Programme	Automobile Engineering	**Semester**	V
Course Code	20AT52I	**Type of Course**	**104:52:312**
Course Name	**Construction and Earthmoving Equipment**	**Credits**	24
CIE Marks	**240**	**SEE Marks**	**160**

Introduction:

Welcome to the curriculum for the Specialisation Pathway – **Construction and Earthmoving Equipment**. This specialisation course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur.

Earthmoving equipment is heavy duty vehicle outlined to perform constructional and mining operations which requires earthworks. The Asia-Pacific has the huge global market share of about two fifth of the global market for earthmoving equipment, which is followed by North America and Europe. Raising urban population demands for better facilities are proving greater opportunity for construction and mining industry, which in turn increases the demand for heavy machines like earthmovers, especially in developing countries such as India and China. In this course the student will be exposed to build, troubleshoot and maintain the hydraulic systems of the earthmovers, Selection of right type of earthmovers based on the requirement, service and maintenance of different earth moving equipment and also to troubleshoot hydraulic components of the earthmovers.

You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to build, troubleshoot and maintain the hydraulic systems of the earthmovers, Selection of right type of earthmovers based on the requirement, service and maintenance of different earth moving equipment and also to troubleshoot hydraulic components of the earthmovers.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an **Internship** in an organisation working on **Construction and Earthmoving Equipment** or take up a **Project** in the related field. After the completion of your Diploma, you shall be ready to take up roles like Service Engineer, Shopfloor Manager, Production In-charge and also can become Entrepreneur in the related field and more.

Pre-requisite

Before the start of this specialisation course, you will have prerequisite knowledge gained in the first two years on the following subjects:

1st year -Engineering Mathematics, Communication Skills, Computer Aided Engineering Drawing, Statistics & Analysis, Basic IT Skills, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Mechanical Science & Engineering and Automotive Engines.

2nd year-Automobile Chassis and Transmission System, Automotive Electrical System, Thermal Engineering and Engine Testing, Automotive Manufacturing Processes, Advanced Automotive

Systems, Design and Drafting, Vehicle Body Engineering and Dynamics and Fuel and Pollution Control. In this year of study, you shall be applying your previous years learning along with specialised field of study into projects and real-world applications.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Instruction to the Course coordinator:

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The Industry Class shall be addressed by Industry experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for industrial/mines/site visits.
7. Cohort owner shall maintain and document the industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom teaching can augment or use for supplementary teaching online courses available through reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Report should be maintained for industrial/field visit, such report shall be considered as industrial assignment.

Course outcome:

At the end course the student will be able to

1. Select the right equipment by analyzing different criteria, perform cost Estimation and analysis of the earthmovers based on given criteria.
2. Build the hydraulic and Pneumatic circuits manually and trough any open-source simulation software.
3. Trouble shoot and service the hydraulic system, steering system, Brakes, under carriage and suspension system of earthmovers.
4. Troubleshooting/ servicing of different mining truck, Industrial truck, Material handling and other construction equipment's.

Detailed course plan

Learning outcomes (Week 1):

At the end of the week the students will be able to:

1. Understand, explain various types of equipment's to be used in the constructions projects and different Earth Moving Operations.
2. Estimate and plan the operating and ownership cost of the equipment.
3. Perform comparative cost analysis for owning and operating heavy equipment
4. Analyse Depreciation, Replacement cost of the equipment and Maintenance & safety Management

Week	CO	PO	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
1	1	3	1	• About Specialization – Future • Companies and Service sectors in India and outside India along with their location • Career opportunities.	4			• About Earth moving equipment- History- Importance- with an Example of a company (like Caterpillar, TATA Hitachi, L&T Komatsu/Ajax/BEML/Eicher, JCB….) • Brief how the need for construction equipment evolved.	2	1	
			2	**Fundamentals of Earth Work Operations:** • Earth Moving Operations- Application. • Difference between **Construction and Mining process/operation.** • Types of Earth Work Equipment. • **Mining Equipment** – Types, application, load carrying	4			**Constructional & earth moving equipment** – Types, application, load carrying capacity – motor graders, loaders, cranes, conveyors and rollers. https://www.youtube.com/watch?v=Ev1wa0wRpqk https://www.youtube.com/watch?v=79esC_pkrEs	3		

				capacity – excavators, power shovels, bulldozers and mining trucks.							
			3	**Construction equipment's Planning and management:** • Planning process of Equipment Criterion for Selection of equipment: • Selection of machines based on type of soil • Haul distance • Weather condition	4			Soil Stabilization Methods and Equipment for: • Compaction • Additives • Dewatering • Freezing. Maintenance Management	3		
			4	• Equipment costs • Ownership cost • Operating cost • Safety Management. • Using right power tools for right job • Vehicle usage register for tracking • *Estimation of Ownership cost-* ***(Practice Using spreadsheets)***	2		2	• Estimation of -Cost of Operating Constructional Equipment – *(Practice Using Spread sheet)*			3
			5	Developmental Assessment			4	Assessment Review and corrective action	-		3
			6	**Industrial Class + Industrial Assignment** **Industry Class on** Planning and Management of construction Construction equipment	2		3				

				or Talk on requirement of earthmoving equipment and their scope by the Earthmover manufacturing company							
Learning outcomes (Week 2): At the end of the week the student will be able to: 1. Explain purpose, applications, types, construction and working of different Hydraulic components of like actuators, Valves, Pumps. 2. Determine the coefficient of discharge through experiments. 3. Build the hydraulic circuits manually/ through automation studio **Note: Use Hydraulic circuit rig up/ Automation studio/ Using Pneumatic circuit rig up/ Video Demonstration any of the above in Practical classes**											
2	2	1,2,4	1	Tutorial (Peer discussion on Industrial assignment)	-	4	-	• Depreciation Analysis, Replacement analysis. ***(Practice Using Spread sheets draw the graphs)***	2	1	
			2	**Hydraulics System:** 1.Leading Industries of hydraulics system used for earthmovers. https://www.youtube.com/watch?v=YrYdZ6J8QxI 2. Hydraulic system used in different types of earthmovers. 3.Fluid- Properties of fluid with definition & formula. Pascal's law. Methods of Transmission of power. 4. Fluid power system, Symbols of various Hydraulics & Pneumatic elements.	3		1	**Hydraulic pumps**: 1.Basic components of hydraulic systems like pumps - Types of pumps- Rotary Pumps, Reciprocating Pumps, Positive displacement flow pump. 2. *Illustration of Pascal's Law (P)*	1		2
			3	**Hydraulic Valves**: 1.Function of Control Valves, Classification of Control valves.	3	1		1.Application (and working) of flow control valves- Non return valve- pilot operated sequence valve, Sequence valve.	2		1

				2. Application (and working) of: directional control valves- Sliding spool type, Rotary spool type, 2/2, 3/2, 4/2, 5/2, 5/3, Poppet valve.				2. Hydraulic accumulator.			
			4	. Application and working of Pressure control valves- Pressure relief valve- Pressure reducing valve	2		2	**Actuators**: Application and working of different types of hydraulic components like actuators: cylinder type-ram type and piston type- single acting cylinder, double acting cylinder.	1		2
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on:** Hydraulic System used in earthmovers and need for hydraulic system in earthmovers. Or Talk on any one type of earthmovers showing its complete hydraulic system.	2		3				

Learning outcomes (Week 3):

At the end of the week the student will be able to:

1. Explain purpose, applications, types, construction and working of different Pneumatic components.
2. Build the hydraulic circuits / Pneumatic circuits manually or through automation studio
3. Perform maintenance of different components of hydraulic and pneumatic system.

Note: Use Hydraulic circuit rig up/ Automation studio/ Using Pneumatic circuit rig up/ Video Demonstration any of the above in Practical classes

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
3	2	1,4	1	Tutorial (Peer discussion on Industrial assignment)		4		Application and working of : Rotary actuators- Gear- vane- piston- Unidirectional – Bidirectional actuators.	2	1	

			2	1.Oil reservoir- Parts of reservoir. 2. Basic Hydraulic circuits: *Control of a Hydraulic cylinder- Single acting hydraulic cylinder, Double acting hydraulic cylinder.*	1		3	Building and Demonstration of *Regeneration Circuit*	1		2
			3	Building and Demonstration of *Flow control system: Meter-in, Meter-out, Bleed-off circuits.*	1		3	Building and Demonstration of *Accumulator Circuit: Accumulator as a shock absorber.*	1		2
			4	Building and Demonstration of Accumulator Circuit: 1. *Accumulator as an auxiliary power source.* 2. *Accumulator used for leakage compensator.*	1		3	*Building* and Demonstration *of Pressure reduction Circuits.*	1		2
			5	**CIE 1 (Written and Skill test)**				Assessment Review and corrective action			3
			6	**Visit any earthmover service center or showroom** Note-down different type of hydraulic system used in different type of earthmover.			5				
Learning outcomes (Week 4): At the end of the week the student will be able to: 1. Draw the hydraulic circuits, simulate and analyze the working of hydraulic and pneumatic systems.												
4	2	3	1	Tutorial (Peer discussion on Industrial Visit), Report submission on visit.		4		1.Practice on *Control of actuators by simple hydraulic circuits.* 2.Port Markings - ports and positions			3

			2	Maintenance of hydraulic system: Its common faults - *visual checks of oil- causes of contamination- preventive measures – maintenance schedule.*			4	**Drafting and Simulation using any opensource simulation software:** *Introduction to simulation software and tools.* (Any simulation open software) **Practice on software tools**			3
			3	*Practice on software tools*			4	*Using software tools: Hydraulic circuit drawing, hydraulic piping drawing*			3
			4	Building of oil power fluid circuits (software): *Control of a hydraulic cylinder*			4	Using software tools Building of: *Pump unloading circuit.*			3
			5	Developmental Assessment				Assessment Review and corrective action		3	
			6	**Industry Class on** Use of the simulation software to develop hydraulic circuits in earthmoving equipment Industry. Or Any relevant topic on uses of simulation software in automobile industry	2		2	Weekly Assignment(1PM-2PM)			1
Learning outcomes (Week 5): At the end of the week the student will be able to: 1. Review the Engine and other features related to engine. 2. Trouble shoot and service the steering system of earth moving vehicles. Demonstrate the Controls of the shovel												
5	3	1,2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		Using software tools Building of: *Hydraulic cylinder sequencing circuit.* Build combination circuit **(using Any simulation software.)**	2		1
			2	Steering System in earthmovers: 1.Power steering - linkage or semi- integral type - integral power steering	2	2		1.*Steering fault finding and remedies* 2. *Checking/ Inspection of Steering mechanism and necessary repair.*			3

				2.Steering of tracked vehicles - Skid steering -clutch /brake steering system- construction and working 3. Planetary steering system - construction and working. 4. Differential steering system - construction and working of each type. 5. Articulated steering– construction & working.							
			3	**Power shovels:** 1.Introduction to power shovels and its basic parts- Specifications. 2.Types and sizes of power shovels. 3.Selecting the Types and Size of Power shovels. 4. Optimum Depth of Cut.	2		2	Factors affecting the output of power shovel- • Class of material. • Depth of cut. • Angle of swing. • Job conditions. • Management condition. • Size of hauling units. • Skills of operator. • Physical condition of the shovel	2		1
			4	Shovel Controls: • *Typical control* • *Bucket controls.* • *Operating mechanism of the bucket in the power shovel.* • *Pedals*			4	Operation of Power shovel- • Planning to Work, • Filling the Bucket, • filling the Bucket from a Stockpile, • To Fill a Bucket When Digging and Loading on Level Ground, • Transporting with a full Bucket, • loading a Truck	1		2
			5	**CIE 2 (Written and Skill test)**	1		3	Assessment Review and corrective action			3

			6	**Industrial Class + Industrial Assignment** **Industry Class on** Engines/ Braking system/ Steering system/ Rear axle / Tyres & Track in earthmovers.	2		3				
Learning outcomes (Week 6): At the end of the week the student will be able to: 3. Explain the specification, attachments, working of the power Shovel. 4. Troubleshoot/ Service the different parts of the power shovel.											
6	4	1,2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		Operation of Power shovel- • Levelling and Pushing operations • Traveling on Sloping Ground https://www.youtube.com/watch?v=tldOKQiMvAk	1		2
			2	Pre-operational checks and maintenance of power shovel – 1. *Tyres and wheels- Practice on wheel changing* 2. *Checking Lubrication and hydraulic system* 3. *Checking Oil levels – engine sump, transmission and differential case*			4	Pre-operational checks and maintenance of power shovel – 1. *Hydraulic oil level reservoir.* 2. *Engine coolant level* 3. *Air filter and air intake* 4. *Fan belt* 5. *Battery condition*			3
			3	1.*Start- up and shut-down procedures of shovel.*			4	Fitting and removal of attachments– • Front Attachment- General purpose excavating bucket, General purpose (operation)penetration bucket, Multipurpose bucket.			3

				2.*Adjusting working attachment for correct functioning during field operation.*							
			4	Fitting and removal of attachments– • Rear attachments- Augers, Grabs, Rippers Fitting and remove common attachments- Front attachment, Rear attachment.			4	1. OLSS in shovel- Circuit diagram, Working, Advantages. 2. Trouble shooting of Hydraulic circuits.	1		2
			5	Developmental Assessment			4	Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on** OLSS system in power shovel Or On any topics related to power shovel	2		3				

Learning outcomes (Week 7):

At the end of the week the student will be able to:

1. Explain the specification, attachments, working of the excavator.
2. Troubleshoot/ Service the different parts of the excavator.

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
7	4	1,2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Excavators:** 1. Excavators – Types- Specifications - Working principle 2.Parts & attachments (outline drawing), working of each part and attachment.	1		2
			2	Engine – *EGR system (Servicing and troubleshooting)*	1		3	1. Power train, Final drive, swing circle.	1		2

								3. Demonstrate the *Swing gear and bearing maintenance.* https://www.youtube.com/watch?v=_iZbFTa_4Sc https://www.youtube.com/watch?v=gKUrPUB0eXQ (Swing bearing replacement)			
			3	1.Perform *Pre- operational Inspection.* 2. Demonstrate the *Operating procedure of excavator.*			4	1.Excavator lifting attachments, lifting operation, lifting capacity. https://www.youtube.com/watch?v=VUhWXtiEUII https://www.youtube.com/watch?v=41Qb4bDrjmU 2.Hydraulic system- CLSS, OLSS 3.closed-centre load sensing system (CLSS) in excavators- Circuit diagram, Working, Advantages.	3		
			4	*Servicing of hydraulic system in excavator.*	1		3	*Servicing of hydraulic system in excavator.*			3
			5	**CIE-3 (Written and Skill test)**				Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on** CLSS system in excavators Or On any topics related to excavators	2		3				
Learning outcomes (Week 8): At the end of the week the student will be able to: 1. Troubleshoot/ Service the different parts of the excavator.											

8	4	2,4	1	Tutorial (Peer discussion on Industrial assignment)		4		1. Excavator bucket: • Types- Rock, General purpose-Construction • Bucket teeth options • Common Blade type. *2.Operating mechanism of bucket in excavator.* https://www.youtube.com/watch?v=mFsbdMioawM https://www.youtube.com/watch?v=rFsA3Nf93fs	2		1
			2	Excavator bucket capacity- 1. Different capacities/ types 2. Bucket capacity calculation based on the purpose of job the excavator is used. 3. Identification of the capacity of the bucket by looking into its model no. of the vehicle (Ex. Get a brochure of L&T Komatsu Excavator if in Model no. is PC130 then what does 13 mean). 4. Track frame and shoe	2	1	1	*Servicing of bucket, frame, swing.*			3
			3	Practice on *Under Carriage Track adjustment*			4	*Practice on changing the track/ Remove and refit Track chain assembly.* https://www.youtube.com/watch?v=1vclSlTTql0			3
			4	*Adjusting working attachment for correct functioning during field operation.*			4	*Maintenance and Regular check-up of excavators* https://www.youtube.com/watch?v=-9qdCjSgI-8			3

			5	Developmental Assessment			4	Assessment Review and corrective action		3	
			6	***Construction site Visit***			5				

Learning outcomes (Week 9):
At the end of the week the student will be able to:
1.Explain the specification, attachments, working of the Bull Dozer.
2. Troubleshoot/ Service the different parts of the Bull Dozer.

			1	Tutorial (Peer discussion on Industrial assignment) & Report Submission on mines visit.		4		**Bull-Dozer:** 1.Dozer parts and functions-Types-Working/Operation of each type-Specification. 2. Bulldozer blades- types-Explanation. 3. Rippers- types-Explanation	3		
			2	1.Operating procedure of Bull dozer. 2. Types of Dozer attachments and blades- Front attachments, Rear attachments.	3		1	1. Demonstrate Dozer Controls- typical control, bucket controls. 2. Controlling the blades			3
9	4	2,4	3	1.Demonstrate Adjustment of the blades- angle adjustment, Tilting adjustment.			4	• Adjusting working attachment for correct functioning during field operation.			3
			4	Demonstrate Adjusting the track-undercarriage.			4	Demonstrate Adjusting the track-undercarriage.			3
			5	**CIE-4 (Written and Skill test)**	1		3	Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on:** Any topic related to Bull Dozer.	2		3				

Learning outcomes (Week 10):
At the end of the week the student will be able to:

1. Troubleshoot/ Service the different parts of the Mining truck. 2. Review a given Fault Codes to determine the faults in the mining truck											
10	4	2,4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Mining truck:** • Mining trucks – Types- Specifications - Working principle (outline drawing). • Truck capacity calculation • Guidelines for reducing the vibrations in earthmoving equipment.	1		2
			2	• Operational restrictions on the dumper trucks. • Articulation lock • *Understand the Fault Codes to determine the faults in the mining truck.*	2		2	Mining truck repair & maintenance: • *Battery maintenance* • *Lubricating system*			3
			3	Mining truck repair & maintenance: • *Steering system* troubleshooting • *Rear axle and front axle*			4	Mining truck repair & maintenance: *Transmission system service & troubleshoot*			3
			4	Mining truck repair & maintenance: • *Hydraulic System*			4	Mining truck repair & maintenance: • *Braking system*			3
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on:**	2		3				

				Any topic related to Concrete mixing truck. Or Any topic related to Rollers and finishing equipment.							

Learning outcomes (Week 11):

At the end of the week the student will be able to:

1.Review a given Fault Codes to determine the faults in the Industrial truck.

1. Troubleshoot/ Service the different parts of the Industrial truck.

Week	C O	P O	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
11	4	2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Industrial Trucks:** • *Understand the Fault Codes to determine the faults in the truck.* • *Repair and maintenance.*			3
			2	*Practice on Tyre maintenance-Replacement of the tyre.*			4	*Practice on Steering system* troubleshooting			3
			3	*Repair and maintenance of truck*			4	*Repair and maintenance of truck*			3
			4	**MATERIALS HANDLING EQUIPMENT:** • Forklifts and related equipment—Need, Parts, Structure • *Repair and maintenance.*	1		3	*Repair and maintenance of forklifts*			3
			5	**CIE-5 (Written and Skill test)**				Assessment Review and corrective action			3
			6	**Showroom/Service station visit**			5				

Learning outcomes (Week 12):

At the end of the week the student will be able to:

1.Repair and maintenance of material handling equipment's.

2. Explain different types of construction equipment other than hauling equipment's.

			1	Tutorial (Peer discussion on Industrial Visit) & report submission on Industry visit		4		Material Handling Conveyors- types – Material Handling Cranes- -- *Repair and maintenance of conveyors and cranes.*	1			2
			2	*Repair and maintenance of conveyors and cranes.*			4	*Repair and maintenance of conveyors and cranes.*	1			2
12	4	2, 4	3	**OTHER CONSTRUCTION EQUIPMENT:** Operating methods and working of • Crane • Mobile crane • Equipment for Dewatering and Grouting • Equipment for demolition. • Under water concreting equipment	2		2	1.Operating methods and working of • Equipment for Dredging • Trenching • Drag line and clamshells 2.Operating methods and working of • Tunnelling • Equipment for Drilling and Blasting • Pile driving Equipment • Erection Equipment	2	1		
			4	**Aggregate production** • Different Crushers • Feeders • Screening Equipment • Handling Equipment **Batching and Mixing Equipment**	2		2	Videos on different types & application of • **Materials handling equipment** • **Other construction equipment**				3

				• Pumping Equipment • Ready mix concrete equipment • Concrete pouring equipment							
			5	Developmental Assessment				Assessment Review and corrective action			3
			6	**Construction site visit/ Mines visit**			5				
Learning outcomes (Week 13): At the end of the week the student will be able to: 1. Demonstrate the mini project which he has worked on.											
13			**Internship** **a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.** **c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.**				**Project** **Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.** **b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **c) Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**			40 Hrs

4. CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 7	CIE 3– Written and practice test	4	30
Week 9	CIE 4– Written and practice test	4	30
Week 11	CIE 5– Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

* The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Model Questions CIE-1

Programme	**Automobile Engineering**	**Semester**	**V**
Course	**Construction and Earthmoving Equipment**	**Max Marks**	**30**
Course Code	**20AT521**	**Duration**	**4 hours**
Name of the course coordinator			

Note: Answer one full question from each section.

Qn. No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
	Section-1 (Theory) – 10 marks				
1.a)	With proper justification, explain how soil help us decide the type of earthmoving equipment need for that purpose?	L4	1	1,2	5
b)	Why are 5/2 valves commonly used for pneumatic control of double acting cylinder whereas hydraulic systems use 4/2 valves, what is the extra port for.	L3	2	1,4	5
2.a)	With a neat Circuit diagram of Meter-in and meter-out, explain how both are different from each other.	L3	2	1,2	5
b)	The site manager needs the excavator for a month, it's a monsoon season he is not sure the number of hours it will be working at site and is in a dilemma whether to rent or lease the excavator, what do you suggest. Write the answer with proper justification.	L4	1	1,4	5
	Section-2 (Practical) - 20 marks				
3)	In the given hydraulic system has excessive operating temperature, also the expert had suggested there might be a possibility of pressure filter block. How do you resolve the problem	L4	2	1,3	20

4)	In the given hydraulic system, the cylinder has air in the system, how do you overcome this situation.	L4	2	1,3	20

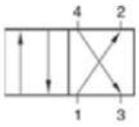
Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)
Sample Question Paper

Programme	**:**	**Automobile Engineering**	**Semester: V**
Course	**:**	**Construction and Earthmoving Equipment**	**Max Marks: 100 Marks**
Course Code	**:**	**20ME52I**	**Duration: 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL (L3/L4)	CO	Marks
	Section-1			
1.a)	With proper justification, explain how soil help us decide the type of earthmoving equipment need for that purpose?	L4	1	10
b)	It is said that maintenance management of construction equipment's is very essential in construction firm. Justify the statement with proper points.	L3		10
2.a)	Compare Depreciation calculation method straight-line method and double declining balance method. Which method is best suitable for calculating depreciation cost of construction equipment, Justify your answer.	L3		10
b)	The site manager needs the excavator for a month, it's a monsoon season he is not sure the number of hours it will be working at site and is in a dilemma whether to rent or lease the excavator, what do you suggest. Write the answer with proper justification.	L4		10
	Section-2			
3.a)	Why are 5/2 valves commonly used for pneumatic control of double acting cylinder whereas hydraulic systems use 4/2 valves, what is the extra port for. Draw the sketch of 5/2valve and 4/2 valve double acting cylinder.	L3	2	10
b)	What is the characteristic of the diagrams given below	L4		10

	 & 			
4.a)	Conclude that why hydraulic systems are preferred for heavy work than the pneumatic systems.	L3		10
b)	Which is the circuit in which the hydraulic motor is located after the speed control valve is, Explain the circuit with neat sketch	L4		10
	Section- 3			
5.a)	This is the equipment used in construction site to clear the site, level land etc. Which is this equipment and how does it help in the process stated above. If you have to buy or rent the bulldozer, how does its size be measured and why?	L4	3	10
b)	The contractor has to build a road, but there are few buildings which has to be demolished and also some trees which uprooted and planted few meters apart. Which earthmover is better for the job, justify your answer. With a neat sketch explain its components.	L3		10
6.a)	"The crawler mounted bulldozer is sometimes advantageous over wheel mounted bulldozers" how do you justify the statement.	L4		10
b)	While choosing the excavator teeth which are the factors to be looked to be considered. What is the type of excavator teeth and how they are different from each other.	L3		10
	Section-4			
7.a)	"Dumper still tip over when travelling on a gentle gradient even if it's not overloaded or being driven too fast" How can it happen, explain with proper justification? State 2 requirements of using a stop block or earth bank at a trench discharging point	L4	4	10
b)	The operator has been asked to tip material into a new trench, Name 5 requirements that must be followed before tipping and why	L3		10
8.a)	What decides the minimum distance that machines must keep from overhead lines and why must the distance be kept.	L3		10
b)	In commercial trucks, the hydraulic fluid has turned milky and is the indicator of water contamination. How can we mitigate the presence of water in hydraulic system.	L4		10

Section-5				
9.a)	The blind spots in trucks are also called as No Zones, which are the 4 blind spots in commercial trucks. What are the tips to be followed to avoid truck accidents.	L3	4	10
b)	Which belt conveyor prevents sliding down of material at an inclination of 55^0 with horizontal. Explain with neat sketch	L4	4	10
10.a)	For a given depth of cut, the output of a power shovel can be increased by decreasing the angle of swing. Is the statement true or false, justify your answer.	L3	3	10
b)	The power shovels are suitable in close range works of excavation. How?	L4	3	10

Sample Question & Scheme of Evaluation for SEE 2

Sl No	Description	Marks
Problem statement	The operator of a mini excavator observes the hydraulic leak. Take the necessary steps to resolve this problem. (Hint: check seals and gaskets)	
1	Problem analysis	10
2	Problem identification	10
3	Equipment/ tools used to repair or replacement	10
4	Dismantling & assembling along with replacing or servicing of given case	30
4	Result (solved the problem or not/ whether it is working condition)	20
5	Viva voce	20
Total		**100**

Equipment:

Sl. No.	Particulars	Quantity
1	Bench mounted Test Rig for Venturi meter	1
2	Hydraulic Single acting/ Double acting cylinder Kit	1
3	Pneumatics Trainer Kit with all standard accessories.	1
4	Any opensource simulation software	1
5	EGR System	1
6	CRDI System	1
7	Excavators	1
8	Bull-Dozer	1
9	Mining truck	1

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Sl. No	Description
1	Deodhar, S.V. "Construction Equipment and Job Planning" , Khanna Publishers, New Delhi,1988.
2	"Construction Machines: Excavators" by Murray Julie, **North Star Editions**
3	"Excavators" by Marcos Victoria, Publisher: Xist Publishing
4	Power Shovels: The World's Mightiest Mining and Construction Excavators by Eric C Orlemann, Publisher : MBI (August 12, 2003)
5	Fluid power Engineering by RK Hegde & Niranjan Murthy
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7	Fluid power transmission and control system by P.G. Mundas
8	Construction Planning, Equipment, and Methods, 9th Edition, Publication Date & Copyright: 2018, McGraw-Hill Education By Robert L. Peurifoy, P.E., Clifford J. Schexnayder, P.E., Ph.D., Robert L. Schmitt, P.E., Ph.D., Aviad Shapira, D.Sc.
9	Oil Hydraulic System By S R Majumdar.