nozzle angle is 20°. The blades are equiangular. If the friction loss in the blade channel is 19% of the K.E. corresponding to the relative velocity at the inlet to the blades, find power developed in the blading when the axial thrust on the blades is 90 N.	10	4	1	2.4.1
6(a)	Compare rotary and reciprocating compressors.	10	3	3	1.3.1
(b)	Prove that condition for maximum blade efficiency in case of 50% reaction turbine is given by relation: $\eta_b = \frac{2 \cos^2 \alpha}{1 + \cos^2 \alpha}$	10	3	3	1.3.1
7(a)	Explain methods to improve efficiency of open cycle gas turbine.	08	3	3	1.4.1
(b)	The following data apply to a gas turbine set using a heat exchanger: Isentropic efficiency of compressor = 0.83, Isentropic efficiency of turbine = 0.85, Mechanical transmission efficiency = 0.99, combustion efficiency = 0.98, Heat exchanger effectiveness = 0.80, Pressure ratio = 4.0, Maximum cycle temperature = 1100 K, Ambient condition = 1 bar and 288 K, Lower heating value of fuel = 43,100 kJ/g. Take $C_p = 1.005$ kJ/kg.K, $\gamma = 1.4$ during compression and $C_p = 1.147$ kJ/kg.K, $\gamma = 1.3$ during combustion and expansion. Calculate specific work output, specific fuel consumption and cycle efficiency. Neglect all losses.	12	4	3	2.4.1



(1)

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END SEMESTER - January 2020 Re-Examinations

Program: B. Tech. (Mechanical Engineering)

Duration: 03 Hrs

Course Code: BTM503

Maximum Points: 100

Course Name: Mechatronics

Semester: V

Notes:

1. Question Number 1 is compulsory
2. Attempt any four questions from remaining (Q. No. 2 to Q. No. 7)
3. If necessary assume suitable data with justification
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Q. No.	Questions	Points	CO	BL	PI
1 (A)	Draw Bode plot and comment on stability for $G(s)H(s) = \frac{200(S+5)}{S(S+1)(S+100)}$	10	4	4	3.3.2
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2 (B)	Explain architecture of 8051 microcontroller with neat block and pin diagram	10	1	2	1.3.2
3 (A)	Two double acting pneumatic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below— A+ Delay B+ B- A- Design pure pneumatic circuit considering 4/2 air-air operated final directional control valves for cylinder A and B.	10	3	4	3.2.2
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4 (B)	Draw programmable logic diagram for the following sequence of operation A+ Delay A-	10	2	5	2.3.3
5 (A)	Two double acting hydraulic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below— A+B+ B- Delay A- Draw the electrohydraulic circuit using 4/3 double solenoid as	10	3	4	3.3.1



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END SEMESTER - January 2020 Re-Examinations

	final directional Control valves.				
5(B)	<p>A second order system has unity feedback and open loop transfer function</p> $G(S) = \frac{500}{S(S+15)}$ <p>(i) Draw the block diagram for closed loop system. (ii) What is characteristic equation? (iii) What is damping ratio and natural frequency values? (iv) Calculate peak time, peak overshoot and settling time for the system output when excited by unit step input. (v) Rough sketch of transient response for unit step input. If input is ramp of 0.5 rad/s, calculate steady step error.</p>	10	4	3	2.3.2
6 (A)	<p>Find transfer function for the following control system</p>	10	2	3	2.3.1
6 (B)	Write short note on (a) Servo motor (b) Stepper motor	10	1	1	1.3.1
7 (A)	<p>Two double acting pneumatic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below—</p> <p style="text-align: center;">A- B+ A+ Delay B-</p> <p>Draw the electro-pneumatic circuit using grouping technique. Further use 4/2 and 5/2 double solenoid as final directional Control valves for cylinder A and B respectively.</p>	10	3	3	3.3.1
7 (B)	<p>Open loop transfer function of unity feedback system is</p> $G(s) = \frac{K}{(1+Ts)S}$ <p>where K and T are constants. Determine factor by which gain 'K' should be multiplied so that overshoot of unit step response reduced from 75% to 25%.</p>	10	4	5	3.3.2



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**RE-EXAM END SEM
ODD SEM DEC 2019**

Program: Mechanical Engineering
Course Code: PC-BTM 501
Course Name: Heat and Mass Transfer

Duration: 3 Hr.
Maximum Points: 100
Semester: V

Instructions:

- Question No 1 is compulsory.
- Attempt any Four questions out of Six questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Make suitable assumptions with proper explanations.
- Draw the suitable sketches wherever necessary

Q. Questions

Q. No.	Questions	Pts	CO	BL	PI
1.	<p>Answer the following questions (any Four)</p> <p>A. Define the terms: Total Emissive Power (E), Monochromatic Emissive Power, Emissivity, and Intensity of radiation.</p> <p>B. What is a black body? How does it differ from a gray body?</p> <p>C. What is lumped capacity? What is meant by transient heat conduction?</p> <p>D. Explain: Efficiency and Effectiveness of Fin.</p> <p>E. Define Reynolds Analogy.</p>	20	1	2	1.3.1
2. A	<p>Calculate the rate of heat flow per unit area through a furnace wall consisting of 200 mm thick inner layer of chrome brick, a centre layer of kaolin brick 100 mm thick and an outer layer of masonry brick 100 mm thick. The inside surface (furnace side) heat transfer coefficient is 74 W/m²K and the outer wall surface is 70°C. The temperature of the inside gases of the furnace is 1670°C. Also calculate the inner wall (Chrome brick) surface temperature and outside surface temperature of middle (Kaolin) brick.</p> <p>Take: K for chrome brick = 1.25 W/mk, K for kaolin brick = 0.074 W/mk, K for masonry brick = 0.555 W/mk.</p>	10	3	3	2.4.2
2. B	<p>An egg with mean diameter of 40 mm and initially at 20°C is placed in a boiling water pan for 4 minutes and found to be boiled to the consumer's taste. For how long should a similar egg for same consumer be boiled when taken from a refrigerator at 5°C. Use lump theory.</p> <p>Take the following properties for egg:</p>	10	3	3	2.4.2

$K = 10 \text{ W/m}^\circ\text{C}$, $\rho = 1200 \text{ Kg/m}^3$, $C = 2 \text{ KJ/Kg}^\circ\text{C}$ and h (heat transfer coefficient) $= 100 \text{ W/m}^2 \text{ }^\circ\text{C}$.

3. A A carbon steel ($K = 54 \text{ W/mK}$) rod with a cross-section of an equilateral triangle (each side 5 mm) is 80 mm long. It is attached to a plane wall which is maintained at a temperature of 400°C . The surrounding air temperature is 50°C and heat transfer coefficient h is $90 \text{ W/m}^2\text{K}$. Calculate the heat dissipated by the rod. Assume a rod (fin) insulated at the tip. **10 3 3 2.4.2**
3. B Air stream at 24°C is flowing at 0.4 m/s across a 100 W incandescent bulb at 130°C . If the bulb is approximated by 65 mm diameter sphere, calculate:
 1. The heat transfer rate, and
 2. The percentage of power lost due to convection.
 Use equation: $\text{Nu} = 0.37 (\text{Re})^{0.60}$
 The thermo-properties of air at bulk mean temperature are:
 $K = 0.03 \text{ W/m}^2\text{K}$, $\nu = 2.08 \times 10^{-6} \text{ m}^2/\text{s}$, $\text{Pr} = 0.697$ **10 3 3 2.4.2**
4. A A cylindrical body of 300 mm diameter and 1.6 m height is maintained at a constant temperature of 37°C . The surrounding air temperature is 14°C . Find out the amount of heat to be generated by the body per hour.
 Use equation: $\text{Nu} = 0.12 (\text{Gr.Pr})^{0.33}$
 The thermo-properties of air at bulk mean temperature are:
 $C_p = 1005 \text{ J/kgK}$, $K = 0.02673 \text{ W/m}^2\text{K}$, $\nu = 16 \times 10^{-6} \text{ m}^2/\text{s}$, $\text{Pr} = 0.701$ **10 3 3 2.4.2**
4. B Derive an expression for LMTD for Counter flow heat exchanger with neat sketch. **10 3 3 2.4.2**
5. A Two large parallel plates at temperature 1000 K and 600 K have emissivity of 0.5 and 0.8 respectively. A radiation shield having emissivity 0.1 on one side and 0.05 on the other side is placed between the plates. Calculate the heat transfer rate by radiation per square meter with and without radiation shield. **10 3 3 2.4.2**
5. B 1) State Fick's law of diffusion. Define the various symbols used and give their units. **05 1 2 1.3.1**
 2) What are the limitations of Fick's law of diffusion? And list and explain various modes of mass transfer. **05 1 2 1.3.1**
6. A The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C . If the individual heat transfer coefficients on both sides are $650 \text{ W/m}^2\text{K}$, **10 3 3 2.4.2**

calculate the area of the heat exchanger.

6. B State and explain Kirchoff's law of radiation. What is intensity of radiation? Prove that total emissive power is π times the intensity of radiation. **10 2 2 2.4.2**
7. **Answer the following questions (Any Four)** **20 1 2 1.3.1**
- A. What is Newton's law of viscosity? What is the relation between kinematic viscosity and dynamic viscosity?
 - B. Explain the radiation shield with its applications.
 - C. How are heat exchangers classified? Define effectiveness of heat exchanger.
 - D. State and explain different types of non-dimensional numbers used in free and forced convection.
 - E. State and explain different types of Fouling observed in heat exchangers



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Re-Examinations – January 2020

Program: B.Tech

Course Code: PC-BTM514 / PCC-BTM504/BTM504

Course Name: Thermal Systems

Duration: 3 Hours

Maximum Points: 100

Semester: V

Notes:

1. Question number ONE is compulsory and solve any FOUR questions out of remaining SIX.
2. Steam table and Mollier diagram is allowed to use.
3. All sub questions to be grouped together.
4. Assume suitable assumptions wherever necessary and justify the same.

Q.No.	Questions	Points	CO	BL	PI
1(a)	Discuss applications of reciprocating air compressors.	5	1,3	1	1.3.1
1(b)	Differentiate between high and low pressure boiler.	5	1,3	1	1.3.1
1(c)	Differentiate between impulse and reaction turbine.	5	1,3	1	1.3.1
1(d)	Describe all the elements of condensing plant with its use.	5	1,3	1	1.3.1
2(a)	Explain in detail working of evaporative condenser with its neat sketch.	8	1	1	1.3.1
(b)	A two stage double acting air compressor delivers air at a rate of 1.35 kg/sec. The suction pressure is 1 bar and interstate pressure is 7 bar and delivery pressure 42 bar. Air enters the low pressure cylinder at 17°C and cooled in the intercooler to 32°C. The clearances in L.P. and H.P. cylinders are 6% and 8% of respective strokes. The law of compression and re-expansion is $p v^{1.21} = C$ in both cylinders. Speed of the compressor is 500 RPM. Find (i) The amount of cooling water required per minute in intercooler, if rise in temperature of water is limited to 20°C (ii) Power required (iii) Diameter and Stroke of L.P. cylinder if $L=D$.	12	2	3	2.4.1
3(a)	Derive equation for general relationship between area, velocity and pressure in a nozzle flow and explain when flow will be subsonic and supersonic for accelerated and decelerated flow.	10	3	1	1.3.1
(b)	Steam at a pressure of 20 bar with 100°C of superheat is allowed to expand through a convergent-divergent nozzle. The exit pressure is 1 bar. If the nozzle is required to supply 2 kg/sec of steam to the turbine, then calculate (i) velocities at throat and exit (ii) areas at throat and exit.	10	4	3	2.4.1
4(a)	Draw a neat sketch of Cochran boiler and explain it in detail stating its main features.	10	3	1	1.3.1



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Re-Examinations – January 2020

(b)	A steam turbine develops 160 kW with a consumption of 19.4 kg/kWh. The pressure and temperature of the steam entering the nozzle are 12 bar and 220°C. The steam leaves the nozzles at 1.2 bar. If the diameter of the nozzle at throat is 7 mm, find the number of nozzles required. If 8 % of the total enthalpy drop is used up in frictional reheating in the diverging part of the nozzle, determine the diameter at the exit of nozzle and quality of steam leaving the nozzle.	10	3	1	1.3.1
5(a)	Explain the phenomenon of surging and choking in centrifugal compressors.	10	3	1	1.3.1
(b)	In a single stage impulse turbine, the diameter of the blade ring is 1m and speed is 3000 RPM. The steam is issued from a nozzle at 300 m/sec and the nozzle angle is 20°. The blades are equiangular. If the friction loss in the blade channel is 19% of the K.E. corresponding to the relative velocity at the inlet to the blades, find power developed in the blading when the axial thrust on the blades is 90 N.	10	4	1	2.4.1
6(a)	Compare rotary and reciprocating compressors.	10	3	3	1.3.1
(b)	Prove that condition for maximum blade efficiency in case of 50% reaction turbine is given by relation: $\eta_b = \frac{2 \cos^2 \alpha}{1 + \cos^2 \alpha}$	10	3	3	1.3.1
7(a)	Explain methods to improve efficiency of open cycle gas turbine.	08	3	3	1.4.1
(b)	The following data apply to a gas turbine set using a heat exchanger: Isentropic efficiency of compressor = 0.83, Isentropic efficiency of turbine = 0.85, Mechanical transmission efficiency = 0.99, combustion efficiency = 0.98, Heat exchanger effectiveness = 0.80, Pressure ratio = 4.0, Maximum cycle temperature = 1100 K, Ambient condition = 1 bar and 288 K, Lower heating value of fuel = 43,100 kJ/g. Take $C_p = 1.005$ kJ/kg.K, $\gamma = 1.4$ during compression and $C_p = 1.147$ kJ/kg.K, $\gamma = 1.3$ during combustion and expansion. Calculate specific work output, specific fuel consumption and cycle efficiency. Neglect all losses.	12	4	3	2.4.1



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Re-Exam January 2020 Examinations	
Program: B.Tech in Mechanical Engineering	Duration: 3 Hrs
Course Code: PC – BTM515	Maximum Points: 100
Course Name: Computer Aided Machine Drawing	Semester: V
Note: SET A 1. Question no. 1 is Compulsory 2. Answer any Three out of remaining Five questions. 3. Answer to all sub questions must be grouped together 4. Assume suitable data if necessary.	
Important Instructions: 1. Create Folder in 'D' drive with title for E.g. <TYM501>_<Endsem>_<NOV 19> 2. Save all the questions in Separate Files in above created folder Only. 3. File Name E.g. <Q1a>_<TYM501> 4. Free Hand Sketches and Calculation of Tolerance should be written in supplement only. 5. SAVE YOUR WORK REGULARLY	

Q. No.		Poin ts	CO/ MO	BL	PI
Q.1 (a)	Given in Figure 1 is Details of Sleeve and Socket joint. Assemble the parts and draw the following views: (i) Sectional Front View (ii) Side View	09 06	03/ 03	03	5.2 .2
Q.1(b)	Draw bill of material for assembly of Figure 1	05	04/ 03	01	1.4 .1
Q.1(c)	Calculate the tolerance limits for $\varnothing 25 H8/f8$.	05	02/ 02	03	1.4 .1
Q.2(a)	A vertical cone, diameter 80 mm and height 100 mm is completely penetrated by a horizontal cylinder, diameter 40 mm so that their axes are at right angles. The axis of horizontal cylinder is parallel to the V.P and 25 mm above H.P., Draw the projections of the cylinders showing lines of intersections by cutting plane method .	15	01/ 01	03	5.2 .2
(b)	Draw Free Hand Sketches of any two of the following: (i) Hexagonal Bolt (ii) Plain Washer	05	02/ 02	01	1.4 .1
(c)	Draw Free Hand Sketches of the following: (i) Unified Thread (ii) Square Thread	05	02/ 02	01	1.4 .1

Q.3(a)	Given in Figure 3 is Details of Universal Coupling. Assemble the parts and draw the following views: (i) Sectional Front View (ii) Top View	09 06	03/ 04	03	5.2 .2
(b)	Prepare Bill of Material for the assembly of Figure 3	05	04/ 04	01	1.4 .1
(c)	Draw Free Hand Sketches of following: (i) Round Key (ii) Flat Saddle Key	05	02/ 03	01	1.4 .1
Q.4(a)	Given in Figure 4 (a) is Partial Front View and Partial Sectional side view of V-Belt Pulley. Draw the following views: (i) Side View. (ii) Detail view of V-groove and V-Belt.	07 03	03/ 05	03	5.2 .2
(b)	Given in Figure 4 (b) is Sectional Front view and Side View of Assembly of Steam Stop Valve. Identify the following parts and draw their views as directed: (i) Valve Cover – (A) Sectional Front View (B) Side View (ii) Handle – Sectional Front View	05 05 05	04/ 06	03	5.2 .2
Q.5(a)	Given in Figure 5(a) is Assembly of Drill Jig. Identify the following parts and draw their views as directed: (i) Jig Plate – (A) Sectional Front View (B) Top View (ii) Stem – Front View	05 05 05	04/ 07	03	5.2 .2
(b)	Given in Figure 5(b) is Assembly of Expansion Pipe Joint. Identify the following parts and draw their views as directed: (i) Gland – Sectional Front View.	05	04/ 05	03	5.2 .2
(c)	Calculate the tolerance limits between Neck Bush and Body of expansion joint for $\varnothing 170$.	05	02/ 02	03	1.4 .1

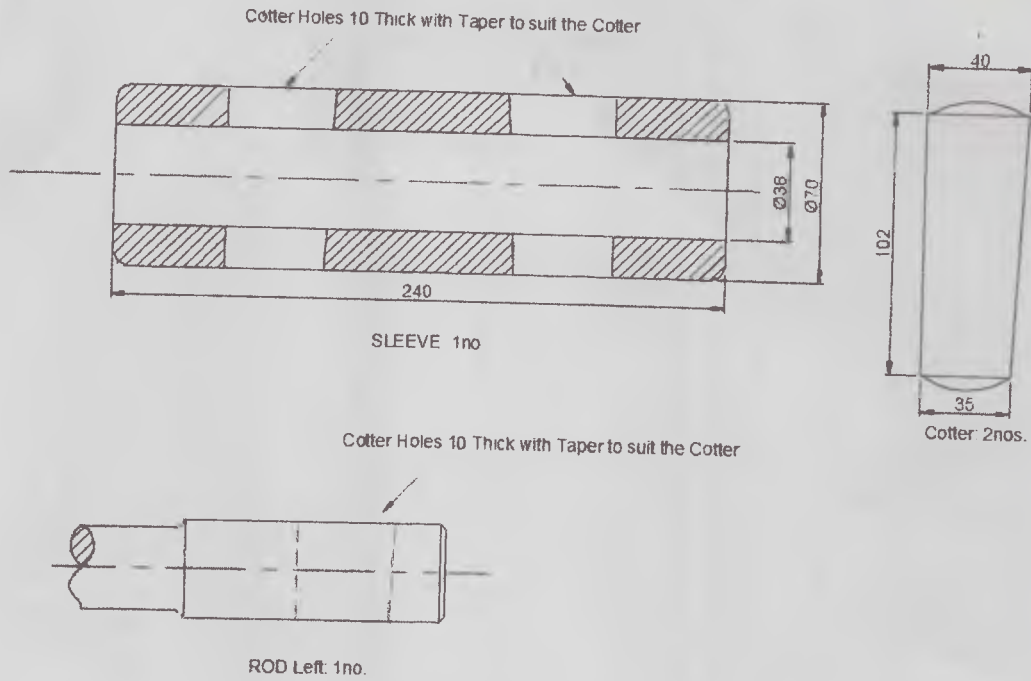


Figure 1

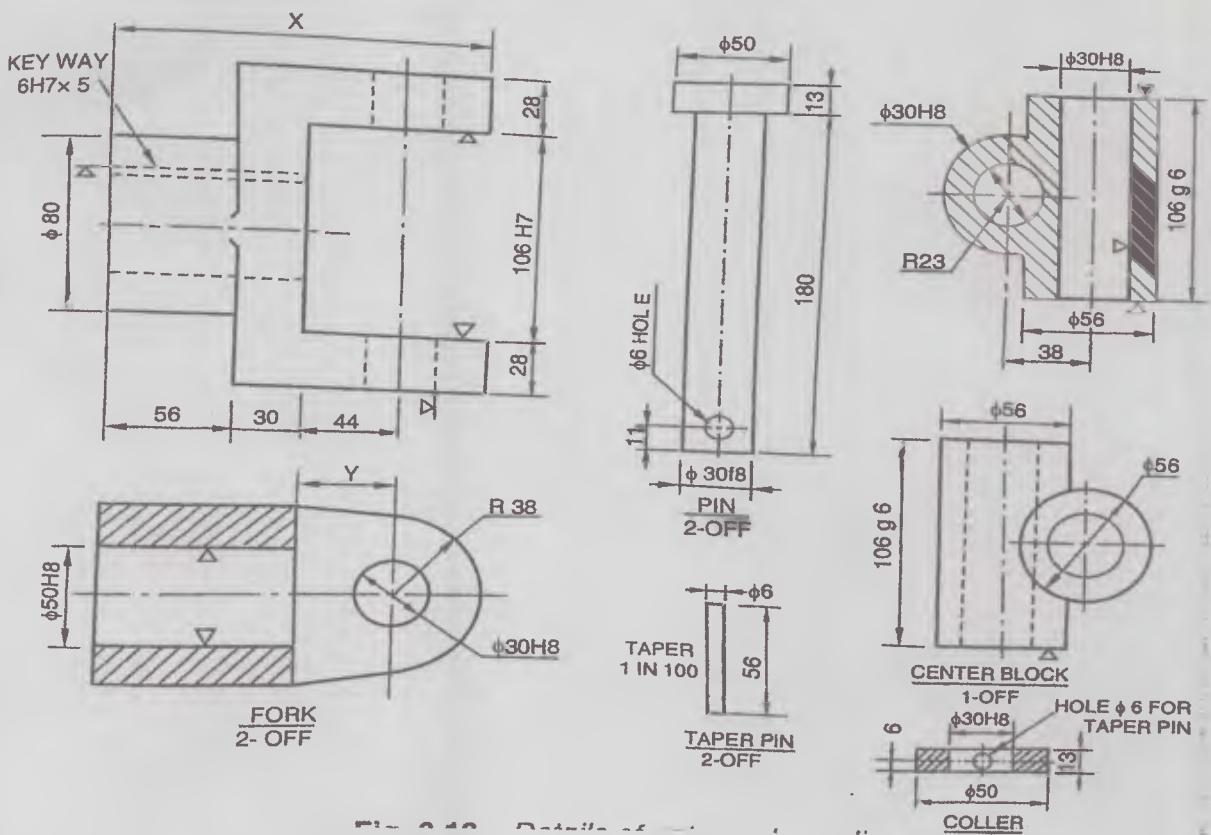
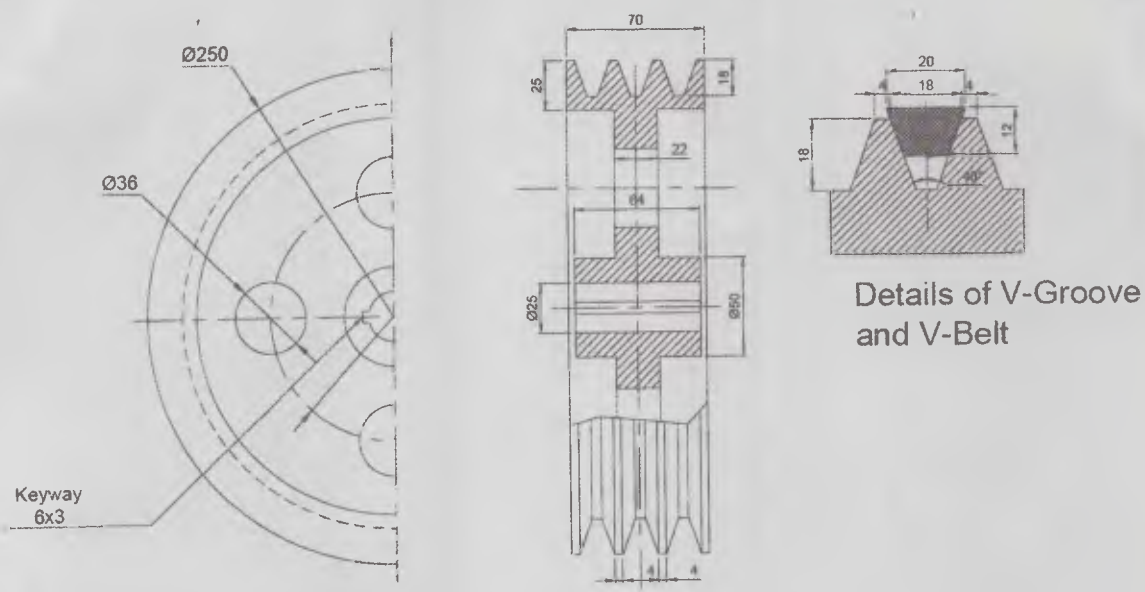


Figure 3



Front View Partial Sectional Side View

Figure 4(a)

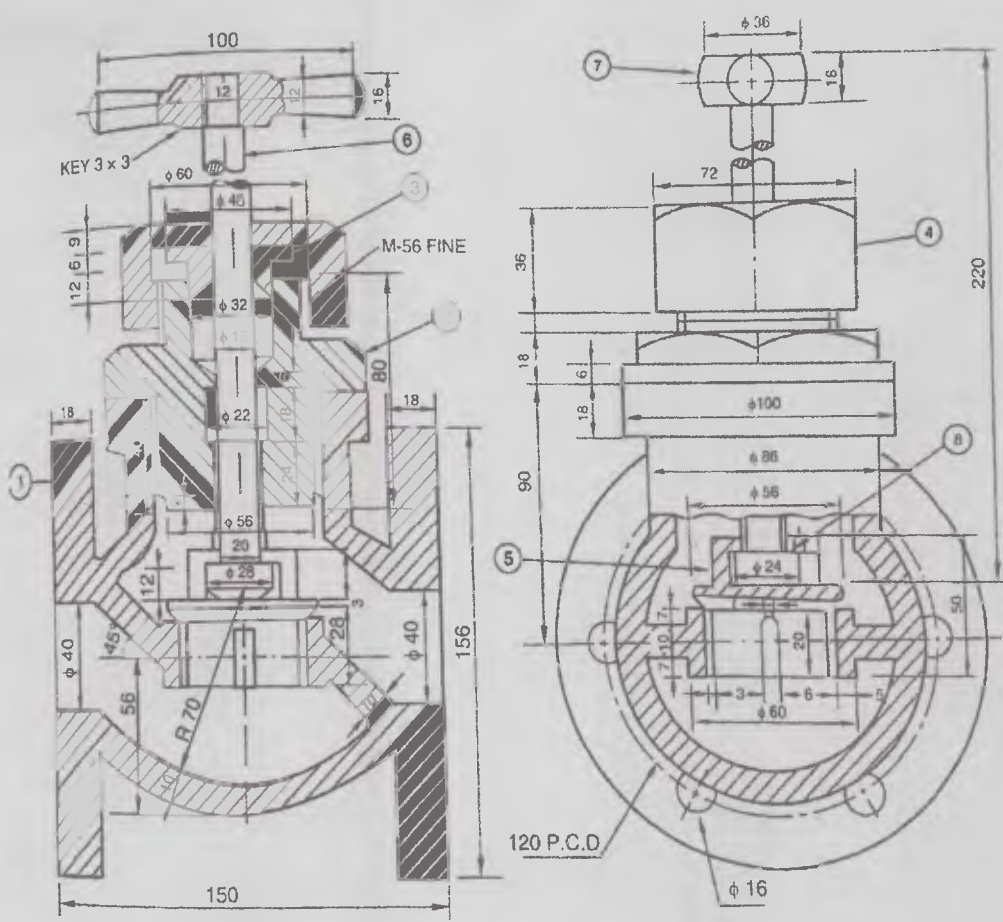


Figure 4(b)

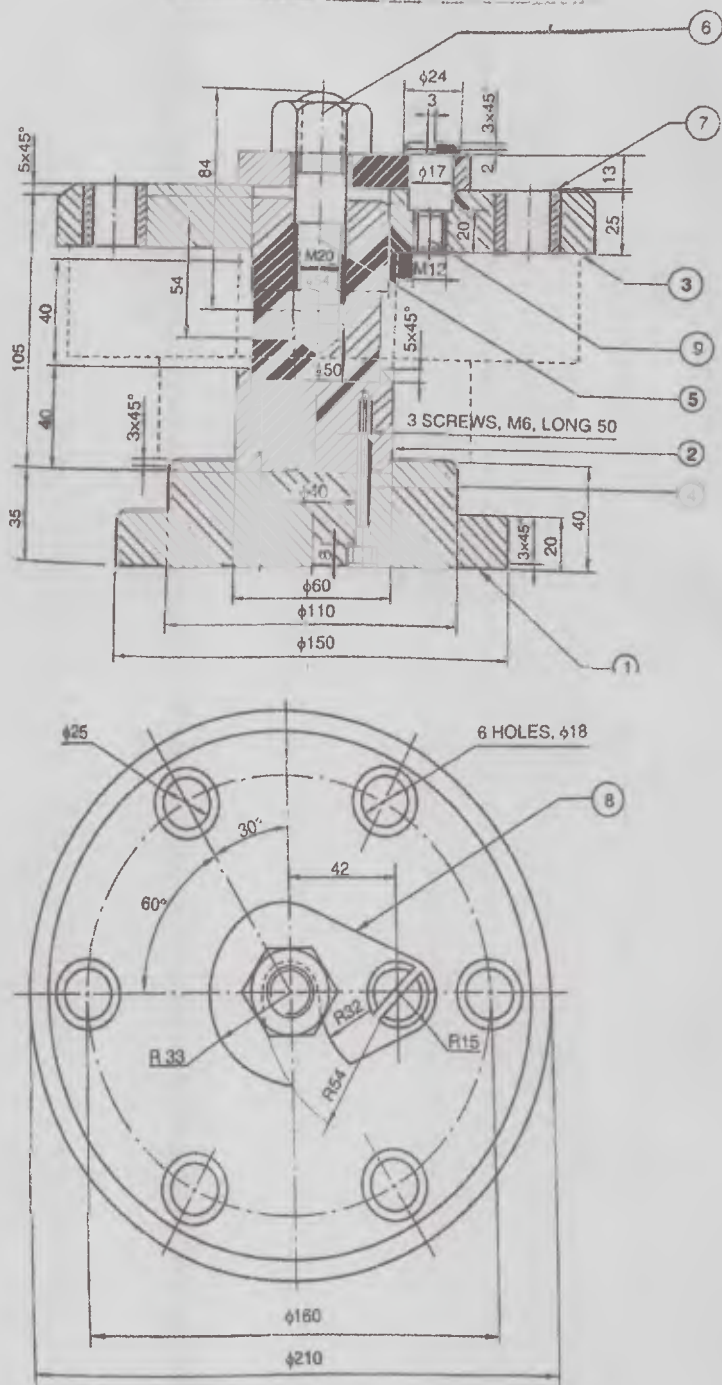


Figure 5 (a)

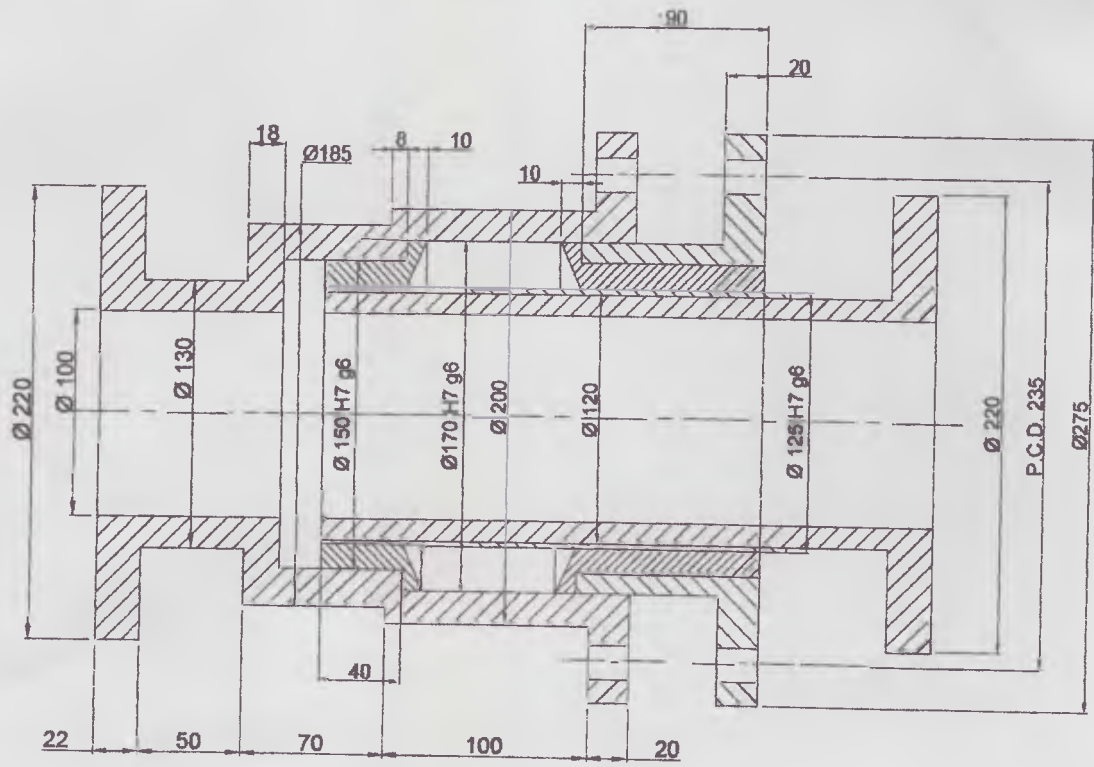


Figure 5(b)



SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058



Re exam January 2020

Program: T.Y. B.Tech Mechanical Engineering

Duration: 03 Hours

Course Code: PC – BTM512

Maximum Points: 100

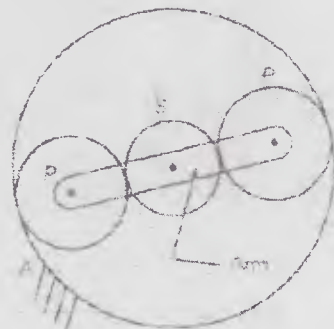
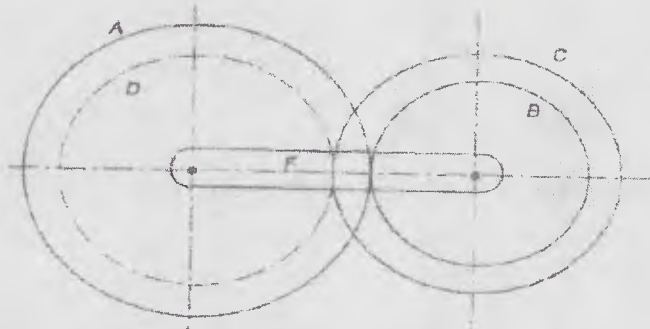
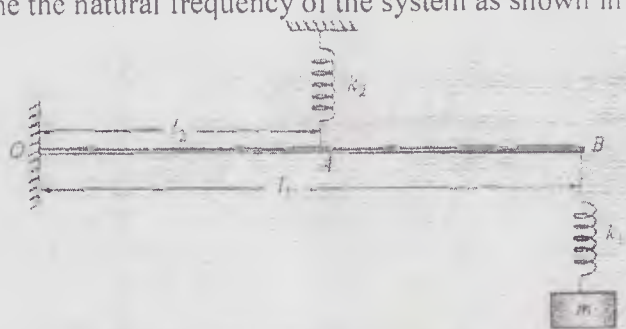
Course Name: Dynamics of Machinery

Semester: V

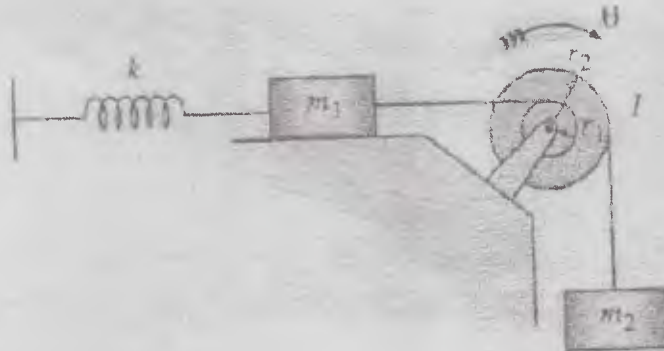
Instructions:

- Attempt any **five** questions
- Assume suitable data wherever necessary and justify the same
- Figures to the right indicate full marks
- Answers to all questions should be grouped together.

Q.No.	Questions	Poi nts	CO	BL	PI
Q1 (a)	Describe the following: I. Bevis Gibson dynamometer II. Belt transmission dynamometer	10	CO1	L3	2.1.3
Q1 (b)	a) In a prony brake dynamometer, the spring balance reading is 200 N, radius of brake drum is 0.3 m, and distance between the drum axis and the hinge of the blocks is 0.6m. Determine the pressure exerted on the drum by tightening the screw, tangential force acting on the brake drum, and the output power of the prime mover if the record speed is 300 rpm. Take coefficient of friction equal to 0.25. b) Explain the working principle of Rope and brake dynamometer.	08 02	CO1	L4	2.1.3
Q2 (a)	Derive an expression for the gyroscopic couple of a disc.	08	CO1	L6	2.4.1
Q2 (b)	A four wheel vehicle of mass 2500 Kg has a wheel base 2.5 m, track width 1.5 m, and height of centre of gravity 0.6 m above the ground level and lies at 1 m from the front axle. Each wheel has an effective diameter of 0.8 m and a moment of inertia of 0.8 kg-m ² . The drive shaft, engine flywheel and transmission are rotating at four times the speed of road wheels, in clockwise direction when viewed from the front, and is equivalent to a mass of 80 kg having a radius of gyration of 100 mm. If the vehicle is taking a right turn of 60 m radius at 60 km/hr, find the load on each wheel.	12	CO1	L3	2.1.3
Q3 (a)	a) Derive an expression for power and effort of the governor. b) Recite the following terms: <ul style="list-style-type: none">• Equilibrium speed• Mean speed• Height• Pickering	06 04	CO1	L1, L5	2.3.1
Q3 (b)	A porter governor has equal arms of 260 mm length each and pivoted on the axis of rotation. Each ball is of 60 N weight and the weight of the central load is 260 N. The radius of rotation of the ball is 160 mm when the governor begins to rise and 250 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort, and power of the governor, when the friction at the sleeve is neglected.	10	CO1	L4	2.1.3

<p>Q4 (a)</p>	<p>In epicyclic gear train as shown in figure has sun wheel S of 30 teeth and two planet wheels P-P of 40 teeth. The planet wheels mesh with the internal teeth of a fixed annulus A. The driving shaft carries the sun wheel transmits 4 KW at 360 rpm. The driven shaft is connected to an arm, which carries the planet wheels. Determine the speed of the driven shaft and the torque transmitted, if the overall efficiency is 95%.</p> 	12	CO1	L4	2.1.3
<p>Q4 (b)</p>	<p>In a reverted epicyclic gear train shown in figure, the arm F carries two wheels A and D and a compound wheel B, C. The wheel A meshes with wheel B and the wheel D meshes with wheel C. $T_A=80$, $T_D=48$ and $T_C=72$. Find the speed and direction of wheel D when wheel A is fixed and arm F makes 240 rpm clockwise.</p> 	08	CO1	L3	1.1.3
<p>Q5 (a)</p>	<p>Define the following terms: 1. Motion 2. Degree of freedom 3. Time period 4. Amplitude 5. Oscillatory motion</p>	10	CO3	L1	2.3.1
<p>Q5 (b)</p>	<p>Determine the natural frequency of the system as shown in figure:</p> 	10	CO3	L6	1.1.2
<p>Q6 (a)</p>	<p>Derive an expression for critical damping, overdamping and underdamping conditions of a vibratory system.</p>	12	CO4	L6	2.4.1

Determine natural frequency of the system as shown in figure by energy method and newtons method.



Q6
(b)

08 CO4 L6 1.1.1

The shaft carries four masses in parallel planes A, B, C and D. The rotating masses and their eccentricities are:

$$M_b = 25 \text{ kg}, e_b = 20 \text{ cm}$$

$$M_c = 40 \text{ kg}, e_c = 10 \text{ cm}$$

$$M_d = 35 \text{ kg}, e_d = 18 \text{ cm}$$

Q7
(a)

The masses at A has an eccentricity of 15 cm. Masses at C and D make angles of 90° and 195° respectively with B in the same sense. The axial distance between B and C is 25 cm. Determine the mass A and its angular position. Also determine the positions of planes A and D.

12 CO2 L3 1.4.1

Q7
(b)

Explain Balancing of :

a) V engines

b) Two stroke inline engine

08 CO2 L2 2.3.1