



**MODEL ANSWER**

**SUMMER- 18 EXAMINATION**

**Subject Title: Industrial Erection and safety**

Subject Code: **17623**

**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept

Q. NO.	sub. Q.No	ANSWER	
Q.1.		Attempt any FIVE	5x4=20
	a.	<b>Role of Erection Engineer is as follows:</b>  i) Erection engineer should have a proper knowledge of materials and tools and equipments  ii) He should have enough experience of handling manpower.  iii) He should have good knowledge of time management.  iv) He should have a proper information and knowledge of cost of labour.  v) He must have knowledge of design, layout and utilization of available resources.  vi) He should avoid waste of materials.	4 M  any four points



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		<p>vii) He should utilize logistic facilities/transport activity properly.</p> <p>viii) He must be aware of safety rules and regulations and all government laws.</p> <p>ix) He should have proper managerial skills to handle people for the project.</p>	
	<b>b.</b>	<p><b>Inspection of hoisting chain is as follows:</b></p> <p>i) Each and every link should be properly inspected at regular interval for any damage</p> <p>ii) Each and every link should be inspected for rust as it reduces strength of the chain, therefore it should be kept or stored at dry and cool place also away from water and moisture</p> <p>iii) If any link is broken or crack is observed, it should be repaired or replaced</p> <p>iv) Proper lubrication should be conducted regularly.</p> <p><b>Necessity:</b></p> <p>i) Inspection is required to avoid any breakage of chain during operation.</p> <p>ii) To avoid accidents.</p>	<p><b>2 M</b></p> <p><b>any two points</b></p> <p><b>2 m</b></p>
	<b>c.</b>	<p>i) It is the point in the body, where whole weight of the body is set to be concentrated this is called as centre of gravity.</p> <p>ii) Estimating Centre of gravity defines the proper lifting of load and avoiding tilting of load.</p>	<p><b>2 m</b></p>

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	<p>a) Symmetrical      b) Unsymmetrical</p> <p>← bridle sling</p>	<p>2 m for diagram</p>
<p>d.</p>	<p><b>Following are different type of chain Hoist:</b></p> <ol style="list-style-type: none"> <li>1) Pull lift Hoist</li> <li>2) Lever operated hoist</li> <li>3) Differential chain hoist</li> <li>4) Spur gear hoist</li> <li>5) Screw geared hoist</li> </ol> <p><b>Uses:</b></p> <ol style="list-style-type: none"> <li>1. It is used for lifting light and heavy loads.</li> <li>2. It is used in fabrication companies, mechanical and marine application.</li> <li>3. It is used in small machine shops</li> </ol>	<p>2 M</p> <p>2M</p>



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	<p><b>e.</b> Causes of accidents are as follows:</p> <ol style="list-style-type: none"><li>1) Human failure</li><li>2) Unsafe working condition</li><li>3) Failure of machine and equipment</li><li>4) Power failure</li><li>5) Broken or damaged parts</li><li>6) Fire break out for explosion</li><li>7) Fuel factor i.e. Poor quality or no fuel may lead to stop the engine</li><li>8) Mechanical mismatch or malfunction</li><li>9) Linkage failure.e.shaft,gear,coupling belt,chain,broken or failure</li><li>10)Control system failure</li><li>11)Failure of ropes chain.</li></ol>	<p><b>4 m</b></p> <p><b>any four points</b></p>
	<p><b>f.</b> Following advance planning should be carried out for the erection of process equipment:</p> <ol style="list-style-type: none"><li>i) Availability of drawing which gives detail of dimension and weight of the equipment that has to be erected</li><li>ii) Drawing for foundation and erection instruction manual of the related equipment should be available</li><li>iii) Lay out of material handling equipment, raw material availability and their storage at the site should be available</li><li>iv)The erection schedule of the equipment should be made or prepared well in advance</li><li>v) A schedule of manpower required for installation specially, fitter, welder and rigger is to be planned as erection and installation is highly skilled and specialized job hence a proper selection of man power is</li></ol>	<p><b>4 m</b></p> <p><b>for any four points</b></p>



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	<p>required.</p> <p>vi) A schedule for transportation for work equipments (eg. Cranes, forklift or caterpillars)</p> <p>vii) A schedule for estimated cost for erection and installation is to be prepared in order to control cost of project.</p> <p>viii) Arrangement of safety equipments such as helmet, safety shoes, gloves and protection glasses, should be made Available to the site according to the work and as per the manpower.</p> <p>ix) Arrangement for receiving and unloading the material, first aid kit, Store room, sitting arrangement for worker and officer and Available at the site and at the required time</p>	
g.	<p>Steps in erection costing is as follows:</p> <p>i) Find out the cost of direct material used for installation. It also involves indirect expenses like material handling equipment also find out labour cost as well as cost of contract people addition of all this cost gives us prime cost</p> <p>ii) Find out the factory overhead like rent on buildings, depreciation of equipments, salary of supervisor, quality control department maintained department, electricity bill, gas and oil utilization, all these are factory overhead</p> <p>factory cost = prime cost + Factory overheads</p> <p>iii) Find out administrative overheads. It includes rent of building, furniture salary to administrative people</p> <p>Office cost= Factory cost + Administrative cost</p> <p>iv) Find out selling overhead like salary to sales man, sales department, advertisement cost, sales promotion cost, comision</p> <p>Total cost= Office cost+ Selling Overhead</p>	<p><b>4 m</b> <b>(any one, diagram or write up)</b></p>

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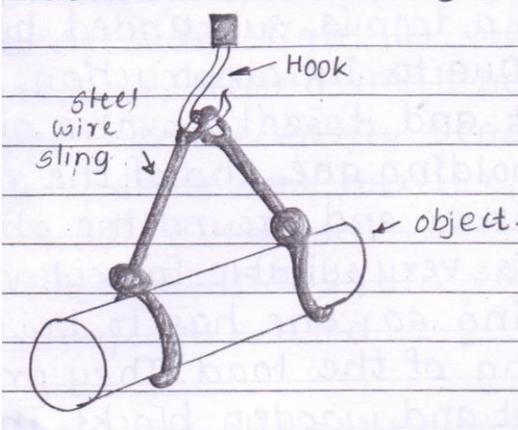
	<p>The diagram is a handwritten cost breakdown on lined paper. It shows a vertical stack of boxes representing different cost components. From top to bottom: 'Prime Cost Direct Cost', 'Factory Cost', 'office Cost', 'Total Cost', and 'Actual Cost'. Brackets on the right side group these into 'factory overhead' (covering Prime Cost and Factory Cost), 'Administrative overhead' (covering office Cost), and 'Selling overhead' (covering Total Cost). A shaded area at the bottom right represents 'Discount'. The 'Actual Cost' is shown as a box that includes the 'Total Cost' and the 'Discount'.</p>	
<p><b>Q.2</b></p>	<p><b>Attempt any FOUR</b></p>	<p><b>4x4=16</b></p>
	<p><b>a.</b> Different types of ropes used in erection:</p> <p>i) Natural fibres ropes</p> <p>    a) Manila rope</p> <p>    b) Hemp rope</p> <p>    c) Sisal rope</p> <p>    d) Coil /Jute rope</p> <p>ii) Synthetic fibres rope</p> <p>iii) Steel wire rope</p> <p><b>Three Stranded rope</b></p> <p>1. The strands of wire ropes consist of two or more wires, which are laid in various geometric arrangements or in combination with steel</p>	<p><b>2 m</b></p> <p><b>2 M</b></p>

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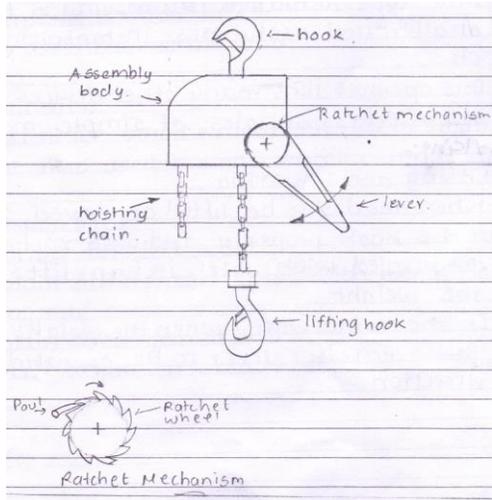
	<p>wires and other materials.</p> <p>2. Just as any number of wires can make up a strand, any number of strands can make up a rope.</p> <p>3. When three strands are laid together to form a rope is called as three stranded ropes.</p> <p>4. Due to many strands, strength of rope increases and it can be used for lifting or loading purpose.</p>	
<p>b.</p>	<p><b>Double Basket sling</b></p>  <p>It uses two steel wire slings, after positioning with the centre of gravity in vertical line with hook the object is lifted. It is used for heavy load lifting compared to single choker sling</p> <p><b>Basket sling</b></p> <p>This is similar to choker sling the only difference is that they are provided with the link that supports flat and surface. It is used in textile mills where the bundle of loads has to be lifted, If the sling has one leg, it is called as single basket and if legs are more it is called as double basket and depending upon a number of legs the basket can be defined</p> <p><b>Turnbuckle sling</b></p> <p>It is used to lift the load horizontally without tilting, Turn buckle slings</p>	<p>2 M</p> <p>2 M</p>

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	are useful for tightening purpose and very much useful in irregular shapes	
c.	<p>Use of Pad/Protector at sharp edges where slings are used</p> <p>i) Usually at the sharp edges steel wire ropes or hoisting chains or basket slings get damaged or kinked, in order to avoid this a pad in the form of rubber, cotton, synthetic material, leather, wooden blocks are used,</p> <p>ii) In order to avoid damages slings are made up flexible rope.</p>	<b>4 M</b>
d.	<p><b>Pull lift Hoist:</b></p> <p><b>Construction:</b></p> <p>i) It consists of a ratchet lever</p> <p>ii) It also has ratchet for operating through lever and handling the loads</p> <p>iii) It is mainly used for pulling horizontal loads, horizontal trolley etc.</p> <p><b>Working :</b></p> <p>i) When load to be lifted, it is located in the hook properly and with ratchet lever it is operated which in turn lifts or moves the load.</p> <p>ii) In the same way, when the weight is to be lowered, ratchet lever is operated in reverse direction.</p> <p><b>Diagram:</b></p> 	<b>4 m</b>

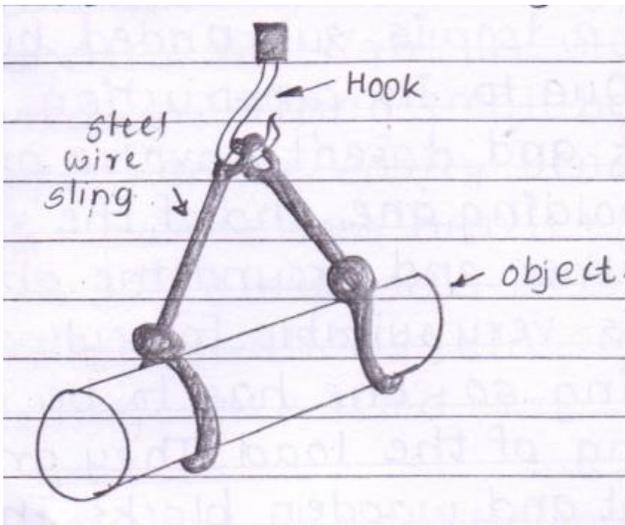


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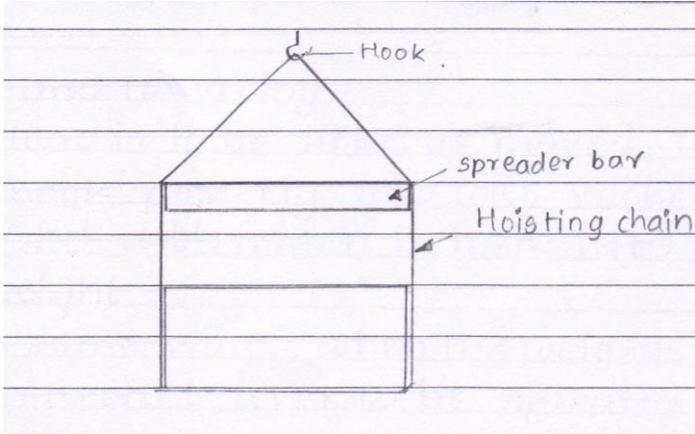
		<p>3. Now the vessel is filled with pressurized water or air or nitrogen and then it is kept for certain predefined interval of time.</p> <p>4. Then pressure is released and during that time any leak or other cracks are observed if there is drop in pressure</p>	
<b>Q.3.</b>		<b>Attempt any FOUR</b>	<b>4x4=16</b>
	<b>a.</b>	<p>Requirements of selection of SWR is as follows:</p> <ol style="list-style-type: none"> <li>1. strength</li> <li>2. Resistance to wear and tear</li> <li>3. Easy availability of steel wire ropes</li> <li>4. Load carrying capacity</li> <li>5. Grade</li> <li>6. Length</li> <li>7. Size</li> <li>8. Lay</li> </ol> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	<p><b>4 m</b></p> <p><b>for any 4 points</b></p>
	<b>b.</b>	<p><b>Double choker sling :</b></p> 	<b>4 m</b>

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	<p>It consists of two steel wire slings, hook and after positioning with the centre of gravity in vertical line with hook the object is lifted. It is used for heavy load lifting compared to single choker sling</p>	
<p><b>c.</b></p>	<p>i) A horizontal bar usually used to lift a load that are not sufficiently protected from crushing by the sling legs.</p> <p>ii) In such cases spreader bar is used.</p>  <p>iii) spreader bars are pipe like structures with eyes on each side</p> <p>iv) The sling passes through the eyes which will change the stress in the slings due to the angle of legs.</p> <p>v) using the spread bar, the lifting capacity of slings are calculated and then it is used.</p> <p>vi) Example: lifting heavy containers, lifting heavy materials like M.S. kept in a container.</p>	<p><b>4 M</b></p>



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d.	<b>Sr.No</b>	<b>Differential Hoist</b>	<b>Pull Lift Hoist</b>	<b>4 M</b> <b>any other relevant points can also be considered.</b>
	1.	It is operated through chain.	It is operated through lever.	
	2.	It consists of cogs with endless chain.	It consists of Lever with sprocket mechanism.	
	3.	It is used for light and medium weight.	It is used for light weight.	
	4.	It is used for lifting the load.	it is mainly used for pulling the load.	
e.	Human Factors in accident prevention is as follows: a) proper knowledge of machine b) proper selecting tools and cutting parameter c) proper planning for executing the work d) Allotment of work and duties to proper personal operator e) Following the instruction as per work orders. f) Supervision, monitoring and controlling			<b>4 M</b> <b>any four points</b>
f.	Need of physical checking of dimensions of equipments and foundation is as follows: 1. Once dimension of equipment is measured, it becomes easy for making foundation. 2. Easy for installation on foundation. 3. Any other projection of machine can be avoided. 4. Bolting on foundation due to measurement will be easy and correct.			<b>4 M</b>



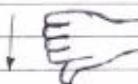
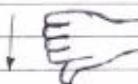
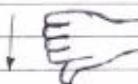


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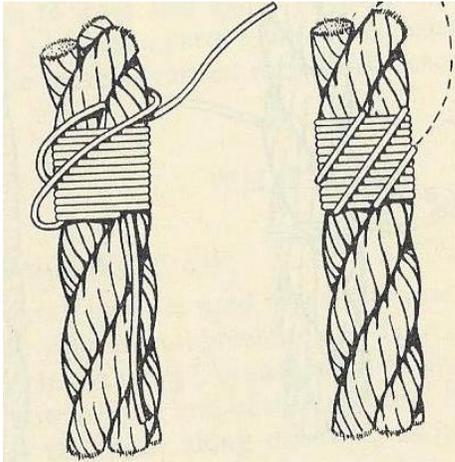
	<table border="1"> <tbody> <tr> <td>3) Rack Trolley.</td> <td></td> </tr> <tr> <td>4) Travel crane / caterpillar.</td> <td></td> </tr> <tr> <td>5) Boom up</td> <td></td> </tr> <tr> <td>6) Boom down</td> <td></td> </tr> <tr> <td>7) Stop / Halt.</td> <td></td> </tr> <tr> <td>8) Emergency stop</td> <td></td> </tr> <tr> <td>9) Slew Boom</td> <td></td> </tr> </tbody> </table>	3) Rack Trolley.		4) Travel crane / caterpillar.		5) Boom up		6) Boom down		7) Stop / Halt.		8) Emergency stop		9) Slew Boom		
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c.	<p><b>(i) Tightening by Pneumatic torque wrench</b></p> <ol style="list-style-type: none"> <li>1. Pneumatic torque wrench provides much better grip compare to manual operation.</li> <li>2. It gives less fatigue to operator for final tightening of bolts.</li> <li>3. Positioning and final gripping of bolt is obtained by applying high torque.</li> <li>4. Due to high torque bolt will not lose in any situation.</li> </ol> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	4 m														

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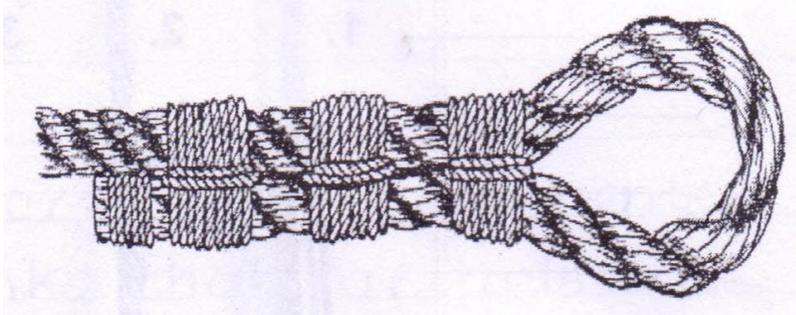
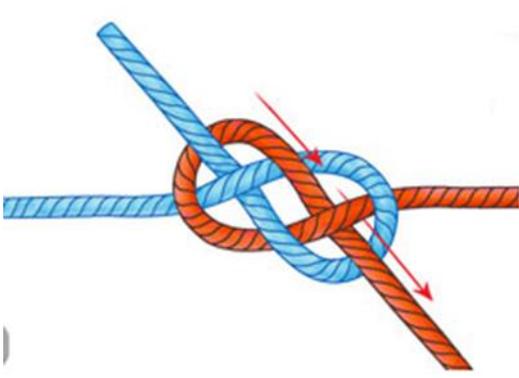
		<p><b>(ii) Importance of safety instructions:</b></p> <p>a) Safety instructions remind the procedure of safe working.</p> <p>b) It gives standard way of working.</p> <p>c) New employees understand the working procedure.</p> <p>d) Avoids accidents.</p> <p>e) Reduces cost of productivity.</p> <p>f) Improves quality of employee and product.</p> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	
Q.5	a	Attempt any One	1x4=4
	i	<p><b>Whipping</b></p>  <p>It is a method of interlocking the stand unwinded at the end of the rope with another rope to prevent more unwinding basically it is a locking dive type which stipes rope ends from unwinding and losing its efficiency.</p>	2 M

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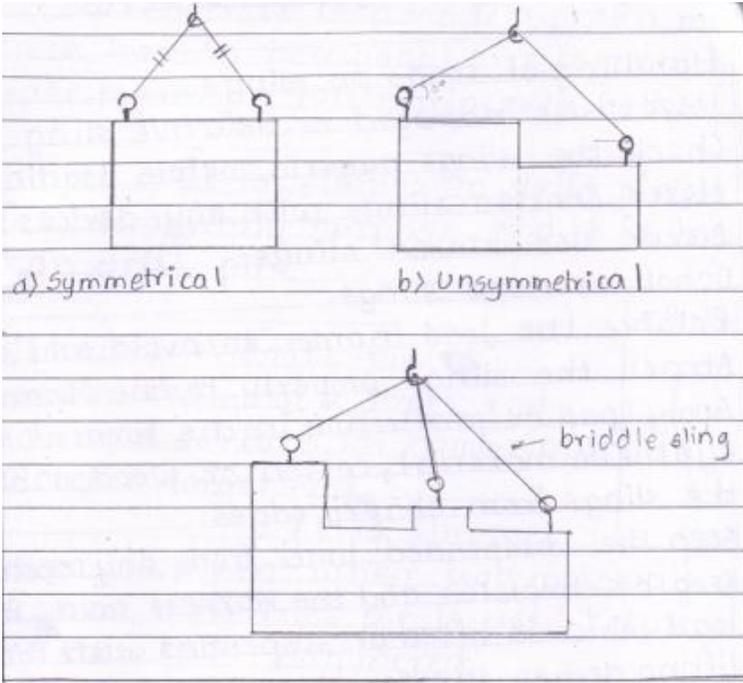
		<p>Seizing</p>  <p>It is a method of making an eye at the end of the same rope with itself and then interlocking or tying it. With another ropes in patterns as shown figure.</p>	<p>2 M</p>
ii	<p>Knots</p>  <p>Bends:</p>  <p>( Note: Approximate or similar diagram can be given marks)</p>	<p>2 M</p> <p>2M</p>	

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	<p><b>b Attempt any TWO</b></p>	<p><b>2x6=12</b></p>
	<p><b><u>(i) Different consideration while handling loads :</u></b></p> <p>i) Never use damaged or defective sling</p> <p>ii) check the slings properly before loading</p> <p>iii) Never shorten slings with any devices</p> <p>iv) Never use kinked slings.</p> <p>v) Estimate centre of gravity of load to avoid accidents.</p> <p><b>Estimation of Centre of Gravity:</b></p> <p>a) It is the point in the body, where whole weight of the body is set to be concentrated this is called as centre of gravity.</p> <p>b) Estimating Centre of gravity defines the proper lifting of load and avoiding tilting of load.</p> 	<p><b>3 M</b></p> <p><b>any three points</b></p> <p><b>3 M</b></p>



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	<p><b><u>ii )Importance of proper illumination for safe working condition:</u></b></p> <p>a) Illumination reduces stress on eyes</p> <p>b) it reduces fatigue to the worker.</p> <p>c) provides ambient and safe working condition</p> <p>d) illumination gives good productivity and quality of work</p> <p>e) It reduces and avoids accidents.</p> <p>f) It provides better visibility to all workers and machineries etc.</p> <p>g) It gives easy and comfortable working area.</p> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	<p><b>6 M</b></p> <p><b>any six points</b></p>
	<p><b><u>iii )Effect on site operation :</u></b></p> <p>i) Check the important dimensions of equipments as per the drawing like length, width and height.</p> <p>ii) Select suitable method for handling equipments depending upon the following</p> <p>(a) weight of equipment</p> <p>(b) Space available for operation</p> <p>(c) Time allowed for erection and installation</p> <p>(d) Cost limitation.</p> <p>iii) Select suitable tools like shackle, slings, sprit level, wrenches, measuring tapes, spanners which are to be used for different purpose.</p> <p>iv) Hoist has to be adjusted so as to balance the equipments.</p> <p>v) Hoist should be adjusted slowly so the position of equipment should match with the position of foundation bolts.</p>	<p><b>6 M</b></p> <p><b>any six points</b></p>



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		<p>vi) With the tools and tackles, it becomes easy and simple to carry out the work.</p> <p>vii) Proper tools always save the time, cost and avoids any sort of accidents.</p> <p>viii) Effect of tools and tackles completes the projects on time.</p> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	
<b>Q.6.</b>		<b>Attempt any TWO</b>	<b>2x8=16</b>
	<b>a</b>	<p><b><u>i) Braided Rope construction :</u></b></p> <p>1. In this type of rope, the core is surrounded by braided shield and rope is balanced in such a way that load is equally distributed in shield.</p> <p>2. It has good flexibility and absorption.</p> <p>3. Easily handling in wet and dry condition</p> <p>4. More gripping.</p>	<b>4 M</b>
		<p><b><u>ii) The objectives of hoisting signals are as follows</u></b></p> <p>1) To reduce number of accidents by handling heavy loads</p> <p>2) The signals should be properly understood by the crane operator.</p> <p>3) It is desirable to fix a copy of signal codes in the crane operators cabin and another copy with the signal operator</p> <p>4) the crane operator should take instruction only from authorized person</p> <p>5) The fingers indicate a hand signals adopted by Indian standard system.</p>	<b>4 M</b> <b>any four points</b>



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<b>b</b>	<p><b>Lubrication and storage of wore ropes:</b></p> <ol style="list-style-type: none"><li>1) Ropes should be proper lubricated.</li><li>2) Core of the rope must be oiled.</li><li>3) Proper oiling of the core of the SWR should be done.</li><li>4) It should be stored in dry place to avoid rust.</li><li>5) It should not be used in places where direct heat, acid or chemicals are present.</li><li>6) It should not be in contact with water or contact of chemical for any reason.</li><li>7) It should be hanged to a hook to avoid kinking.</li><li>8) Ropes are to be kept at proper place after use.</li></ol> <p><b>(Note: Any other relevant points can also be considered for checking)</b></p>	<b>8 M</b>
<b>c</b>	<p><b><u>i) following are the time schedule followed during erection:</u></b></p> <ol style="list-style-type: none"><li>1) The erection schedule of the equipment should be made or prepared well in advance.</li><li>2) A schedule of manpower required for installation specially, fitter, welder and rigger is to be planned as erection and installation is highly skilled and specialized job, hence a proper selection of manpower is required.</li><li>3) A schedule for transportation for work equipments (e.g. Cranes, fork lift, caterpillar) and materials at the site should be available or to be made available.</li><li>4) A schedule for estimated cost for erection and installation is to be prepared in order to control the cost of project.</li></ol>	<b>4 M</b>



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	<b>c</b>	<b><u>ii) Advantage of manila ropes:</u></b>  1.It has good strength  2.It is abrasion resistance  3.Flexible  4.Does not absorb water  5.Resistance to certain chemicals  <b>((Note: Any other relevant points can also be considered for checking))</b>	<b>2 M</b>
	<b>c</b>	<b><u>iii ) Erection costing</u></b>  It is a system of computing cost of production or running a business or allocation a expenditure to various stages of production or different of a company.	<b>2 M</b>