MATERIAL HANDLING SYSTEMS **Course Code : 315370**

Programme Name/s : Production Engineering
Programme Code : PG
Semester : Fifth
Course Title : MATERIAL HANDLING SYSTEMS
Course Code : 315370

I. RATIONALE

Study of material handling systems is the crucial need for optimizing operational efficiency, reducing costs, ensuring workplace safety, and enhancing logistical and manufacturing processes through systematic management of material flow and storage. This course will give insights to diploma production engineer for selection and use of appropriate material handling system in various industries.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select efficient material handling systems to optimize logistics, minimize costs, and ensure safe and effective movement of goods.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop plant layout for minimum material handling.
- CO2 - Select relevant material handling and lifting equipment.
- CO3 - Select relevant hoisting machinery and equipment.
- CO4 - Select relevant conveyer system.
- CO5 - Select relevant advance material handling system.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315370	MATERIAL HANDLING SYSTEMS	MHS	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Apply principles of material handling equipment in the given situation. TLO 1.2 Draw plant layout for minimum material handling for the given application. TLO 1.3 Explain different factors of engineering and economic for material handling equipment selection. TLO 1.4 Compare different material handling equipment. TLO 1.5 Maintenance of the given material handling equipment.	**Unit - I Introduction to material handling** 1.1 Introduction of material handling equipment (MHE), Functions and Principles of material handling. 1.2 Relationship to plant layouts (Product layout, Process layout) 1.3 Engineering and economic factors for selection of Material Handling Equipment 1.4 Maintenance procedure of MHE 1.5 Classification according to applications of MHE	Lecture using chalk-board PPT presentations Video Demonstrations
2	TLO 2.1 Select the components of material lifting systems for the given application with justification. TLO 2.2 Explain lifting and rigging load handling attachments. TLO 2.3 Explain working of different types of lifters.	**Unit - II Materials lifting equipment** 2.1 Components of material lifting equipment: Flexible hoisting appliances such as welded chains, roller chains, hemp ropes, and steel wire ropes, fastening methods of wire and chains as per IS code 12735 (1994) (Westerman table) 2.2 Attachments: Lifting tackles, lifting and rigging load handling attachments, Various types of hooks-forged, eye bolts, eye hook, electric lifting magnet, vacuum lifter, grabbing attachment for loose materials, crane attachment for handling liquids/ molten metal, fork lift.	Lecture Using Chalk-Board PPT presentations Video Demonstrations Site/Industry Visit

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the Working and operation of different types of hoist. TLO 3.2 Explain the Working and operation of different types of crane. TLO 3.3 Explain the Working and operation of different types of lift. TLO 3.4 Select relevant hoist for the given application with justification. TLO 3.5 Select relevant crane for the given application with justification.	**Unit - III Hoisting machinery and equipment** 3.1 Working of Hoisting machinery and equipment: Working of different type of hoists such as lever operated hoist, differential hoist, electric and pneumatic hoists. 3.2 Working of different types of Cranes and Industrial Lifts: Working of rotary cranes, trackless cranes, bridge cranes, cable cranes, Introduction to types of Industrial Lifts and hydraulic Jack.	Lecture Using Chalk-Board PPT presentations Video Demonstrations Demonstrations model Site/Industry Visit
4	TLO 4.1 Explain different types of conveyor. TLO 4.2 Explain working and operation of surface transport equipment. TLO 4.3 Select relevant conveyor system for the given situation with justification. TLO 4.4 Select surface transport equipment for the given situation with justification.	**Unit - IV Conveying machinery** 4.1 Working of traction type conveyors such as belt conveyors, chain conveyors, bucket elevators, escalators; Working of traction less type conveyors such as gravity type conveyors, screw conveyors hoppers, gates and feeders. 4.2 Surface transport equipment–working & functions of trackless equipment such as hand operated trucks, powered trucks, tractors, industrial trailers Function. 4.3 Wagon tipplers, stackers, reclaimers, their constructional details, pneumatic and hydraulic conveyors.	Lecture Using Chalk-Board PPT presentations Video Demonstrations Site/Industry Visit
5	TLO 5.1 Explain working and operation of AGV. TLO 5.2 Explain working and operation of ASRS. TLO 5.3 Explain the ergonomic consideration for selection of MHE. TLO 5.4 Select advance material handling equipment for the given situation with justifiction.	**Unit - V Advanced material handling equipment** 5.1 Special Material Handling Equipment: Working and benefits of AGV (Automated Guided vehicle), Automated storage and retrieval system (ASRS); selection criteria 5.2 Ergonomic considerations	Lecture Using Chalk-Board PPT presentations Video Demonstrations Site/Industry Visit Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of MHS. LLO 1.2 Ckeck the condition of chains, ropes and hooks. LLO 1.3 Detect faults in chains, ropes and hooks.	1	*Maintenance of chains, ropes, and hooks	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Identify different types of lifting components. LLO 2.2 Operate different lifting machine components and attachments. LLO 2.3 Analyse material handling equipment for workshop.	2	Safety of lifting machine	2	CO2
LLO 3.1 Dismantle crane using proper tools. LLO 3.2 Assemble crane using proper tools. LLO 3.3 Calculate working load carrying capacity.	3	Dismantle and assemble of Cranes	2	CO3
LLO 4.1 Operate different types of hoists LLO 4.2 Operate different types of cranes LLO 4.3 Operate different types of lifts	4	*Operate hoisting machine and equipment	2	CO3
LLO 5.1 Dismantle hydraulic jack. LLO 5.2 Assemble hydraulic jack. LLO 5.3 Calculate working height and load carrying capacity.	5	*Dismantle and assemble of hydraulic Jack (hydraulic lift)	2	CO3
LLO 6.1 Check relationship between driver and driven shaft of the given belt conveyor system. LLO 6.2 Calculate slack of the given belt conveyor system. LLO 6.3 Calculate speed of the driver and driven shaft for the given belt conveyor system; also calculate power transmission capacity.	6	Belt conveyors system	2	CO4
LLO 7.1 Dismantle a chain conveyor. LLO 7.2 Assemble chain conveyor.	7	*Dismantle and assemble of chain conveyor	2	CO4
LLO 8.1 Dismantle a gravity type conveyor. LLO 8.2 Assemble a gravity type conveyor.	8	Dismantle and assemble of gravity type conveyor	2	CO4
LLO 9.1 Identify various parts of the AGV/ASRS. LLO 9.2 Operate AGV/ASRS LLO 9.3 Program AGV/ASRS for the given application.	9	*Programming of AGV/ASRS	2	CO5
LLO 10.1 Calculate the dimensions like height of base for keeping the box of material for unloading and loading to cleaning the applied oil of door inner panels in stores.	10	Ergonomic considerations of material handling system	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of Chains (1.5 meter load carrying capacity 500 kg), Ropes (10-20 mm 1000 mm/reel Elevator Rope) and Hooks (150 kg Load Bearing Stainless Steel Rotatable Fork Hoist Chain Lifting Hook)	1,4
2	Working model of hydraulic lift (height 1 meter, 50 kg load), Pneumatic lift (height 30cm, 50 kg load), Hydraulic jack(Height 10cm, 2 Ton load)	2,4,5
3	Crane components (hoist lifting capacity 100 kg)	3,4
4	Working model of belt conveyors (length 1.5 meter and velocity 20-50 mm/sec for transporting small objects)	6,7,8
5	Working model of chain conveyor (length 1.5 Meter, Load 20 kg) for transporting small objects	6,7,8
6	Automatic Guided Vehicle With Conveyors (Lifting Capacity: 25 kg to 2000 kg, Loading And Unloading : Automated, Automation Grade : Automatic)	9
7	Automated Storage Retrieval System for laboratory	9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to material handling	CO1	10	4	4	8	16
2	II	Materials lifting equipment	CO2	8	4	4	6	14
3	III	Hoisting machinery and equipment	CO3	8	4	4	6	14
4	IV	Conveying machinery	CO4	8	4	4	6	14
5	V	Advanced material handling equipment	CO5	6	2	4	6	12
Grand Total				**40**	**18**	**20**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests of 30 marks and average of two-unit tests.
- For laboratory learning 25 Marks

Summative Assessment (Assessment of Learning)

- End semester assessment of 25 marks for laboratory learning.
- End semester assessment of 70 marks.

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	2	-	2	2			
CO2	3	2	-	2	-	2	2			
CO3	3	2	-	2	-	2	2			
CO4	3	2	-	2	-	2	2			
CO5	3	2	-	2	-	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	N. Rundenko	Material Handling Equipment	Peace Publisher, Moscow ISBN-13 : 978-0714702858 (2007)
2	M. P. Alexandrow	Material Handling Equipment	MIR Publishers, Moscow ISBN-0714717452 (1981)
3	R.B. Chowdary & G.N.R.Tagore	Material Handling Equipment	Khanna Publishers, Delhi ISBN-978-81-7409-105-5 (1986)
4	Apple J. M.	Plant layout & Material Handling	John Wiley Publishers ISBN-13 : 978-0471071716 (1977)
5	Immer J. R.	Material Handling	McGraw Hill, New York ISBN-13 : 978-0070316775 (1953)
6	Dr. O. P. Khanna	Industrial Engineering and Management	Dhanpat Rai publications (P) Ltd. New Delhi ISBN-13 : 978-8189928353 (2004)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/Up1oSSJn6oM?si=3J8eks-DjBfOxYZT	Material handling systems
2	https://youtu.be/NDTyxwU7rXs?si=kMcOuP37bZdV6Ufa	Material handling safety
3	https://youtu.be/PusvVnC_4Uc?si=w4uwpeOtdjSKKiYW	Material handling
4	https://youtu.be/1Oiu_vRPpnA	Cranes
5	https://youtu.be/tDK48Hpbxk0	Lifting tools & tackles safety
6	https://youtu.be/cocQN63hNMg	Lifting Tools & Tackles
7	https://youtu.be/WLZyfeTRUVs	Pneumatic Conveyer
8	https://youtu.be/pSspz70MoFA	Bucket Conveyer
9	https://youtu.be/H0PB2g0FdHE	Stackers, reclaimers

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Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students