SPPU In-Semester Offline Examination April 2022

Class - TE   Branch- Mechanical   Semester- II

Subject- Artificial Intelligence and Machine Learning   Subject Code- 302049

Maximum Marks: 30   **Duration: 60 Minutes**   Date: 04/04/2022

Instructions: 1. Solve Q1 or Q2, Q3 or Q4.
                2. Assume suitable data wherever necessary.
                3. Use of scientific calculator is allowed.
                4. Draw neat diagram if required.

Q. No.	Question	Marks
1.a	Differentiate between Artificial Intelligence and Machine Learning with example.	5
1.b	List and describe the applications of Machine Learning in mechanical engineering?	5

1.c	Define following terms
	     1. Reasoning 2. Learning
	     3. Perception 4. Motion and Manipulation
		5

OR		
2.a	Describe following terms 1. Knowledge representation 2. Planning	5
2.b	What are the different approaches of Machine Learning? Describe any one with example.	5
2.c	Write short note on Cybernetics and brain simulation.	5

Q. No.	Question	Marks
3.a	Explain in brief any two methods of feature selection technique?	5
3.b	Consider the following table for classification. Decide which attribute should be selected for the splitting using Information Gain. <table><tr><td>Fruit colour</td><td>Taste</td><td>Count</td></tr><tr><td>Yellow</td><td>Sweet</td><td>10</td></tr><tr><td>Red</td><td>Sweet</td><td>5</td></tr><tr><td>Green</td><td>Sour</td><td>15</td></tr><tr><td>Orange</td><td>Sour</td><td>5</td></tr></table>	10
OR		
4.a	What do you mean by feature extraction? Explain in brief.	5
4.b	Select most appropriate attribute for the splitting (Decision Tree) using Gini index. Use the following table for classification considering Loan approved as target attribute <table><tr><td>Credit Rating</td><td>Accommodation</td><td>Loan Approved</td></tr><tr><td>Above 600</td><td>Own</td><td>Yes</td></tr><tr><td>Above 600</td><td>Rent</td><td>No</td></tr><tr><td>Above 600</td><td>Own</td><td>Yes</td></tr><tr><td>Below 600</td><td>Own</td><td>No</td></tr><tr><td>Below 600</td><td>Own</td><td>Yes</td></tr><tr><td>Below 600</td><td>Rent</td><td>No</td></tr><tr><td>Above 600</td><td>Rent</td><td>Yes</td></tr></table>	10

SPPU In-Semester Offline Examination April 2022

Class - TE   Branch- Mechanical   Semester- II

Subject- Artificial Intelligence and Machine Learning   **Subject Code- 302049**

Maximum Marks: 30   **Duration: 60 Minutes**   Date: 04/04/2022

Instructions: 1. Solve Q1 or Q2, Q3 or Q4.
               2. Assume suitable data wherever necessary.
               3. Use of scientific calculator is allowed.
               4. Draw neat diagram if required.

Q. No.	Question	Marks
1.a	Differentiate between Supervised and Unsupervised learning with example.	05
1.b	Explain various steps of machine learning?	05
1.c	What is knowledge representation in AI? Describe types of knowledge in brief?	05
OR		
2.a	What is AI and state the importance of AI in manufacturing industry?	05
2.b	What are the different approaches of Artificial Intelligence? Describe any one with example.	05
2.c	Explain Reinforced Learning with suitable example.	05

Q. No.	Question	Marks
3.a	What is meant by Feature Extraction of dataset? Explain the concept of PCA technique.	05
3.b	Select most appropriate attribute for the splitting (Decision Tree) using Information Gain. Use the following table for classification considering Brand as target attribute. **Milage / Fuel Type / Brand** Above 20 — Diesel — KIA Below 20 — Petrol — KIA Below 20 — Petrol — Maruti Below 20 — Petrol — Maruti Above 20 — CNG — Maruti Above 20 — Diesel — Maruti	10
OR		
4.a	Explain the term Entropy and Information gain value in Decision Tree?	05
4.b	Find Eigen values and Eigen vector for PCA for following dataset $$\begin{bmatrix} 1 & 1 \\ 3 & 5 \\ 4 & 3 \\ 5 & 6 \\ 6 & 7 \\ 7 & 8 \end{bmatrix}$$	10

The data table in 3.b:

Milage	Fuel Type	Brand
Above 20	Diesel	KIA
Below 20	Petrol	KIA
Below 20	Petrol	Maruti
Below 20	Petrol	Maruti
Above 20	CNG	Maruti
Above 20	Diesel	Maruti

SPPU In-Semester Offline Examination-April 2022

Class: Third Year   Branch: Mechanical Semester: II

Subject: Design of Transmission Systems   (Code: 302051)

(2019 Pattern)

Maximum Marks: 30

Instruction to the candidates:

1) **Answer Q1 or Q2, and Q3 or Q4.**
2) Neat diagrams must be drawn wherever necessary.
3) Figure to the right side indicate full marks.
4) **Assume suitable data if necessary.**
5) Use of electronic Pocket calculator is allowed.

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Q1:A Derive the beam strength equation of spur gear tooth and state the assumptions made.   *04Mark*

Q1:B A spur pinion with 20^0 full depth involute teeth is transmitting 7.5kW power at 1000rpm from an motor. The starting torque of motor is twice the rated torque. The number of teeth on the pinion is 25, while the module is 4mm. The face width is 45mm. Beam strength of pinion is 11800N. Determine the ultimate tensile strength of gear pair material, if both gears are made of same material.   *04Mark*

$Y = 0.484 - (2.87/Z)$ and $C_v = 3/3 + V$

Q1:C A helical gear pair is used in gear box of agriculture application, it consists of 24 teeth pinion and 96 teeth gear. The pressure angle is 20° and the helix angle is 24°. The pinion receives 100 kW power through electric motor to its shaft and rotates at 4000 rpm. The normal module of gear pair is 2.5mm and face width is 20mm. The gears are made of alloy steel 11Mn2 ($S_{ut} = 570\text{N/mm}^2$) and the surface hardness of 310 BHN. The service factor is 1.5 Determine: *07Mark*
I.   Tangential component
II.   Gear ratio factor
III.   Wear strength
IV. P_{eff}, if the factor of safety is 1.5 for pitting failure
$C = 11400\text{N/mm}^2$

OR

Q2: A Explain the significance of the helix angle on the performance of helical gears.   *04Mark*

Q2:B A helical gear pair system consists of 20 teeth pinion and 100 teeth gear. The pressure angle is 20° and the helix angle is 23°. The face width of each gear is 35 mm and it's ten times the normal module. The material for pinion is C25Mn75 ($S_{ut} = 560\text{N/mm}^2$) and gears are is C15Mn75 ($S_{ut} = 440\text{N/mm}^2$) and heat treated to surface hardness of pinion is 250BHN and gear is 220BHN. Determine: *04Mark*
I.   Wear strength
II. P_{eff}, if the factor of safety is 1.5 against wear failure

P.T.O

$C= 11400N/mm^2$, $Y'=0.484-(2.87/Z')$

Q2:C   A pinion of spur gear pair is running at 5kW, 1500 rpm electric motor. Minimum teeth to avoid interference for 20 degree full depth involute spur gear are considered. Speed ratio is 4:1. The starting torque of the motor can be assumed to be 125% of the rated torque. The gears are made of alloy steel 15Cr65 (S_{ut} = 600 N/mm^2) and deformation factor C is 11400 N/mm^2. The pressure angle is 20°. Module is 2.5mm and face width of gear pair is 22mm. Assume that the gears are manufactured to meet the requirements of Grade 5 and calculate: *07Mark*

     I.   The dynamic load by using Buckingham's equation.
     II.   Calculate the effective load.
       Error for 5 gear grade: $e= 5.00+0.40\phi$ $\phi=m+0.25d^{1/2}$
       $C_v= 3/(3+v)$

Q3:A   Differentiate between straight bevel gear and spiral bevel gear.   *03Mark*

Q3:B   A pair of straight bevel gears is used in Ice gola making machine and it consists of a 40 teeth pinion meshing with a 40 teeth gear. The module and the face width are 4 mm and 44 mm respectively. The pinion as well as the gear are made of steel (S_{ut} = 600 N/mm^2). Determine the beam strength of the tooth.   *06Mark*
   $Y'=0.484-(2.87/Z')$

Q3:C   A 7.5kW power at 720rpm is supplied to the worm shaft. The worm gear drive is designated as 2/40/10/5. The worm has RHS threads and the pressure angle is 20^0. Determine the lead angle and Rubbing velocity.   *06Mark*

<div align="center">OR</div>

Q4:A   Define the following terms: *03Mark*
     I.   Pitch cone distance
     II.   Pitch angle
     III.   Mitre gear

Q4:B   A worm gear box with an effective surface area of 2.5 m^2 is operating in still air with a heat transfer coefficient of 20 W/m^2°C. The temperature rise of the lubricating oil above the atmospheric temperature is limited to 50°C. The worm gears are designated as, 1/30/10/8. The worm shaft is rotating at 1600 rpm and the normal pressure angle is 20°. Assume Coefficient of friction is 0.030 based on rubbing velocity. Determine efficiency of worm gear drive.   *06Mark*

Q4:C   A pair of worm and worm wheel is designated as 2/60/10/6. The worm is transmitting 5kW power at 1500rpm to the worm wheel. The coefficient of friction is 0.15 and the normal pressure angle is 20 deg. Determine the lead angle and torque transmitting capacity of worm.   *06Mark*

**************** End of Paper ******************

SPPU In-Semester Offline Examination-April 2022

Class: Third Year   Branch: Mechanical Semester: II

Subject: Design of Transmission Systems   (Code: 302051)

(2019 Pattern)

Maximum Marks: 30

Instruction to the candidates:

1) **Answer Q1 or Q2, and Q3 or Q4.**
2) Neat diagrams must be drawn wherever necessary.
3) Figure to the right side indicate full marks.
4) **Assume suitable data if necessary.**
5) Use of electronic Pocket calculator is allowed.

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Q1:A	What is dynamic load? Explain the methods to estimate of dynamic load on gear tooth.	*04Mark*
Q1:B	A spur gear pair used in transmission system for automobile application with the following data;	*04Mark*

$20°$ full-depth involute teeth profile, number of teeth on pinion = 20, number of teeth on gear = 60, speed of pinion = 1200 rpm, module = 3.5 mm service factor = 1.25, face width = 10m, Both gears are made of steel with an ultimate tensile strength of 750 N/mm². Using the velocity factor $6/(6+v)$ to account for the dynamic load, calculate

    I.   Beam strength;

    II.   Rated power that the gears can transmit without bending failure, if the factor of safety is 1.5.   Y=0.484-(2.87/Z)

Q1:C	A helical gear pair used in gear box of industrial application, it consists of 25 teeth pinion and 100 teeth gear. The pressure angle is $20°$ and the helix angle is $25°$. The pinion receives 100 kW power through I.C. Engine to its shaft and rotates at 4000 rpm. The normal module of gear pair is 2.5mm and face width is 20mm. The gears are made of alloy steel 17Mn1Cr95 (S$_{ut}$=800N/mm²) and the surface hardness of 311 BHN. The service factor is 1.5 Determine	*07Mark*

    I.   Tangential component

    II.   Gear ratio factor

    III.   Wear strength

    IV. P_{eff}, if the factor of safety is 1.5 for pitting failure

Y'=0.484-(2.87/Z')

OR

Q2: A	Explain the effective load on helical gear tooth. How to estimate the effective load on helical gear tooth?	*04Mark*
Q2:B	A helical gear pair system consists of 22 teeth pinion and 88 teeth gear. The pressure angle is $20°$ and the helix angle is $23°$.The face width of each gear is 30 mm and it's ten times the normal module. The material for pinion is 17Mn1Cr95 (S$_{ut}$=800N/mm²) and gears are is 15Cr13 (S$_{ut}$=750N/mm²) and heat treated to surface hardness of pinion is	*04Mark*

230BHN and gear is 310BHN. Determine,

    I.   Wear strength

    II. P_{eff}, if the factor of safety is 2 against pitting

$C= 11400N/mm^2$, $e=e_p+e_g$ and $C_v= 5.6/(5.6+V^{1/2})$, $Y'=0.484-(2.87/Z')$

Q2:C A pinion of spur gear pair is used in agriculture gear box and it running at 3.7kW, 1500 rpm electric motor. Minimum teeth to avoid interference for 20 degree full depth involute spur gear are considered. Speed ratio is 3:1. The starting torque of the motor can be assumed to be 150% of the rated torque. The gears are made of alloy steel 15Cr65 (S_{ut} = 600 N/mm^2) and deformation factor C is 11400 N/mm^2. The pressure angle is 20°. Module is 4 and face width of gear pair is 11m. Assume that the gears are manufactured to meet the requirements of Grade 4 and calculate.   *07Mark*

    I.   The dynamic load by using Buckingham's equation.

    II.   Calculate the effective load.

    Error for 4 gear grade: $e= 3.20+0.25\phi$ $\phi=m+0.25d^{1/2}$

    $C_v= 6/(6+v)$, $Y=0.484-(2.87/Z)$

Q3:A What are the causes of gear tooth failure?   *03Mark*

Q3:B A pair of straight bevel gears is used in automobile differential gear box and it consists of a 24 teeth pinion meshing with a 48 teeth gear. The module and the face width are 5 mm and 45 mm respectively. The pinion as well as the gear is made of steel (S_{ut} = 600 N/mm^2). Determine the beam strength of the tooth.   *06Mark*

$Y'=0.484-(2.87/Z')$

Q3:C 1 kW power at 720 rpm is supplied to the worm shaft. The number of starts for threads of the worm is four with a 50 mm pitch–circle diameter. The worm wheel has 30 teeth with 5 mm module. The normal pressure angle is 20°. Determine the efficiency of the worm gear drive and the power lost in friction. Assume the coefficient friction is 0.035.   *06Mark*

OR

Q4:A Derive the Cone distance equation for bevel gear with neat sketch.   *03Mark*

Q4:B A worm gear box with an effective surface area of 1.5 m^2 is operating in still air with a heat transfer coefficient of 15 $W/m^2°C$. The temperature rise of the lubricating oil above the atmospheric temperature is limited to 50°C. The worm gears are designated as, 1/30/10/8. The worm shaft is rotating at 1200 rpm and the normal pressure angle is 20°. Coefficient of friction is 0.024 based on rubbing velocity. Determine the power transmitting capacity based on the thermal considerations.   *06Mark*

Q4:C A pair of worm and worm wheel is designated as 2/60/10/6. The worm is transmitting 5kW power at 1500rpm to the worm wheel. The coefficient of friction is 0.1 and the normal pressure angle is 20 deg. Determine the lead angle and torque transmitting capacity of worm.   *06Mark*

**************** End of Paper ****************

SPPU In-Semester Examination – April 2022

Third Year Mechanical Engineering **Semester: II**
Subject: Surface Engineering **Subject Code: 302052 – B**
Maximum Marks: 30 **Duration: 60 Minutes** **Date: 08/04/2022**
Instructions:

(i) Answer **Q.1** or **Q.2** and **Q.3** or **Q.4**

(ii) Draw a neat diagram wherever necessary.

(iii) Assume suitable data if necessary.

Q. N.	Question/Description	Marks
1	A) What is Corrosion triangle? State its significance.	7
	B) Write short note on effects of various parameters on Erosive Wear.	8
	OR	
2	A) What is piling and Bedworth rule? What assumptions can be made for gauging protective films?	7
	B) List various forms of corrosion. Explain any one form of corrosion with neat sketch.	8
3	A) List and describe metallurgical aspects of corrosion.	7
	B) Explain salt spray technique of corrosion testing with neat diagram.	8
	OR	
4	A) Suggest improvements to be done in design procedure for effective corrosion control.	7
	B) Write short note on: I) Cathodic Protection II) Anodic Protection	8

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SPPU In-Semester Examination – April 2022

Third Year Mechanical Engineering   Semester: II

Subject: Surface Engineering   Subject Code: 302052 – B

Maximum Marks: 30   **Duration: 60 Minutes**   Date: 08/04/2022

Instructions:

(i)   Answer **Q.1** or **Q.2** and **Q.3** or **Q.4**

(ii) Draw a neat sketch wherever necessary.

(iii) Assume suitable data if necessary.

Q. N.	Question/Description	Marks
1	A) Explain adhesive wear based on the mechanism of mechanical interlocking?	7
	B) List galvanic series of metals? How will you select metals based on the galvanic series?	8
	OR	
2	A) Discuss effect of various parameters on erosive wear.	7
	B) Describe the concept of electrode potential? State its significance?	8
3	A) List electrochemical methods of corrosion testing. Describe any one electrochemical method of corrosion testing?	7
	B) List at least four special alloys. Comment on use of any two special alloys for practical engineering applications.	8
	OR	
4	A) Suggest improvements to be done in design procedure for effective corrosion control.	7
	B) Write short note on: I) Cathodic Inhibitors II) Anodic Inhibitors	8

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Third Year Mechanical Engineering　　　　　　**Semester: VI**

Subject: Computer Aided Engineering　　　　　**Subject Code: 302050**
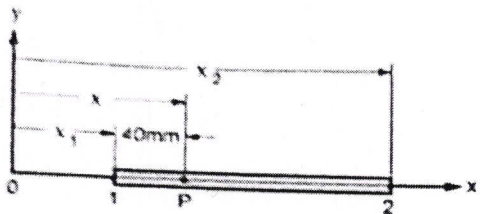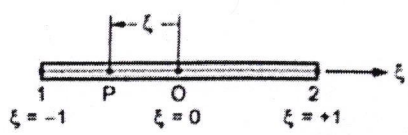
Maximum Marks: 30　　**Duration: 60 Minutes**　　　**Date: 05/04/2022**
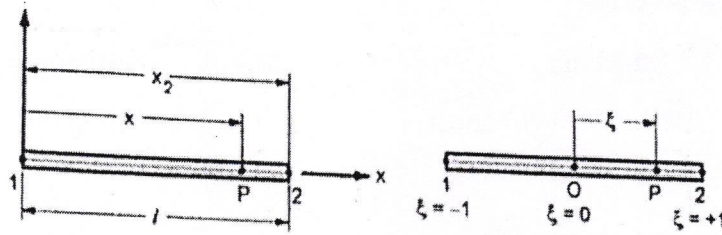
Instructions:

    (i)　　　　Answer Q.1 or Q.2, Q.3 or Q.4

    (ii)　　　Draw a neat diagram wherever necessary

    (iii)　　Figure to the right indicates full marks.

    (iv)　　Use of calculator is allowed.

    (v)　　　Assume suitable data if necessary.

Q. No.	Question/Description	Marks
1	a) The two noded one-dimensional element has nodes 1 & 2 located at the distances of 200 & 360 mm respectively from Y-axis. The displacement of nodes 1 & 2 are 0.03 mm & -0.05 mm respectively. At point P, located at a distance 40 mm from node 1 within the element determine: (i) the natural coordinate (ii) The linear shape function (iii) the displacement (a) Local co-ordinate system　　(b) Natural co-ordinate system	10
	b) Explain in detail FEM procedure	5
	OR	
2	a) The 1-D element has a length of 200 mm. The temperatures at nodes 1 & 2 are 100°C & 40°C respectively. Evaluate the shape functions associated with nodes 1 & 2, if the temperature is to be estimated at point P within the element, situated at 150mm from node 1. Also calculate temperature at point P.	10

(a) Local Coordinate System   (b) Natural Coordinate System

	b) Explain the use of CAE in product development	5
3	a) Explain Mesh Independent test	7
	b) Explain Mesh Refinement method	8
	OR	
4	a) Explain types of Meshing in brief	7
	b) Explain the representation of Bolted and Welded joints	8

Third Year Mechanical Engineering   **Semester: VI**

Subject: Computer Aided Engineering   **Subject Code: 302050**
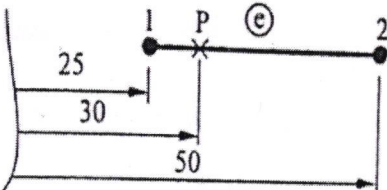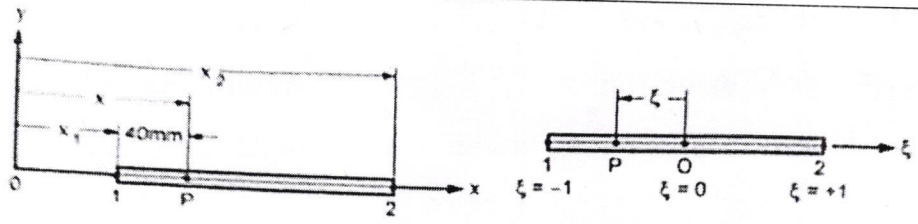
Maximum Marks: 30   Duration: 60 Minutes   **Date: 05/04/2022**

Instructions:

(i)	Answer Q.1 or Q.2, Q.3 or Q.4
(ii)	Draw a neat diagram wherever necessary
(iii)	Figure to the right indicates full marks.
(iv)	Use of calculator is allowed.
(v)	Assume suitable data if necessary.

Q. No.	Question/Description	Marks
1	a) A 1D Spar element having a linear shape function as shown in figure. If the temperature of Node 1 is $50°\,C$ and at Node 2 is $-20°\,C$ determine: (i) the natural coordinate (ii) The linear shape function (iii) the temperature at Point P 	10
	b) Differentiate between FEM, FDM and FVM	5
	OR	
2	a) The two noded one-dimensional element has nodes 1 & 2 located at the distances of 150 & 400 mm respectively from Y-axis. The displacement of nodes 1 & 2 are 0.04 mm & -0.06 mm respectively. At point P, located at a distance 40 mm from node 1 within the element determine: (i) the natural coordinate (ii) The linear shape function (iii) the displacement	10

(a) Local co-ordinate system   (b) Natural co-ordinate system

	b) Derive the relation between Natural and Local Coordinate system	5
3	a) Explain various Element Quality Criteria	8
	b) Explain the effect of Mesh Density in Critical Region	7
	OR	
4	a) Write Short notes on i) Use of Symmetry ii) Geometry associate mesh	8
	b) Explain various Element Selection Criteria	7

SPPU In-Sem Offline Examination-April 2022

Class: TE   Branch: Mechanical   Semester: VI

Subject: Composite Materials (Elective - II)   Code: (302052)(A)

Time : 1 Hour   **Max. Marks: 30**   **Date: 08/04/2022 Friday**

Instructions to the candidates:
1) Answer Q1 or Q2, Q3 or Q4.
2) Neat diagrams must be drawn wherever necessary.
3) Assume suitable data if necessary.

Q.N	Sub	Question	Marks
1	a	Give the characteristics of Composite material? Also give the classification of composites based on matrix and reinforcement?	8
	b	List out the functions of matrix phase and reinforcement phase of composite materials?	7
		Or	
2	a	What do you mean hybrid composite and list out the advantages of hybrid composites materials?	8
	b	Discuss the need of Composite materials?	7
3	a	How composites are manufactured using Hand Layup method. Briefly explain with processing steps.	8
	b	Explain compression moulding techniques with neat diagram.	7
		Or	
4	a	How composites are manufactured using Spray Layup method. Briefly explain with processing steps.	8
	b	Explain Pultrusion Process with neat sketch.	7

SPPU In-Sem Offline Examination-April 2022

Class: TE   Branch: Mechanical   Semester: VI

Subject: Composite Materials (Elective - II)   Code: (302052)(A)

Time : 1 Hour   **Max. Marks: 30**   Date: 08/04/2022 Friday

Instructions to the candidates:
1) Answer Q1 or Q2, Q3 or Q4.
2) Neat diagrams must be drawn wherever necessary.
3) Assume suitable data if necessary.

Q.N	Sub	Question	Marks
1	a	Give the classification of composites based on reinforcements. Discuss the types of continuous fiber.	8
	b	List out the functions of matrix phase and reinforcement phase of composite materials?	7
		Or	
2	a	What do you mean hybrid composite and list out the advantages of hybrid composites materials?	8
	b	Discuss the need of Composite materials?	7
3	a	How composites are manufactured using Hand Layup method. Briefly explain with processing steps.	8
	b	Explain compression moulding techniques with neat diagram.	7
		Or	
4	a	What is Filament Winding? Mention its advantages and limitations.	8
	b	Explain injection moulding techniques with neat diagram.	7

Class: TE   Branch: Mechanical/Electrical   Semester: VI

Subject: e-Vehicle System Design   **Code: 302033MJ**

Time : 1 Hour   **Max. Marks: 30**   **Date: 11/04/2022 Monday**

Instructions to the candidates:

1) Answer Q1 or Q2, Q3 or Q4

2) Neat diagrams must be drawn wherever necessary.

3) Assume suitable data if necessary.

Course Outcomes

Course Outcome	Blooms Taxonomy Level	After successful completion of course, student will be able to
302033MJ 1	3	DISCOVER wheel based steering systems
302033MJ 2	4	CLASSIFY and EVALUATE suspension systems

Ques. No	Sub	Question	Marks	CO	BL
1	a	Draw the general layout of steering system	8	CO 1	2
	b	Illustrate working of Recirculating ball steering gear with neat diagram	7	CO 1	3
OR					
2	a	What is the difference between delta and tadpole layout	8	CO 1	2
	b	Illustrate working of Rack and pinion steering gear with neat diagram	7	CO 1	3
3	a	Analyze Topology Optimization of Front Upright of Racing Suspension with flow chart	8	CO 2	3
	b	Explain working of telescopic absorber with neat sketch	7	CO 2	2
OR					
4	a	Illustrate different types of coil spring used in vehicle? Explain with neat sketch?	8	CO 2	3
	b	Explain Struck and Link Type Suspension System with diagram?	7	CO 2	2

_____End of Paper_____

Third Year Mechanical Engineering   Semester: VI

Subject: Robot Programming and Simulation   Subject Code: 304183 HR

Maximum Marks: 30   **Duration: 60 Minutes**   Date: 11/04/2022

Instructions:

- (i) Answer Q.1 or Q.2, Q.3 or Q.4
- (ii) Draw a neat diagram wherever necessary
- (iii) Figure to the right indicates full marks.
- (iv) Use of calculator is allowed.
- (v) Assume suitable data if necessary.

Q. No.	Question/Description	Marks
1	a) **Explain the Functions of Robot Operating Systems**	5
	b) **Explain the particulars of ROS Equation**	10
	OR	
2	a) **List the levels of ROS Distribution**	5
	b) **Describe various ROS Framework**	10
3	a) Explain various Teaching Methods for Robot Programming	7
	b) Explain with Example How a robot Program can define a path in Space	8
	OR	
4	a) Describe the Generations of Robot Programming Languages	7
	b) Write suitable program for Palletizing or Loading a Machine	8

SPPU In-Sem Offline Examination – April 2022

Third Year Mechanical Engineering **Semester: VI**

Subject: Robot Programming and Simulation **Subject Code: 304183 HR**

Maximum Marks: 30 **Duration: 60 Minutes** **Date: 11/04/2022**

Instructions:

(i) Answer Q.1 or Q.2, Q.3 or Q.4
(ii) Draw a neat diagram wherever necessary
(iii) Figure to the right indicates full marks.
(iv) Use of calculator is allowed.
(v) Assume suitable data if necessary.

Q. No.	Question/Description	Marks
1	a) Explain the Differences between ROS and Other Operating systems	5
	b) Describe various ROS Framework	10
	OR	
2	a) Summarise the History of Robot Operating systems	5
	b) Explain the various levels of ROS Concepts	10
3	a) Describe various Textual Robot Languages	7
	b) Illustrate with example Wait, Signal and delay Command	8
	OR	
4	a) Describe the methods of Motion Interpolation	7
	b) Illustrate with Example How a robot Program can define a path in Space	8