IMME Institute of Maintenance Management Education

The following 'Maintenance Management Quiz' has been designed to evaluate the awareness about maintenance management functions. Maintenance engineers willing to participate in this quiz should get in touch with IMME. IMME will provide instructions & answer sheets, arrange evaluation of answers and subsequently inform the marks scored by each candidate individually.

Maintenance Management Quiz

Instructions: Tick (✓) **True** or **False** for the following questions / statements:

(1) A manufacturing company is like a tree - whereas production and profits are all roots, maintenance is all fruits.

(2) Productivity, in the simplest form, is defined as a ratio of output to input. In case of 'Maintenance Labour', the following can be said to represent 'output' and 'input' factors:
Output = Available Maintenance Man-hours – Utilized Maintenance Man-hours
Input = Available Maintenance Man-hours

(3) In any plant, higher the capital investment in plant & machinery, higher is the stake in downtime cost.

(4) Maintenance cost is incurred whenever maintenance resources are utilized or wasted. Further, how efficiently various maintenance resources are utilized in a plant, it all determines maintenance cost performance in that plant.

(5) In tribology, surface hardness is the one and only most important characteristic of interacting metal pairs while dealing with friction and wear aspects.

(6) The total time devoted on any maintenance job can generally be grouped in three distinct classes, viz. 'Prepare', 'Perform' and 'Put Away' activities, known as 3Ps. All these three classes of activities represent productive time only.

(7) There is nothing more beyond preventive and predictive maintenance that a maintenance department can really do and perform. Therefore, a maintenance department should always strive for better and better preventive and predictive maintenance only.

(8) Excessive lubrication is not as harmful as inadequate lubrication. Whereas there are many disadvantages of inadequate lubrication, there is hardly anyone for excessive lubrication.

(9) Irrespective of the nature of any maintenance job, the job priority would necessarily be governed by the criticality of the machine it belongs to.

(10) The complete subordination of maintenance function to production department is now acceptable in modern maintenance organizations to assure total economy in manufacturing operations.

(11) Planning turnaround jobs should start one month in advance of the scheduled date only. Planning earlier than one month's time cannot prove much fruitful, because many changes usually come up with time and the very purpose of maintenance planning may be defeated.

(12) Quite sometimes, machines are not taken or availed for preventive maintenance due to absenteeism, priority of the ongoing production programme, engagement of maintenance crews on other jobs and non-availability of spares. Besides these reasons, there could still be some more specific reasons for not being able to do preventive maintenance at scheduled time.

(13) Knowing any failure in advance, i.e. knowing 'What', 'Where' & 'When' something is going to breakdown does not help a maintenance engineer substantially because, in any case, it would ultimately need replacement, whether you know it or not.

(14) The effects of over-budgeting in maintenance can lead to excessive build-up of spares inventory.

(15) After a set of maintenance performance indices is selected, it becomes important that the sources and the means of collecting the relevant data are also clearly spelt out to all the concerned people.

(16) 'How frequently' a machine fails represents its reliability or unreliability. On the other hand, 'How quickly' a machine can be restored indicates its maintainability.

(17) A machine, which cannot justify its economics of investment either in my case or in your case, cannot justify its economics of investment in anybody's case.

(18) Failures can be classified in various ways. According to the speed of failure, failures can be classified as 'Gradual or Wear-out Failures' and 'Sudden or Catastrophic Failures'. For 'Gradual or Wear-out Failures', whereas preventive and predictive maintenance action can be planned, however, for 'Sudden or Catastrophic Failures', no such action can generally be taken.

(19) Although reclamation of various parts can often prove economical in a developing country, yet it has the disadvantage that all the reclaimed parts exhibit poor reliability on subsequent usage.

(20) Six "What" concept can be usefully employed in Value Analysis, as indicated below:
What is the item?
What is the function?

What does it cost?
What is its worth?
What else can do the function?
What will be its cost?

(21) An accident occurs when an unsafe condition is combined with an unsafe act. Eighty to ninety percent of all accidents are caused by human factors. Thus,'Unsafe Acts' represent the major cause for most of the industrial accidents.

(22) "Reducing Consumption Cost" and "Reducing Stocking Cost" of maintenance materials constitute main guiding principles to effect reduction in total maintenance materials cost in a company.

(23) It's not all too correct, when we say that 'perceive the problem rightly, get the right solution', and 'perceive the problem wrongly, get the wrong solution'.

(24) Total Productive Maintenance advocates that maintenance is not the work of maintenance department alone. People working together really make the essence of total productive maintenance.

(25) Effects of both under-maintenance and over-maintenance prove bad and uneconomical, and both these ailments are commonly found in many industries.

(26) Due to improvement in productivity, costs are reduced, profits are enhanced, and greater return on investment for the company gets assured.

(27) Since machine failures are often uncertain, unpredictable and random, substantial amount of maintenance work cannot be planned properly in advance.

(28) The following formula proves useful in calculating plant utilization:

$$\text{Plant Utilization (\%)} = \frac{\text{Total Planned Hours} - \text{Down time}}{\text{Total Planned Hours}} \times 100$$

(29) Whereas only pure wear is involved in adhesive wear, it's both wear & tear, which is normally encountered in abrasive wear process.

(30) If we reduce the 'Work Content' of a maintenance job, the 'Time Content' of the job gets reduced automatically. However, if we reduce the 'Time Content' of the job, it does not necessarily reduce the 'Work Content' of the job.

(31) Except one activity, rest all activities, noted below, form part of a preventive maintenance programme:
Planned Lubrication
Planned Inspection
Minor Adjustments & Repair

(32) Proper housekeeping and planned lubrication of plant equipment and machinery are basically very important functions of maintenance. It's wisely said that if these activities are carried out properly, half of the maintenance problems are already over.

(33) Equipment categorization is adopted to find the criticality of various equipments in a relative manner, which helps to decide a selective maintenance policy for different equipments.

(34) Owing to economical reasons, sometimes we prefer decentralization and other times centralization in various maintenance organizations.

(35) If a PERT chart somehow involves more than one critical path, it can be safely assumed that the interdependence of different activities has not been considered correctly and the PERT chart is wrong.

(36)The purpose of machine codification is mainly to allocate a short name to each individual machine for ease in writing.

(37) In order to achieve uninterrupted operation of plant, condition-based maintenance goes one step further from preventive maintenance to exercise better control on downtime.

(38) Last year maintenance expenditure incurred in one plant was Rs. 80 lakhs and the plant capacity utilization was achieved at 80%. Next year, sales turnover resulting from 90% plant utilization was planned and therefore maintenance budget for the next year would need to be raised to Rs. 90 lakhs approximately.

(39) For an equipment, breakdown frequency ratio was recorded at an average of 0.02 per hour. It can be concluded that the reliability of the equipment in the form of mean time between failures (MTBF) is 50 hours.

(40) At the time of commissioning of a machine, the production cycle time was 60 seconds. After one year, the same was reduced to 45 seconds through various design modifications incorporated by maintenance department. It can be concluded that these design modifications actually resulted in improving reliability of the machine.

(41) Present Cost Method and Annual Worth Method are two popular methods, which can be employed for the purpose of investment analysis in case of new assets.

(42) Controlling 'Frequency of Failures' together with 'Average Repair Time' of each failure is necessary to minimize downtime of plant equipment and machinery.

(43) Modern safety management inculcates faith that every accident can be foreseen and therefore it can be prevented. Key to safety is accident prevention. Both unsafe conditions and unsafe acts, commonly referred as safety defects, constitute the necessary

elements of accident chain reaction. The elimination of various safety defects, therefore, helps in preventing accidents. It forms the basis for accident prevention.

(44) The inventory carrying cost in the stores of a company was estimated at 25%. However, the yearly inflation rate was noticed at about 7%. Therefore, if an item is kept in stores for a period of 1 year, it will actually cost 18% more to the company after one year compared to its original price.

(45) 'Hidden Problems' or problems in 'No Problem' areas can be dug out effectively when people are groomed to keep hunting such problems continuously.

(46) All out elimination of losses and wastage is the ultimate goal of TPM. It aims at complete elimination of six big losses and strives for achieving zero defects and zero breakdowns for various equipments.

(47) Maintenance is often referred as thankless job because when operations move smoothly, production people are the first to be complimented, and when anything goes wrong, maintenance people are the first to be blamed. For 'thankless' image, maintenance people themselves are primarily responsible.

(48) Break Even Analysis implies that a certain point, in relation to plant capacity utilization, when total revenue equals total cost, is referred as break-even point. The break-even point represents the point of no profit and no loss.

(49) Higher profits in an industry will always represent higher productivity.

(50) One of the main reasons for sub-optimal utilization of capacity is attributed to poor organization of maintenance functions in a plant.

(51) Training is basically organized to enhance the competence of the employees. However, it does not offer any kind of motivation to them.

(52) Sometimes maintenance people can do wonders by their unique design modifications in plant equipment and machinery. In such cases, the capital cost of modifications can be much too insignificant compared to the huge financial benefits with a small pay back period of few months only.

(53) In a large plant, one maintenance manager claimed that 1% of downtime in his plant amounted to Rs. 5 crores. As a well-informed engineer, you cannot accept such an exaggerated statement.

(54) In order to achieve high production, it is always necessary to curb and control both downtime and idle time as far as possible.

(55) Better maintenance methods are primarily evolved for efficient utilization of maintenance labour time. However, they rarely help to reduce downtime of different machines.

(56) Preventive maintenance can be termed more as an engineering necessity rather than an economic requirement.

(57) For continuously operated equipment, provision of centralized lubrication will tend to provide a definite advantage.

(58) Normally an equipment categorization plan consists of a certain number of factors, their degrees and weightages in order to find relative criticality of different machines.

(59) Organizationally, it does not make much difference if a person is reporting to one or more bosses. It's entirely and exclusively up to management's decision.

(60) The most basic requirement of maintenance planning lies in reducing the overall costs only.

(61) Although every person has five senses, yet only three senses are commonly employed for inspection in preventive maintenance, e.g. see, listen and touch. The fourth and the fifth senses are never employed for such a purpose.

(62) Fixed time maintenance can incur higher maintenance cost in two ways. Firstly, if a part scheduled for replacement at a fixed frequency fails in between the two consecutive periods, it will increase indirect cost of maintenance. Secondly, if a part is replaced at a fixed frequency whereas it could have provided more service life, it will increase direct maintenance cost.

(63) A maintenance budgeting exercise should not only be meant for better allocation of working capital but also to ensure that optimum costs are incurred with better performance.

(64) Even though plant availability was increasing progressively in a plant, the plant capacity utilization was found fluctuating on year-to-year basis. Such a trend can occur mainly due to power problems, sales limitations, production delays, process problems, etc.

(65) The probability of survival of a machine was noticed 92% in a period of 1000 hours. It means that the machine will experience 8% downtime in a period of 1000 hours.

(66) Theoretically, if it's assumed that there are a number of components in a system, each having 100% reliability, then the reliability of the overall system will be independent of the number of parts and their functional configuration, whether series or parallel.

(67) It's rightly said that the cost of modifying equipment during the operational stage is many times higher than the same at the initial design stage.

(68) The aim of controlling failures lies in reducing downtime or increasing machine availability in the most economical manner. It's, therefore, either failure frequency or repair time, or both, need to be reduced to achieve such an aim. However, reduction in failure frequency always needs to be given the first priority.

(69) Management of a company need to clearly communicate to their workers that each worker is responsible for his own individual safety and that management has little, if anything, to do about it.

(70) The inventory of 'C' class items, in terms of money value, is often found higher than that of either 'A' or 'B' class items in different stores.

(71) With inventory carrying cost at 25% in the stores of a company, a spare part purchased at a price of Rs. 2,500/- will actually cost more than Rs. 5,000/- when issued from the stores after 4 years.

(72) Problem-solving starts with a positive attitude. If we feel something can be done, it will ultimately be done. Half of the problem is already solved once we believe 'it can be done'.

(73) 'Total Quality' in all spheres of works activities on one hand and 'Total Productivity' in all areas of works resources on the other constitute two major business drivers to attain world-class status.

(74) The average productive utilization of maintenance workers in many industries is estimated at about 60%. A major proportion of their time is simply lost on account of various unproductive activities.

(75) In order to improve their performance, maintenance people are always required to reduce their workload. On contrary, however, production people are always required to increase their workload in order to improve their performance.

(76) "You can always do over-maintenance, but not under-maintenance" is one of the most basic principles of maintenance.

(77) There is only one way to improve maintenance productivity in a plant – keep input constant and increase output.

(78) The higher the wastage in industry, the lower is productivity without any influence on profitability.

(79) Halogen lamps, compared to sodium vapour lamps, are employed in factory flood lights to ensure less power consumption.

(80) Profitability in two companies can be taken for fruitful comparison of their economical performance as well as their productivity.

(81) With the advancement of technology, whereas production is able to find easier ways to perform its function due to built-in automation, maintenance function is getting increasingly difficult and complex. Maintenance function further assumes greater importance since all hi-tech plants involve high capital investment.

(82) Although direct maintenance cost in a plant may appear to be low, yet considering indirect cost of maintenance also, total maintenance cost will often appear to be high.

(83) In one company, 1% additional utilization of capacity due to improvement in maintenance meant additional production of 10 tonnes. If the sales price of the product is Rs. 10,000/- per tonne, with company's profitability at 25%, it will show increase in profit of Rs. 25,000/- for the company.

(84) In method study, by using appropriate symbols, a Flow Process Chart (Material Type) can be drawn for any overhauling job and critically examined to effect reduction in time for the job.

(85) In machine inspection, when inspectors can be trained to acquire so much expertise that they can predict the nature of the impending problem along with time of failure solely through the use of their personal skills, it's better known as predictive maintenance.

(86) For higher temperature applications, non-soap based greases are commonly employed.

(87) The purpose of deciding criticality of various machines in a plant is mainly to facilitate maintenance management by selection.

(88) When decentralization in maintenance organization is acceptable, generally, it's always useful to keep maintenance planning, maintenance workshop, operation & maintenance of utilities, major overhauling, etc. in a decentralized manner only.

(89) Maintenance planning deals with activities, such as forecasting of future work, deciding methods of working, estimating manpower & material requirements, etc. However, it does not deal with reduction of failures of different equipments.

(90) A planned maintenance system is an assemblage of maintenance objectives, goals, activities, resources, procedures, paper work, etc. built with suitable elements to plan, schedule, execute, record, analyze and control maintenance functions.

(91) Ideally maintenance should be carried out just at that point of time when a machine really needs maintenance, as otherwise in all other cases, it will either result

in over-maintenance or under-maintenance.

(92) There should not be any provision for revising maintenance budget anytime during the financial year, otherwise the very purpose of budgeting would be lost altogether.

(93) The ratio of maintenance cost to percentage plant availability for three consecutive years emerged as Rs. 2.31 lacs, Rs. 1.92 lacs and Rs. 1.70 lacs, thereby indicating maintenance cost incurred in achieving average 1% plant availability in a company. Such a decreasing trend can be treated favourable for the economics of the company.

(94) Generally, if $\frac{\text{Operating Hours}}{\text{No. of Breakdowns}}$ ratio is high, then the ratio of $\frac{\text{Sum of Repair Times}}{\text{No. of Breakdowns}}$ will also be high.

(95) The failure rate of a motor is 1 per year. This data can be used to determine the MTBF of the motor. In this case, MTBF of the motor will be 1 year only.

(96) A machine with built-in high reliability will also provide better maintainability and facilitate maintenance personnel to perform their job much efficiently.

(97) Effects and causes bound all problems. Whereas effects are easily perceivable, on contrary, however, causes may not generally be so. Each problem needs to be tackled for its causes rather than effects otherwise the problem will reappear. Further, cause finding is a fact-finding exercise; it needs time, thinking and resources.

(98) The time taken in detecting the fault after a breakdown has occurred is referred as ‘Fault Delay Period’.

(99) Basically, house keeping, which is mainly dependent on ‘5S’ principles, is not a part of safety practice. However, to improve house keeping, a competition may be necessary from time to time and house keeping audit may be required both by internal and external agencies.

(100) When we keep spares in stock, we incur stock-in cost, also known as inventory carrying cost or holding cost. The more the time a spare part is kept in stock, higher is the stock-in cost. On the other hand, when a spare part is not available in stock, we incur stock-out cost, mainly in the form of downtime cost.

(101) Whereas cost of over-stocking spares increases from ‘C’ to ‘A’ class of items, cost of under-stocking reduces from ‘V’ to ‘D’ class of items.

(102) Man is so constituted as to see what is wrong with a new thing, not what is right. To verify this, submit a new idea to a committee. They will obliterate 90

percent of the rightness for the sake of 10 percent wrongness.

(103) According to recent concepts of TPM, each operator should primarily own his machine; made responsible to keep it clean; and carryout small repairs, when required. It's popularly known as autonomous maintenance.

(104) Any improvement in maintenance is possible when maintenance people believe that "there is always a scope for improvement".

(105) Maintenance is not just about repairing machines after breakdowns. In true sense, it's to prevent & correct, predict & be proactive, design-in & design-out and achieve various maintenance goals at minimum maintenance cost.

(106) "You can't do anything if it's not economical" represents one of the most basic principles, which should be known to all maintenance people.

(107) The ultimate economics of a company can be found in the ratio of profit to capital, commonly referred as return on investment. Payback period is another useful economic term, which is closely related to return on investment. For example, if payback period is 2 years, the return on investment will be 20%.

(108) By way of over-capitalization, we can always ensure maximum return on investment.

(109) Productivity is all about the effective utilization of various resources deployed in a plant. Better the utilization of the resources, better will be the productivity.

(110) Since compressed air is not a very costly commodity, it's not much useful to control losses associated with compressed air generation, distribution and usage, because savings in energy conservation will not be much too significant.

(111) In one company, different lunch timings were allocated for production and maintenance departments, i.e. 11.30 AM to 12 Noon for production department and 12 Noon to 12.30 PM for maintenance department. Also, the lunch timings for supervisors were fixed between 12.30 PM to 1.00 PM. By having such staggered lunch timings, maintenance people could freely access machines for half an hour to sort out any petty maintenance problems and thus saved downtime to a certain extent. Whereas it represents a case of better utilization of maintenance manpower, it does not indicate improvement in maintenance productivity.

(112) Flat belt drive compared to V-belt drive system can result in appreciable savings in power consumption.

(113) Unfortunately equipment is used and very often misused, and the numbers of jobs created by misuse are considerable, even though it's often difficult to prove and establish in certain cases.

(114) Due to rise in prices although the cost of maintenance will tend to be on higher side, yet due to substantial reduction in plant downtime at the same time, total maintenance cost will usually emerge out on lower side.

(115) Work study techniques can be usefully employed for the improvement of various methods – the way a certain job is performed presently and evolving a better method for the job to effect reduction in resources, time, cost, etc.

(116) It will generally be more difficult to increase plant availability from 95% to 98% than further improvement from 98% to 99.5% by way of better planned maintenance practices.

(117) An increasing consistency number of grease indicates higher stiffness of the grease. As a general rule, in conditions involving high loads or high temperatures, stiffer grease with higher consistency number is commonly recommended to make it soft in actual working conditions.

(118) If maintenance people can effectively control maintenance requirements of most critical and critical machines, it can generally be said that they have almost controlled all the requirements.

(119) The characteristics of a centralized maintenance organization are represented by more manpower requirement as well as more manpower utilization.

(120) A maintenance job involving various activities, which needs to be completed over a period of time, can be planned and scheduled in the simplest manner by using a Gantt chart.

(121) A master inspection checklist for a machine provides a master preventive maintenance document, which should remain unaltered for the entire service life of the machine.

(122) Preventive maintenance concept is based on periodic inspection of machines to prevent failures. However, there is a limitation in this technique because preventive maintenance is normally carried out on the basis of inspection through human senses. Condition-based maintenance employing a number of condition monitoring equipments provides better method because it facilitates in checking various parameters in a quantitative manner, which is not possible through the use of human senses.

(123) In a shock pulse meter, a transducer is used to apply shocks to antifriction bearings and their behaviour to such shocks is monitored to know the condition of the bearings.

(124) Without knowing the frequency of vibration, generally, it‘s not possible to diagnose as to which part of the machine is causing the problem.

(125) Reliability refers to increasing machine availability by increasing mean time between failures (MTBF) or reducing frequency of failure in a specified period of time.

(126) If apparently nothing could be done for normal wear failures of a machine, they can forever be treated as unavoidable failures.

(127) Ideally a machine failure analysis and control programme should constitute the following steps:
Record and codify failures
Compile cumulative failure data
Analyze cumulative failure data
Suggest remedial measures
Implement remedial measures and follow up

(128) In a plant, a large number of people belonged to older generation and were less educated. They had a tendency of not wearing safety shoes, masks, goggles, earplugs, etc. while at work. Their mind-set was such that a thing, which has not happened until now, cannot happen. Since such people cannot be changed, it's advisable to assign them less risky work.

(129) In cases, where the stock-in cost for an item is too low, it may not at all be necessary to keep the item in stock.

(130) The psychological barriers to the process of creative thinking mainly comprise of habits and attitudes. Habits and attitudes are said to be the main roadblocks in change for betterment.

(131) An equipment having 90% plant availability, 90% performance efficiency and 100% rate of quality products will show overall equipment effectiveness (O.E.E.) as 90%.

(132) It is the habitual unproductive work, which often accounts for major proportion of wastage in maintenance work.

(133) Reduction or increase in downtime by merely 1% can show significant changes in the overall economics of a company.

(134) The role of maintenance function ends soon after the repair of the machine is over. Mastering the art of quick trouble-shooting and repair work of different machines is what a maintenance engineer should only know in maintenance management.

(135) The ratio of 'Total Production' to 'Total Cost' can serve as a useful indicator of productivity in a plant.

(136) Increase in productivity necessarily means increase in return on investment and also increase in return on investment necessarily means increase in productivity.

(137) Routine maintenance inspection and subsequent correction of plant equipment, such as alignment, wear & tear, malfunctioning, soot/dirt accumulation, leakages, cracks & openings, contamination, loose fittings, corrosion, erosion, etc. are essential, since all these factors affect energy conservation programmes.

(138) Late starts and early quits, travelling and transporting tools & spares, receiving instructions, picking up and putting away tools & materials, personal needs, idling, etc. are certain factors which clearly indicate maintenance delays but they do not normally influence the productive utilization of maintenance workers.

(139) Life-cycle cost of an equipment is the sum total of operation and maintenance costs for the entire service life of the equipment excluding its initial capital cost.

(140) If plant availability is increased by 5%, in all its probability, it will not exactly be equivalent to 5% increase in plant utilization, mainly because a part of it is likely to be lost by way of various factors, such as power problems, material shortages, etc.

(141) Indirect Maintenance Cost in a plant is often referred as the cost incurred on wasteful utilization of various maintenance materials and labour resources.

(142) One of the most important aspects of method study in maintenance work is to divide the entire job into smaller elements and examine them in detail. It's the most common sense approach to do so because by following such method only, we can investigate the total elements of unproductive work and wasteful time in any job.

(143) Some common pumps, motors, gear boxes, etc. can be kept ready in assembled form. Whenever any failure of such equipment occurs, it can be replaced in lesser time. The damaged equipment can be repaired subsequently and kept ready for future use. Such type of maintenance is often called as opportunity maintenance.

(144) The concept of Maintenance Prevention basically stands for preventing or avoiding the need of maintenance in the first place. Quite sometimes, when a better material of construction in equipment design is incorporated, the need of maintenance can be reduced drastically.

(145) In dusty environments, soap-based greases become susceptible to cake formation thereby losing their ability to lubricate the parts.

(146) Having a separate maintenance planning & development cell and having a separate team for preventive maintenance work can often raise productivity of maintenance department in a large plant.

(147) While preparing schedules for planned maintenance work in a plant, breakdowns of various machines were referred during the last 12 months. Availability of spares in stores was confirmed before a major schedule, and both mechanical and electrical maintenance jobs were carried out simultaneously. Wherever found necessary, assistance from the machine operator was also taken to facilitate the planned maintenance work. All such activities provide useful help in effective functioning of planned maintenance system.

(148) Industrial Stethoscopes are often employed to detect excessive noise emitting from various rotating parts of a machine, such as bearings, gears, etc. to identify wear problems.

(149) In a blower operating through V-belt drive, if belt tension is not proper or excessive load is present during operation, then r.p.m. of blower shaft is likely to vary. Therefore, if r.p.m. is checked periodically, any variation thereof can help establishing the impending problem.

(150) A Stroboscope flashes intermittent light pulses on the moving parts of a machine under visual inspection. The frequency of light pulses can be adjusted in a Stroboscope. Whenever a moving part is inspected under such light pulses, the part seems stationery or moving at a very slow speed, which makes the job of inspection much easier.

(151) Reliability of a system consisting of two pumps, each having reliability of 90% and one of them always kept as standby, will be 100%.

(152) All the following factors, except one, indicate failure causes for various machines:

Normal Wear
Faulty Maintenance
Defective Spares
Defective Machine Design
Faulty Operation

(153) Before lifting any heavy load with the help of used V-belts, one should ensure that such V-belts do not possess any visible cracks.

(154) In reciprocating compressors with plate valves, inlet and outlet cages were found to be of the same design. To avoid the risk of interchangeability of the suction and the delivery valves, it may be thought necessary to change the design of the delivery valve.

(155) Reconditioning or salvaging of various spare parts can be organized as a planned and systematic engineering activity to restore them to reusable condition. Whereas such an activity helps to reduce the spare parts cost, it cannot facilitate to reduce the spare parts inventory.

(156) The term paradigm, in business connotation, refers to conventional wisdom. A shift in paradigm is however not recommended to change or improve things in an organization.

(157) By reducing cost, the ultimate economic objective of a company, i.e. maximum return on investment is facilitated. Reducing cost is largely within the control of a company. The problem however is to identify the potential areas for cost improvements in general and the contribution which can be made by the maintenance engineer in particular.

(158) Payback period and return on investment (ROI) in a company are related to each other in a manner that higher the return on investment, greater will be the payback period.

(159) Every minute of lost time during breakdowns, for whatever be the reason, incurs a double cost – firstly the cost of non-productive time and secondly the revenue which is not generated.

(160) Productivity and Production though mean different things, yet increase in productivity certainly leads to rise in production.

(161) The concept of Terotechnology lays emphasis that equipment designers, manufacturers and users should work in unison to achieve the common objective of minimum life-cycle costs.

(162) In large plants, direct cost of maintenance is usually many times more than the indirect maintenance cost.

(163) Solid lubricants are used when lubricants in the form of oils & greases cannot be used for certain reasons. However, solid lubricants can be used only at low temperatures and under low load conditions.

(164) The form used for reporting a breakdown can be called ‘Maintenance Request Slip’, or ‘Breakdown Slip’, or ‘Work Order’, or by any other suitable name. All such forms, however, include one important column, such as ‘Nature/Details of Fault/Breakdown’. While reporting a breakdown, one should only write ‘machine not working’, or ‘machine out of order’, or ‘machine breakdown’ under this column because that is the only right way to do so.

(165) Eddy current testing method can only be used for magnetic materials for detecting flaws and monitoring corrosion in tubes.

(166) To find the rate of corrosion or erosion in pipelines and pressure vessels, an ultrasonic thickness gauge can be employed.

(167) Surface cracks cannot be detected at high temperatures by employing dye penetrant inspection method.

(168) In a reactor consisting of five parts, reliability of each part is as shown below:

S. No.	Part	Reliability
(a)	Agitator	0.95
(b)	Thermowell	0.92
(c)	Bottom Valve	0.85
(d)	Gear Box	0.99
(e)	Motor	0.90

In order to improve the reliability of the system, as the very first step, we should necessarily concentrate on improving reliability of the weakest link, i.e. Bottom Valve.

(169) Either of carbonising or nitriding processes can be used with equal advantage in heat treatment of shafts to improve endurance limit for fatigue.

(170) If the probability of fatal or serious accident through a falling object, while performing a job, is as low as 0.15%, there is absolutely no risk of any accident when the object falls at the very first instance.

(171) In ABC analysis, whereas 'A' items represent high price items, on the other hand, in VED analysis, 'V' items indicate vital or critical parts.

(172) Increase in productivity necessarily means reduction in costs and also reduction in costs necessarily means increase in productivity.

(173) Experts say that the ratio of 'Sales Turnover' to 'Capital Investment' represents a very good overall index of productivity.

(174) Hydraulic power pack of an arc furnace was unable to maintain minimum pressure of 150 kg/cm^2 for tilting operation during winter season. It was found that hydraulic oil used to get more viscous during winter season and therefore resulted in pressure drop. Because of non-availability of sufficient pressure, therefore, the furnace could not be operated efficiently. The only remedy, in this case, lies in using less viscous hydraulic oil during winter season.

(175) Finding appropriate answers to the questions, such as 'What is to be maintained', 'How is it to be maintained' and 'When is it to be maintained'- all form part of maintenance planning and scheduling activities.

(176) In vibration monitoring, whereas vibration amplitude, velocity and frequency provide relevant parameters for analysis, phase of the vibration does not serve any useful purpose.

(177) In order to evaluate effectiveness of maintenance work in context of overall economics of a company, an index indicating maintenance cost to sales turnover ratio can be quite useful.

(178) Spares inventory turnover ratio compared on year-to-year basis can reveal the excessive build-up of inventory and as a result appropriate corrective actions can be planned to control the situation.

(179) If the reliability of a machine gets doubled, its maintainability too gets doubled automatically.

(180) A lower value of mean time between failures (MTBF) for a machine suggests that failure frequency should be controlled. However, a higher value of mean time to repair (MTTR) needs investigation of maintainability aspects as well as probe into maintenance methods.

(181) The availability of a machine can be calculated only when all such factors as Up Time, Down Time & Idle Time are necessarily known in quantitative terms.

(182) In order to avoid dangers of sparking due to the accumulation of static charge on a person while working on a machine, he should essentially wear non-conducting shoes.

(183) In comparison to raw materials, the consumption pattern of spare parts is generally found quite erratic and non-uniform. It's the excessive range of spare parts together with uncertainty of their requirement that makes the job of controlling inventory even more difficult and challenging.
(184) When different people indent the same item separately, it often creates a problem. Improper codification of items together with decentralized planning, procurement & storage generally result in such problems.

(185) Until unless output or input, or both are affected, there can neither be any rise nor any decline in maintenance productivity.

(186) By becoming QS certified company, it can be rest assured that maintenance activities will automatically become efficient, and that the maintenance performance will start showing rising trend year after year.

(187) When the amplitude of vibration disappears immediately after the electrical power to the machine is switched off, it can be concluded that the vibration is mainly due to electrical problem.

(188) In case when all three indices, namely 'Maintenance Cost to Capital Cost Ratio', 'Maintenance Cost to Sales Turnover Ratio' and 'Maintenance Cost to Production Tonnage Ratio' show a decreasing trend, it will almost entirely mean definite improvement in maintenance cost-effectiveness.

(189) Whereas ‘Failure Free’ operation of a machine is indicative of its reliability, ‘Quick Maintenance’ design features of a machine are representative of its maintainability.

(190) For an equipment, the more the ratio of MTTR to MTBF, the higher will be its availability.

(191) A keyed shaft coupling of an equipment of high horse power rating, such as turbine & generator can be too robust a design, but it can lead to multiple mechanical defects should the torque get increased to an unsafe proportion anytime during the operation. However, by introducing a well-designed taper lock coupling, the equipment can be made quite safe even if the torque exceeds the critical value.

(192) One brake shoe on the trolley wheel of an EOT crane fell down on floor, but neither hit any worker nor any machine. Generally, such incidents need not require any investigation.

(193) On an average, the amount of money blocked in any store at any point of time is indicative of its average inventory.

(194) ‘Vital Few and Trivial Many’ represents well-known Pareto’s law. According to this law, a small percentage of total items represent a major share of total inventory and a high percentage of total items represent a minor share of total inventory in any store. It’s also popularly known as ABC analysis.

(195) Losses, wastage, delays and various other abnormalities is a common phenomenon in maintenance work. If all such problems could be properly controlled, it will certainly lead to improvement in maintenance productivity.

(196) Magnetic plugs provided in oil return lines can attract wear particles even of the minutest size and thus represent a simple method of wear debris analysis.

(197) The downtime of a machine is bound to be high if ‘Mean Waiting Time (MWT)’ before the actual repair is also high.

(198) Assurance or service level for a spare part indicates the probability of its availability in stores, when required. With a view to ensure optimum stocks, assurance levels for different categories of spare parts need to be decided as per the economic principles of inventory management.

(199) For a given rate of consumption of an item, an increase in the number of purchase orders will tend to reduce its inventory.

(200) The whole concept of maintenance has undergone a gradual change over the past few decades. The Americans brought out the concept of ‘Productive Maintenance’. ‘Condition-based Maintenance’ came up to deal with the problems of

over-maintenance. The Britishers developed the concept of ‘Terotechnology’ thereby advocating minimum life-cycle costs for physical assets. The Concept of ‘Reliability-centred Maintenance’ started in USA. The Japanese suggested the concept of ‘Total Productive Maintenance’. All these new developments have contributed significantly towards the growth of maintenance management functions.