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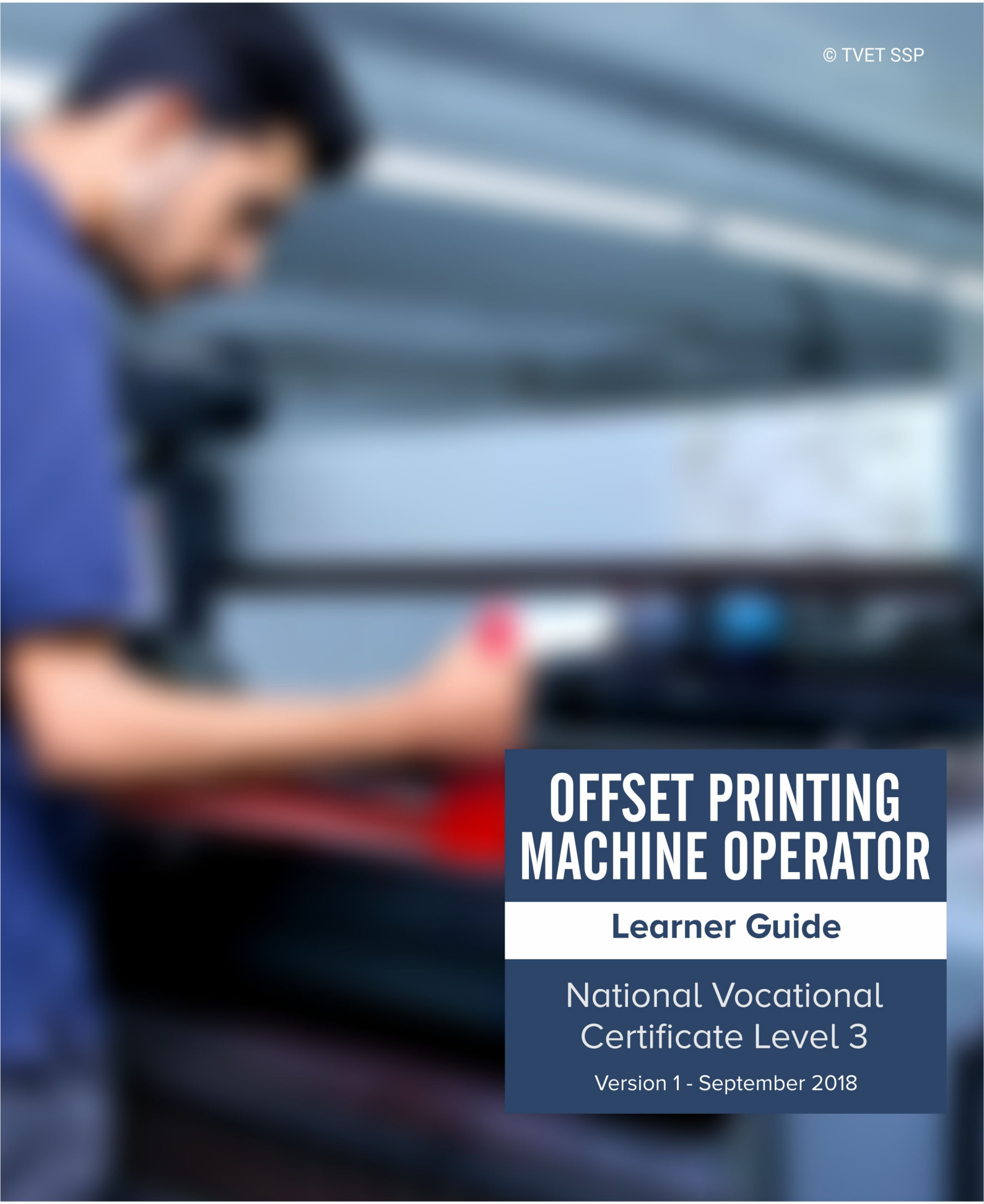

OFFSET PRINTING MACHINE OPERATOR

Learner Guide

National Vocational Certificate Level 3

Version 1 - September 2018

NAVTTC

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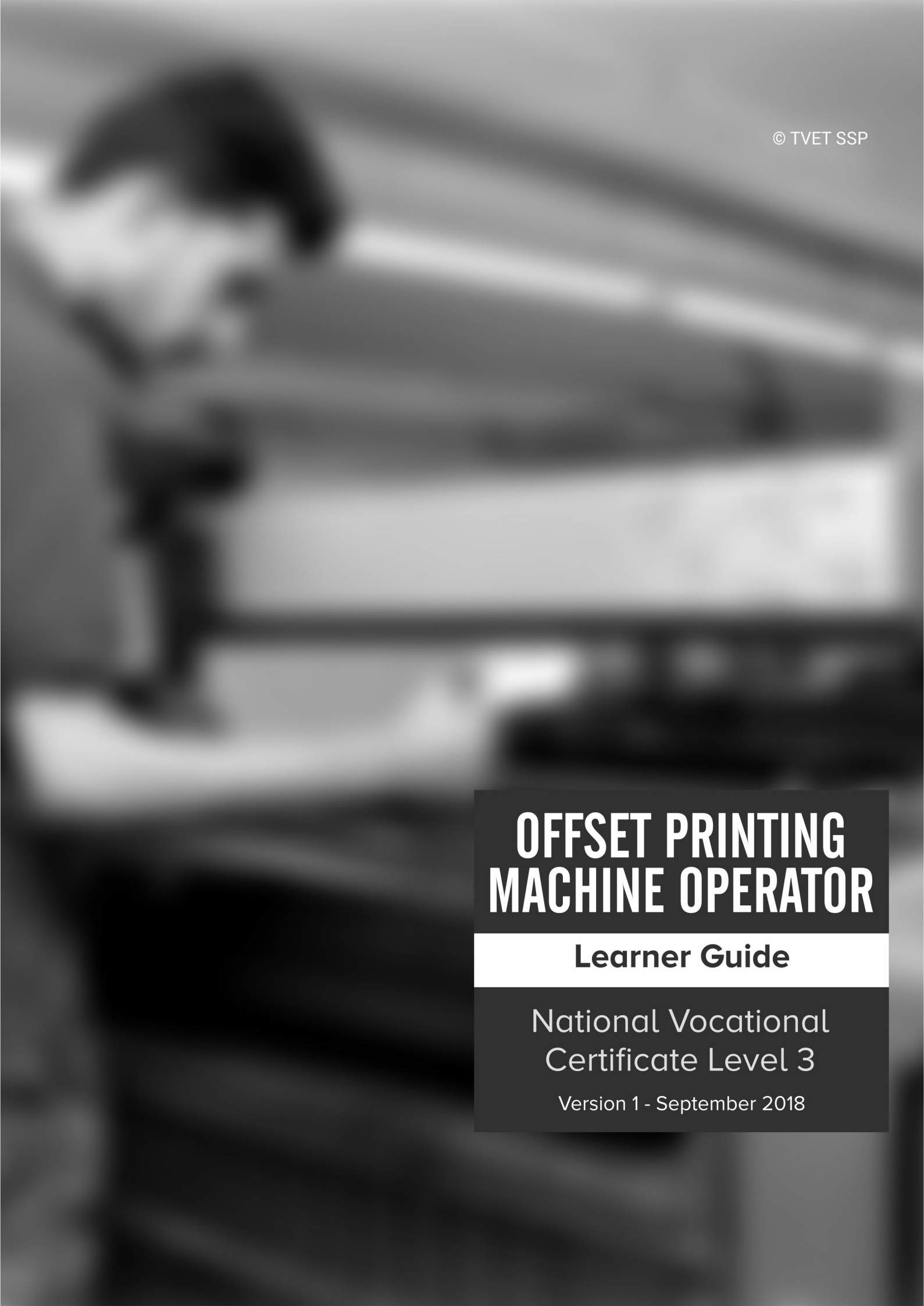

OFFSET PRINTING MACHINE OPERATOR

Learner Guide

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Introduction:

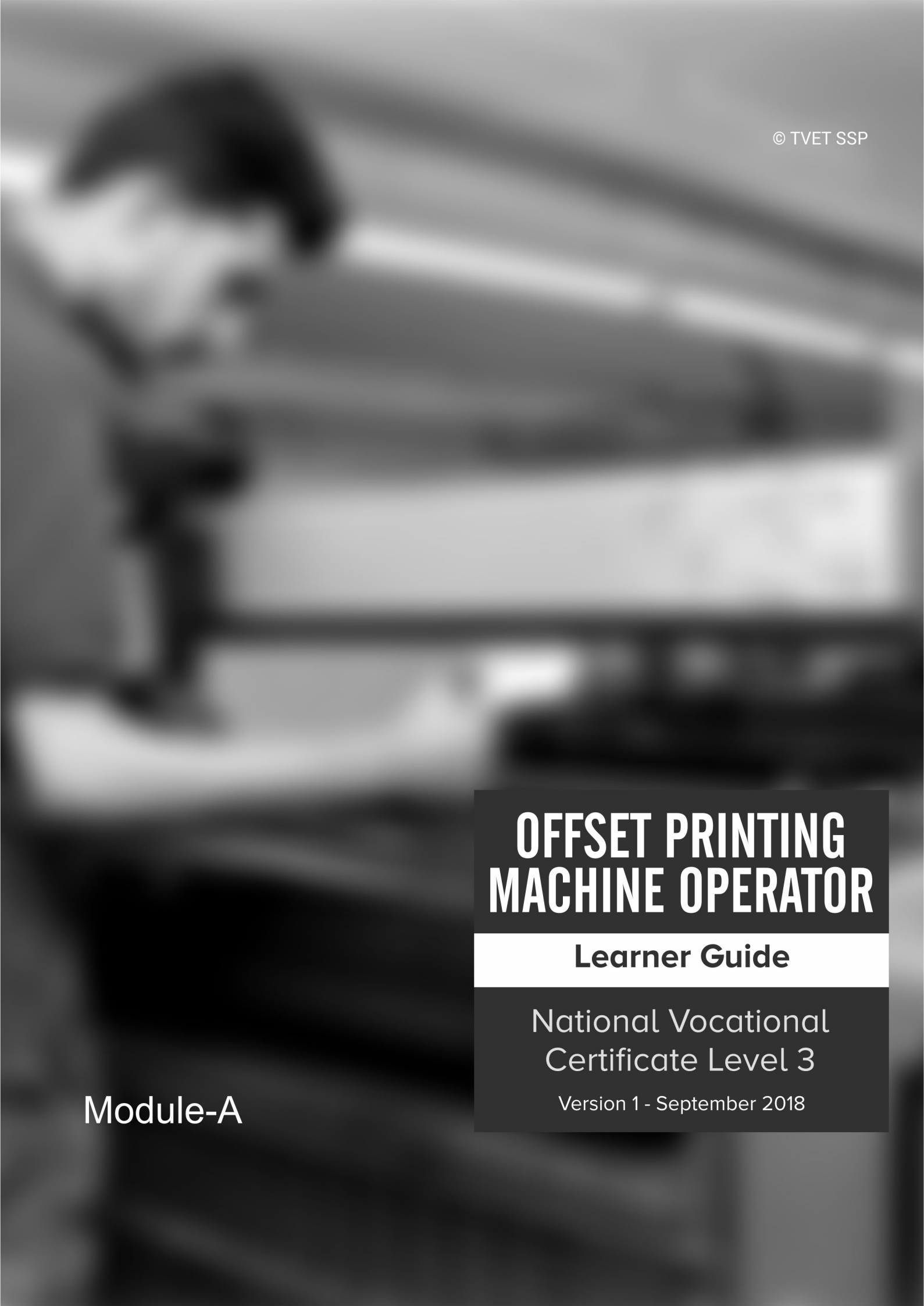
This Learner's Guide is developed on the basis of competency standards and curriculum of "Offset Printing Machine Operator".

The National Vocational & Technical Training Commission (NAVTTC) has developed a national qualification entitled, "National Vocational Certificate Level-3 in Printing & Packaging Technology (Offset Printing Machine Operator)". Relevant industry and employers were consulted in the design and validation processes in order to come up with a national qualification that fulfills the requirements of the sector in general and the occupation in particular.

This book covers all the topics in a clear and organized format for the Printing Technology students. Through learning outcomes practical activities were added step by steps. The topics covered were neatly illustrated for better understanding of the learners. All of the lesson pages were carefully designed to eliminate distraction and to focus the pupil's full attention on the work at hand.

It carries 5 learning modules which are as under:

Module A: Perform color management
Module B: Maintain graphic chemicals in machine
Module C: Develop professionalism
Module D: Perform communication
Module E: Manage press room waste



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Module-A

Module A: Perform Color management

Learning Outcome:

After completion of this module the learner will be able to:

- Match color L*A*B* values with given reference as per docket/job card,
- Maintain Delta E (∆E) of colors within the specified range during production.
- Fill ink ducts with quantity as per SOP,
- Maintain ink film layer manually on sheets with given reference on manual machines,
- Maintain ink film layer by computer print control (CPC) on sheets with given reference on advanced machines.
- Control wet ink on sheets through proper drying chemicals/powder.
- Unload low stacks from the machine as per SOPs.

Learning Unit 1-1:

Control L*a*b* values

Overview:

This learning unit deals with color management, ΔE, process colors, L*a*b* values and its matching mechanism. The learner will be able to match color L*a*b* values with given reference as per docket/job card, maintain Delta E (ΔE) of colors within the specified range during production.

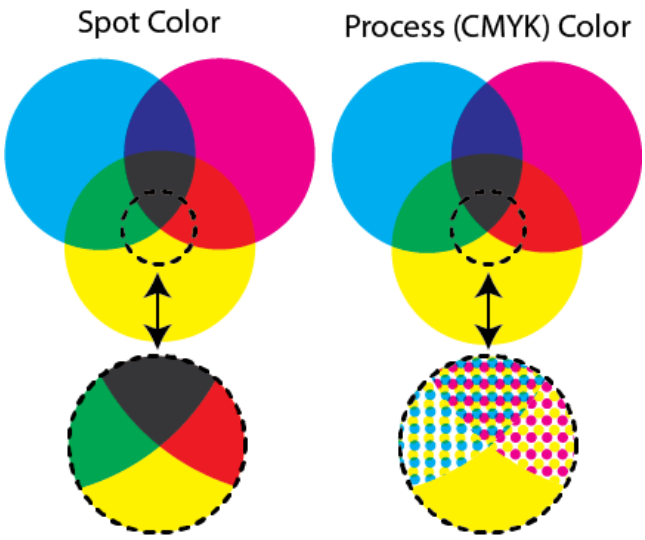
Process colors:

Process color is produced by printing a series of dots of different colors.
All the colors are created from layers of four primary colors CMYK (Cyan, Magenta, Yellow and Black) in halftone dots to create a full color effect. This is called 4-color process (CMYK).

> Do you know?
>
> The “K” doesn’t technically stand for black; it stands for “key plate,” which is the plate of a printing press that carries the black ink.

To reproduce a color image, a file is separated into four different colors: Cyan (C), Magenta (M), Yellow (Y) and Black (K) then original image is created.

During separation, screen tints comprised of small dots which are applied at different angles to each of the four colors. The screened separations are then transferred to four different printing plates, one for each color, and run on a printing press with one color overprinting the next. The composite image is perceived by the naked eye with the illusion of continuous tone.



Spot Colors:

In offset printing, a spot color is a color generated by an ink (pure or mixed) that is printed using a single run.

A spot color is a special premixed ink that is used instead of, or in addition to, process inks, and that requires its own printing plate on a printing press. Use spot color when few colors are specified and color accuracy is critical.

When there is a need to match a particular color (a background or specific color i.e. in a logo) during printing on substrate, the use of a spot color is carried out.

Color Measurement & Color Management

Color management:
It is the controlled conversion between the color representations of various devices, such as image scanners, digital cameras, monitors, TV screens, film printers, computer printers, offset presses, and corresponding media.

CIE color standard

Color management requires understanding of standardized process which provides structured methods and reliable repeated data that save time in process.

Color is an optical phenomenon, but a sensory impression converted by eye and brain. Color is not a physical variable therefore it has no physical unit. An object is not colored, but the sensation of color is produced as a result of reflection of light. An object that reflects red light of a visible spectrum appears red by our brain. An object that reflects completely entire visible light appears to be white and object that absorbs lights appears to be black.
The primary goal of color management is to obtain a good color match across different platforms, like Pre-press, Press and Viewing environment.

Do you know?

An object is not colored, but the sensation of color is produced as a result of reflection of light.

In 1931, CIE (Commission International de l'Eclairage)a French Organization took big step in creating standardized system of color measurement by specification of spectral properties (e.g. light prism) of standard illuminants (light) and information concerned with standard observers and color description approaches.

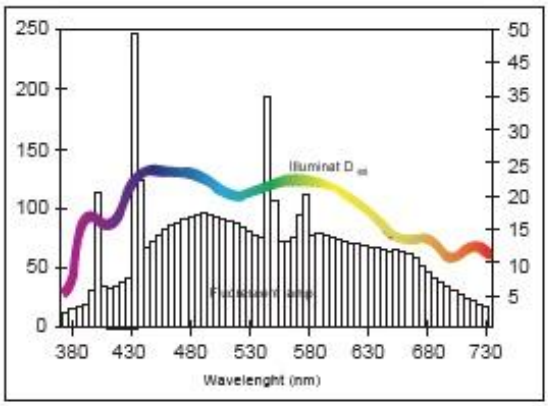
CIE Color illuminates

CIE has defined many standards for illuminants so far. The one mostly related to printers are listed in the following table:

Standard	Nature of Light Source	Color Temperature of Light Source
A	Typical Lamp	2856K
C	Fluorescent Lamp (Rich in Blue)	6800K
D65	Average Indoor Light	6504K
D50	Warm Indoor Daylight	5083K

Note:

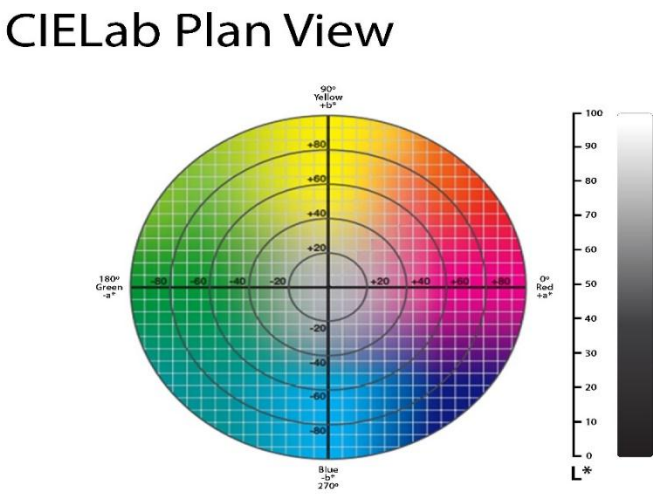
Although these standards are displayed in the form of spectral energy distribution and available to be used in the counting of chromaticity, it is impossible to obtain corresponding light sources of the same spectral energy distribution. For instance, “light” lamps are used to represent D65 and D50 illuminants, for color observation, which are the light sources closest to the standards and available to printing houses. The following graph illustrates the comparison between D65 Standard illuminants and typical light source of fluorescent lamp.



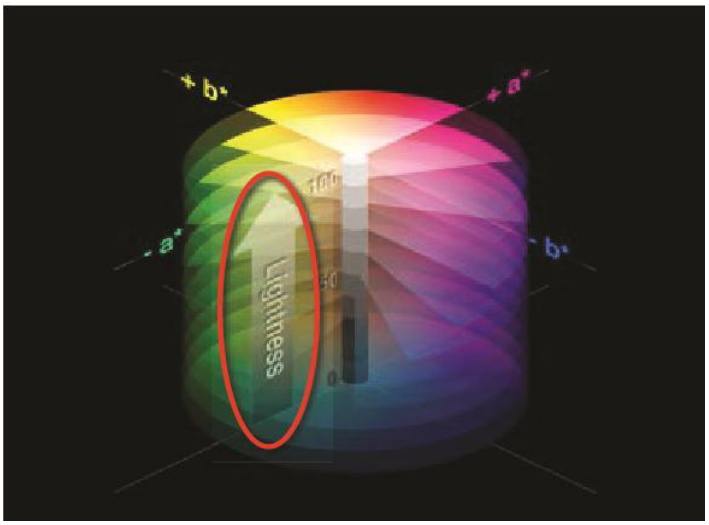
CIE L*a*b* color space:

CIE (International Commission on Illumination) built a more uniform color system around how humans perceive color: this is the CIE L*a*b*. CIE Lab represents colors by using the

coordinates in a uniform color space consisting of lightness variable and chromaticity indices.
L*a*b* is a color space defined by International Commission on Illumination. L*a*b* values are used to standardize color values in a mathematical manner so that any device or person can perceive the same color as required by the job.
All the colors are created from four basic process colors CMYK (Cyan, Magenta, Yellow and Black). L*a*b* values represent a 3-dimensional graph (x, y, z axis) or a color space gamut where L* is on Z-axis. In another words the central vertical axis which represents lightness values, the value range is from 0 (black) to 100 (white). The lower the value of color, the darker it gets (e.g. 15 L* means Black) and higher the value of the color, lighter the color gets (75 L*).



The a-a' axis, which runs from positive to negative, indicates amounts of red and green so this mean a* on the X-axis is represents the mix of green and red where negative is greener (e.g. -0.42 a*) and positive is redder (e.g. +0.42 a*) and The b-b' axis, which runs from positive to negative, indicates amounts of yellow and blue that is b* on the Y-axis represents the mix of yellow and blue where negative is bluer (e.g. -0.42 b*) and positive is yellower (e.g. +0.42 b*).



Color measurement instruments

Although we have discussed how to define colors with CIE standards, we still need to find an approach for evaluating reflective lights of samples, for actual measurement.

Moreover, we need to measure and learn tristimulus values, which can be acquired with a **Spectrophotometer** or a colorimeter. The methods used by the two devices are quite different from each other, although both can provide tristimulus values.

Spectrophotometer measures the intensity of light reflected from the samples, with an interval of 5, 10 or 20nm, according to different devices. We collect the corresponding discrete values in the whole visible spectrum, enabling the spectrophotometer to provide integrated spectral reflectance curves, and XYZ tristimulus values can be calculated from these curves.

Tristimulus values:

Are three **values** used together to describe a colour and are the amounts of three reference colours that can be mixed to give the same visual sensation as the colour considered

The **Colorimeter** is quite similar to the densitometer in many aspects, measuring reflective lights of samples with photoelectric cell of color filters. Due to the selection of filters, spectral sensitivity is similarly matched to the CIE Color matching function.

This method can provide only limited precision since it is very hard to find filters matching precisely with the CIE color matching function. However, it provides a convenient way to fabricate simple and inexpensive spectrophotometric measurement devices. Since the whole spectral reflectance curves are not provided, the colorimeter cannot indicate the metamerism (Changing of color in various density of light and angle) of color matching.

Nowadays, portable spectrophotometer, similar to portable densitometer, is also available; they are simple and convenient. However, densitometer, colorimeter and Spectrophotometer of different designs may get different results on the same sample, since colors of an object are, to a large extent influenced by gloss reading and illuminating angles. Different devices may use different geometric conditions for illumination and observation. A device on the desktop calculates the integral of light reflected from the sample, or receives light in the integrating sphere and reflected from the sample (it is optional to include or not include mirror reflected). The relatively cheaper device is usually used for color measurement in the printing industry by treating the sample at an angle of 0º or 45º and measuring from the angle of 45º or 0º.
Therefore the mirror reflectance is eliminated. Due to the difference of these geometric conditions, values acquired from a device cannot easily be compared, with the values directly acquired from another device of different design. Although established international

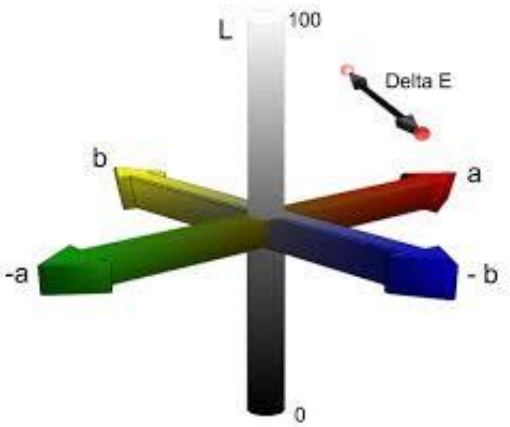
measurement standards are available, difference also exist in the reading, because of different designs in the measuring instruments.

What is delta E (ΔE)? (Color Variation)

The variance in color values is represented by ∆E.
∆E is the measure to understand how human eye perceives color difference between two samples. '∆' is a mathematical term which represents change. ∆E value will range from 0 to 100.

Delta E (ΔE) is a single numerical value indicating the difference between printed color and desired color. This difference is expressed by the geometric distance between two colors.

Although the calculation of color difference was defined based on the color vision of the human eye, some color differences are evaluated differently between the color difference (ΔE) and the human eye. This is because the color discrimination of the human eye greatly differs from the range of (ΔE) color differences defined by CIE L*a*b*. Sensitivity to color differences is low for the colors with high saturation.



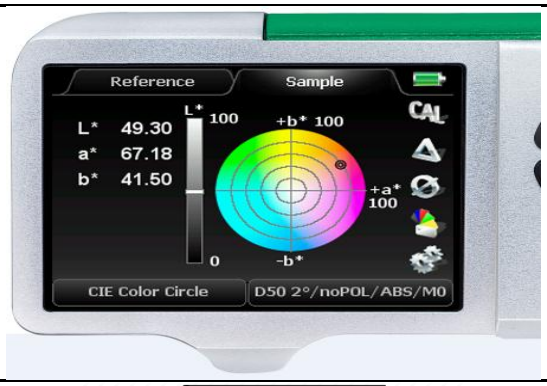
Delta E (ΔE)	**Perception**
<= 1.0	No perceptible by human eyes.
1 - 3	Perceptible through close observation
4 - 10	Perceptible at a glance
11 - 49	Colors are more similar than opposite
100	Colors are exact opposite

Practical Activity:

Module: A	Perform color management	
	Learning Unit: 1-1	Control L*a*b* values and Color management

	Practical Description	Use a spectrophotometer to find out L*a*b* values and Delta E values of a sample
Time:	**10 min**	
Equipment	Offset printing machine	
Tools	Spectrophotometer, light booth	
PPE	Proper dress code, safety shoes	
Materials	Printed sample/Color swatch	
Key Point	Spectrophotometer may be built into the CPC or may be an independent device.	
Learning Outcome:	The learner will be able to find out the color density, L*a*b*and Delta (Δ)E of a color with spectrophotometer.	
Precautions:	Ensure that sensor of spectrophotometer and the sample are dust free before operation. Ensure calibration of spectrophotometer.	

Instructions	Illustrations
1. Collect the sample.	
2. Place the sample under spectrophotometer sensor.	
3. Press the button	

4. Record the Lab values of the sample from display	
5. Check the value and check for variance from the job card/Specimen.	
6. Communicate to supervisor.	
7. Maintain the desired L*a*b* values	

Learning Unit 1-2:

Control ink density

Overview:

This learning unit deals with; ink density, controlling ink density, precautionary measures adopted during ink controlling and numeric standards of ink density in printing machine. It also defines; the function of ink duct, CPC procedure of ink layer maintenance on sheet for manual printing machine and film layer.

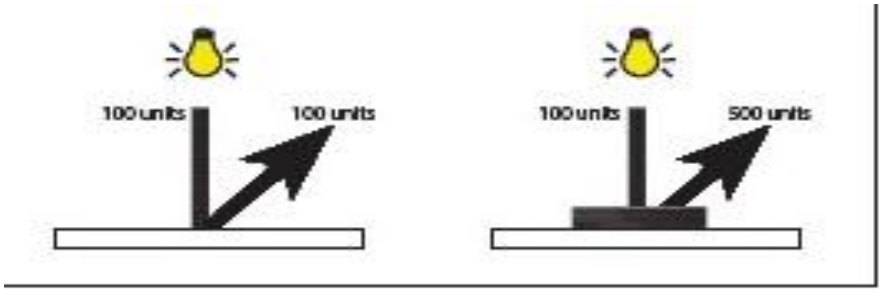
Ink Density

Density is the level of darkness in a negative or positive film or print. The measurement of density is called densitometry. An instrument called a densitometer is used to measure the density. Any printing process from the simplest black and white work to complex color work will benefit from the use of a **densitometer**.

Optical density is a kind of measurement value, applicable to Trans-missive samples (films) and reflective samples (printed substrate). The function of the trans-missive densitometer is to measure the amount of light transmitting to a sample, while the reflective one is to measure the amount of light reflected by the sample.

A layer of printing ink can absorb the light; the thicker the ink films is, the more light will be absorbed, and the printed matter will appear darker -- this is the definition of reflectivity. Based on reflectivity, optical density can be calculated, and the computing equation thereof is:

Density= Log_{10} (1/Reflectivity)



Density and densitometer

Densitometer is an important measurement tool to quantify the properties of printing and

also plays an important role in improving color reproduction control.

Color control is achieved using a densitometer or scanner to measure the control strip. Measurement results for each color convey the machine operator whether to increase or decrease ink in a certain area. The print must match the original or the fixed system data as closely as possible. The press operator continually takes sample sheets to monitor and maintain ongoing color and log throughout the run.

Wet density and dry density

Lights reflected by the surfaces of wet ink film and dry ink film are different, particularly in printing on coated or uncoated substrate. Ink looks more saturated before it is dried, but the colors of ink will change after it dried thoroughly, which is called “dry back”. Densitometer readings are different than that of just pulled out from the press and not yet dried. Reservation for the dry back has to be estimated so as to reach correct densities on dry backs.

In order to estimate the influences of dry back, we can use densitometers equipped with polarizing filters. First, we shall predict what will happen after the ink film have dried, so as to know how polarizing filters work. At the time of printing on the paper, the surface of printing inks is very flat, even if on rough paper. When illuminated by the light, printing inks will absorb and reflect some light, while reflecting other light directly. Since the ink film is flat, most of the light reflected by the surface will directly shoot to the light source and not received by the photo diode, which leads to high measured density and visual density. However, after the ink film is dried and printing inks fixed to the surface of certain paper (rough and uncoated paper), the reflection of the surface will be limitless and the photodiode can receive reflected lights, which leads to the reduction of measured density, even if the thickness remains the same.

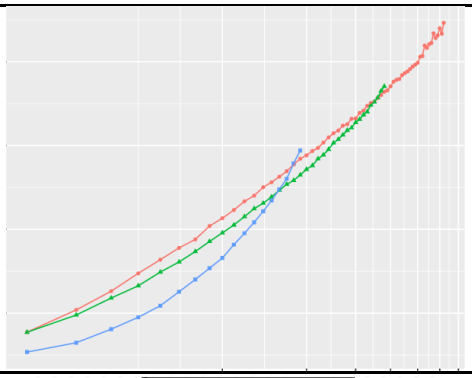
Function of ink duct in printing Machine

Ink duct assembly for offset printing machines having an ink duct and a rotary duct roller. The ink fountain is a reservoir that holds ink. Offset ink is not a fluid ink, it looks more like a kind of thick paste. From the ink fountain this ink needs to be transferred to the printing plate or cylinder. From there that ink will be transferred to the paper or another substrate. The inking system is responsible for this transfer. It needs to break the thick, viscous ink down into a thinner, more workable and uniform ink film. This is done by a set of rollers.

Practical Activity:

Module: A	**Perform color management**	
	Learning Unit: 1-2	Control ink density
	Practical Description:	Use a densitometer to find out density values of various spot colors
Time:	**10 min**	
Equipment	Densitometer	
Tools	Ink scrapper (chansa)	
PPE	Proper dress code, safety shoes	
Materials	Printed sample	
Key Point	Density of the sample will vary with darkening of colors	
Learning Outcome:	The learner will be able to find out the density of a color layer.	
Precautions:	Ensure that sensor of densitometer and the sample are dust free before operation. Ensure the calibration of densitometer.	

Instructions	**Illustrations**
1. Collect the sample	
2. Place the sample under densitometer sensor	
3. Press the button	

4. The display will show a percentage values of the sample	
5. Record the values	
6. Communicate to the supervisor	
7. Maintain the ink density as per the SOP	

Learning Unit 1-3:

Control drying parameters

Overview:

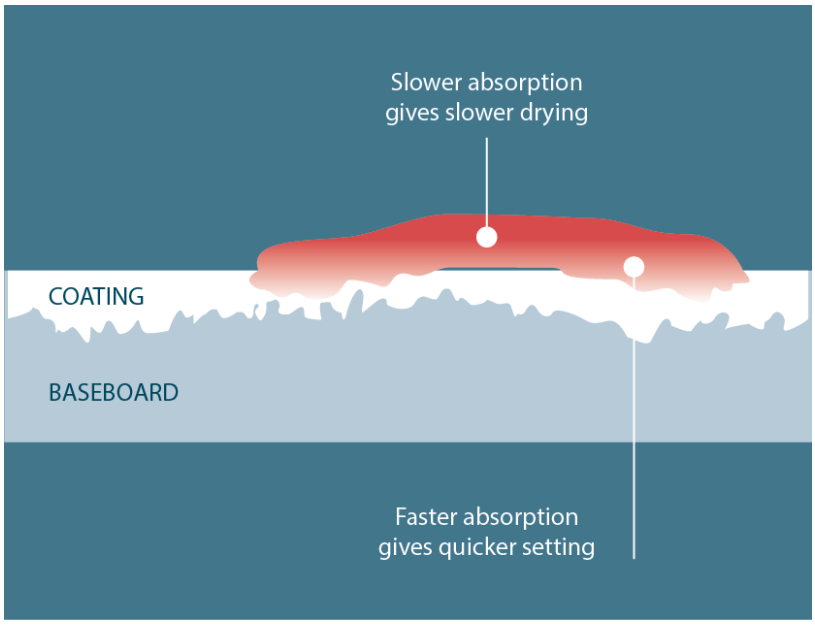
This learning unit explains about the drying agents used in printing industry. It also states the application of drying agents.

How does the ink dry

The drying of the ink is a combination of a physical phenomenon “penetration into the substrate” and a chemical phenomenon “air oxidation”.

Penetration into the substrate

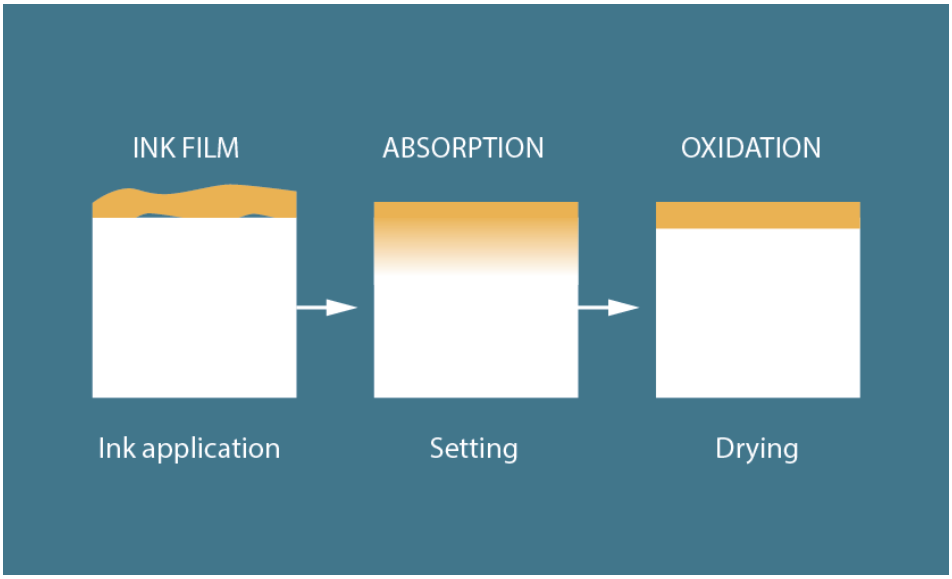
During printing, as soon as the ink is deposited on the substrate, certain ingredients of the ink penetrate into the substrate. These are liquid ink components, i.e. mineral or vegetable diluents like fats. Mineral diluents, which are more fluid, have a tendency to penetrate more quickly than vegetable diluents. The rapidity and ease with which they penetrate depends on the quality, surface condition and porosity of the substrate. If the substrate is more porous, then the penetration process will be faster. In the case of non-absorbent substrate such as tracing paper or synthetic substrates, no penetration occurs. Drying is entirely through air oxidation.



Air oxidation

This chemical phenomenon begins as soon as the print leaves the press. Air oxidation corresponds to the hardening of the varnishes in the ink through a chemical process that occurs on contact with oxygen in the air. In the first stage, the reaction begins on the surface of the ink film and then spreads throughout the body of the film. This air oxidation mechanism can be accelerated on the press itself by adding drying agents to the ink.

The drying of the ink, whatever its formulation, involves the two above mentioned phenomena. By adjusting the mix of the ink, the balance can be switched towards penetration or air oxidation.



Common reasons of applying drying agents

1. Excessive ink application
2. Low pH value of the paper/board and/or the fountain solution.
3. Low concentration of drying components of inks.
4. High dosage of fountain solution.
5. High moisture content of paper/board.
6. Ink composition
7. Low temperature or high air moisture in the printing room.
8. Viscosity of inks and varnishes.

Corrective measures:

1. Decrease of ink application.
2. Adjust the pH of the fountain solution from 4.5 – 5.5
3. Add drying compounds to inks. This must be done with the assistance of ink supplier.
4. Reduce the dosage of fountain solution.
5. Replace the paper/board with high moisture. Avoid exposing the board to moist environments.
6. Try using the newest ink batches. Ask for technical assistance of ink supplier.
7. Control the moisture and temperature to a range of 20 – 23 °C (68 – 74 °F) and 50 - 60% of relative moisture.
8. Other actions:
    a. Use of anti-set-off powder.
    b. Add dryness enhancers to fountain (Chiller tank).
9. Use higher pigmentation ink. Higher the pigment ratio, less ink deposit required to obtain ink density.

Drying agents:

There are two basic types of drying agents used in offset printing; fountain dryers and ink dryers**.**

Fountain Dryer should be added to premixed fountain solution. Once Fountain Dryer is added to the fountain (water), ink will start to oxidize (dry) the top layer.

Ink Dryer is an ink additive that has a catalyst for cross linking reactions. Ink dryers attach itself to the pigment and varnishes in the ink and then attaches to the substrate. Its properties then create a chemical reaction that allows drying from top to bottom and side to side at the same time. It also increases rub resistance, eliminates chalking and also keeps the inks characteristics of body and tack unchanged.

Under certain conditions in the offset printing process, problems with the drying of inks can appear. Often these defects are identified as scum and release of inks; also the drying of inks can take longer than required, which has an impact on printing quality.

In case of excessive dosage of dryer the following problems can occur:

1) It is going to have an adverse effect on the ink film
2) It drastically impacts the tack of the ink
3) Causes stripping issues on the rollers

Application of drying agents:

All manufacturers of drying agents provide application specifications on their respective packaging.

Drying agents vary with their chemical and physical characteristics therefore they should be applied as per manufacturer's specifications.

In order to get proper drying, the following characteristics need to be monitored:

- pH Value using pH meter/strips
- Conductivity using conductivity meter
- Chiller temperature
- Isopropyl alcohol (IPA) Ratio
- Fountain solution ratio according to the pH of water.

Practical Activity:

Module: A	**Perform color management**	
	Learning Unit: 1-3	Control drying parameters
	Practical Description:	Add drying agent to fount and ink
Time:	15 min	
Equipment	Calibrated beaker, Weighing Scale, pH meter, Conductivity meter, IPA meter	
Tools	Scrapper	
PPE	Proper dress code, Rubber gloves, safety shoes	
Materials	Ink and Ink dryer	
Key Point	Mix proper amount of ink dryer in ink as per specifications on dryer packaging.	
Learning Outcome:	The learner will be able to control drying problems of ink in offset printing.	
Precautions:	Drying agents should be applied as per manufacturer specification.	

Instructions	**Illustrations**
1. Use the calibrated beaker to measure the drying agent as per manufacturer's instruction.	
2. Add the drying agent to the ink and mix using the scrapper	

3. Add ink to the printing machine	

Summary of the Module:

- Process color is produced by printing a series of dots of different colors. All the colors are created from layers of four primary colours CMYK (Cyan Magenta Yellow and Black) in halftone dots to create a full color effect.
- In offset printing, a spot colour is any colour generated by an ink (pure or mixed) that is printed using a single run.
- Color management is the controlled conversion between the color representations of various devices, such as image scanners, digital cameras, monitors, TV screens, film printers, computer printers, offset presses, and corresponding media. The primary goal of color management is to obtain a good color match across different platforms, like Prepress, Press and Viewing environment.
- CIE (Commission International de l'Eclairage) created a standardized system of color measurement by specification of spectral properties (e.g. light prism) of standard illuminants (light) and information concerned with standard observers and color description approaches.
- CIE Lab represents colors by using the coordinates in a uniform color space consisting of lightness variable and chromaticity indices.
- L*a*b* values are used to standardize color values in a mathematical manner so that any device or person can perceive the same color as is required by the job.
- L*a*b* values are represented a 3-dimentional graph (x, y, z axis) or a color space gamut where;
    i. L --lightness
    ii. a --redness/ greenness
    iii. b --yellowness/blueness
- ∆E (Delta E) is the measure to understand how human eye perceives color difference between two samples. '∆' is a mathematical terms which represents change. ∆E value will range from 0 to 100.
- Spectrophotometer measures the intensity of light reflected from the samples

- Density is the level of darkness in a negative or positive film or print. The measurement of density is called densitometry and the instrument used to measure the density, is called Densitometer.
- Lights reflected by the surfaces of wet ink film and dry ink film are different, particularly in printing on coated or uncoated paper.
- The ink fountain is a reservoir that holds ink. From the ink fountain this ink needs to be transferred to the printing plate or cylinder then it will be transferred to the substrate.
- The drying of the ink is a combination of penetration into the substrate and air oxidation. Ink penetration is very dependent on the type of substrate printed. By adjusting the mix of the ink, the balance can be switched towards penetration or air oxidation.

- There are two basic types of drying agents used in offset printing; fountain dryers and ink dryers. All manufacturers of drying agents provide application specifications on their respective packaging. In order to get proper drying, the following instruments need to be monitored; pH meter, Conductivity meter, chiller temperature scale, Level of water in tank through visual confirmation, IPA Ratio and Fountain solution ratio.

Frequently Asked Questions

(FAQs)

Question	Answer
1. What does “K” stand for in CMYK?	It stands for “key plate,” which is the plate of a printing press that carries the black ink.
2. Define spot color.	A spot color is a special premixed ink that is used instead of, or in addition to, process inks
3. What are process colors?	A process color is printed using a combination of the 4 standard process ink: cyan, magenta, yellow and black (CMYK).
4. Why color management is important?	The primary goal of color management is to obtain a good color match across different platforms, like Prepress, Press and Viewing environment.
5. What is the purpose of Spectrophotometer?	Spectrophotometer measures the intensity of light reflected from the sample
6. What is ∆E?	∆E is the measure to understand how human eye perceives color difference between two samples.
7. What L*a*b* values mean?	L*a*b* values are represented a 3-dimensional graph (x, y, z axis) or a color space gamut
8. What does L*a*b denotes?	L --lightness a --redness/ greenness b --yellowness/blueness
9. What is density?	Density is the level of darkness in a negative or positive film or print.
10. How many types of drying agents are used in offset printing?	There are two types of drying agents: Fount dryer and ink dryer

11. Where is the fountain solution added?	Fountain solution is added to water.
12. State two reasons for non-drying of ink.	1. Excessive use of ink 2. High level of moisture in substrate
13. What is the recommended optimum temperature for offset printing?	20^{o} C to 30^{o}C
14. When anti-set-off powder is used?	When there is an issue of set-off.
15. What happens when the water tank is dirty?	Scumming

Self-Assessment

(MCQs)

Mark the correct one from the given options. You can check your answer with the Answer Key at the end of this module.

Q 1: Which of the following is NOT a common cause for non-drying of ink?

a) High moisture content of substrate

b) High air moisture in the printing room

c) Low pH value of the fount solution

d) Color of the ink

Q 2: When not drying, which of the following corrective actions can fix the problem?

a) Change printing plates

b) Adjust the dosage of fountain solution

c) Adjust L*a*b* value

d) Use spectrophotometer

Q 3: Two basic types of drying agents are:

a) Fount dryer and ink dryer

b) L*a*b* and ΔE

c) Conventional and alcohol

d) Local and imported

Q 4: Which of the following is an effect of non-drying inks:

a) Low dot count

b) Non-aligned impression

c) Bleeding

d) Low L*a*b* values

Q 5: Conductivity is measured by:

a) A spectrophotometer

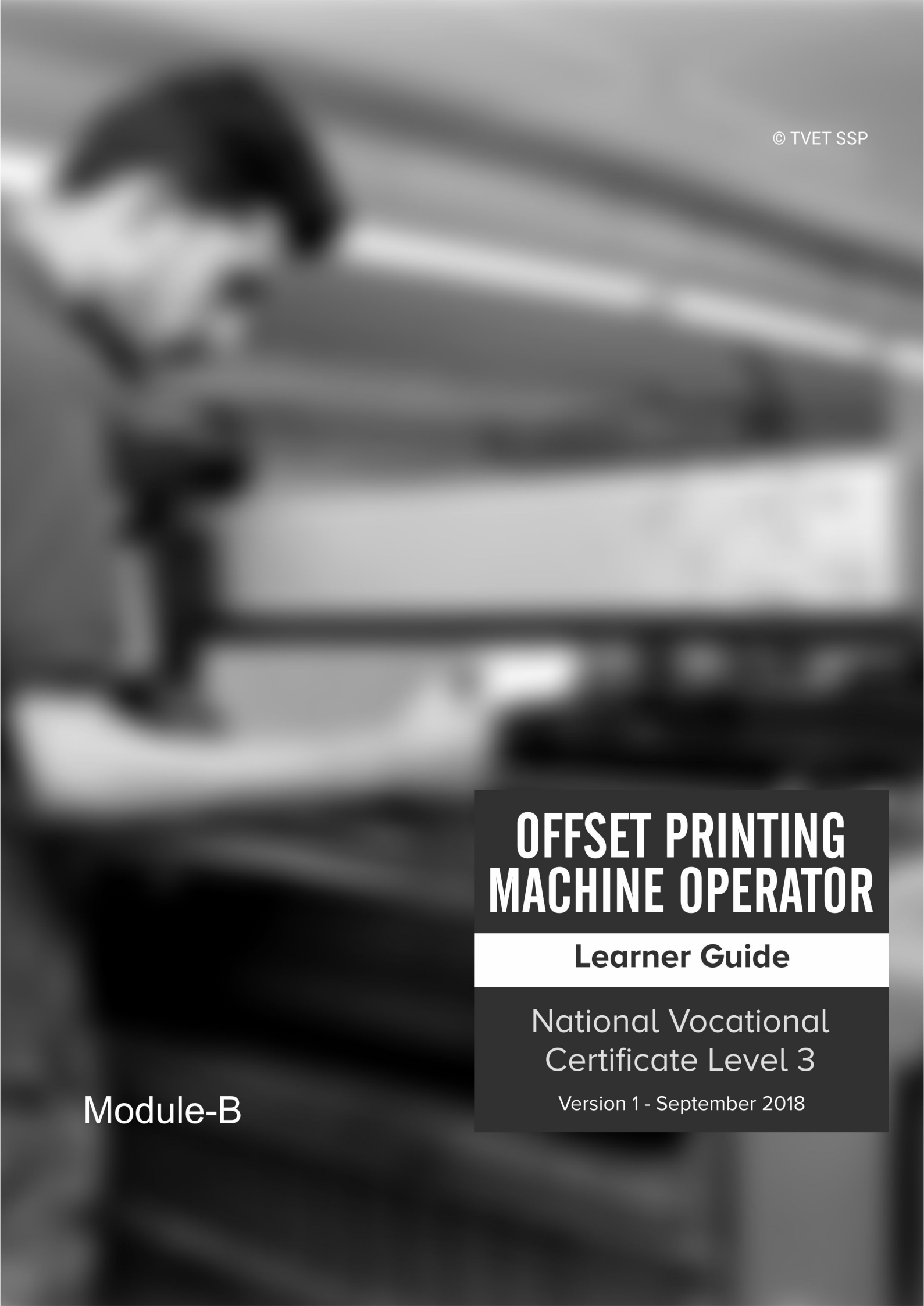
b) A pH meter

c) A thermometer

d) A conductivity meter

Answer Key

MCQ No.	Correct Answer
1	d
2	b
3	a
4	c
5	d



OFFSET PRINTING MACHINE OPERATOR

Learner Guide

National Vocational Certificate Level 3

Version 1 - September 2018

Module-B

Module B: - Maintain graphic chemicals in machine

Learning Outcome:

After completion of this module the learner will be able to:

- Keep pH value with in approved range,
- Put pH value in log Book.
- Put in raw water conductivity value in log book
- Control raw water conductivity as per SOP
- Put in water conductivity value in log book after control.
- Put in water temperature value in log book
- Control water temperature as per SOP.
- Mix water with recommended chemical composition as per sops,
- Maintain water quantity in chillers as per SOP
- Put in IPA value after mixing in water in log book,
- Control IPA value in water as per SOP
- Maintain fountain solution in water as per SOP
- Record fountain solution percentage in log book

Learning Unit 2-1:

Maintain pH value

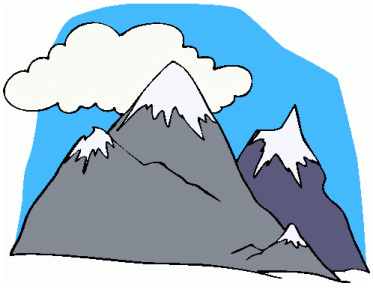
Overview:

This learning unit deals with the pH value, its importance in printing process and methods to measure pH values.

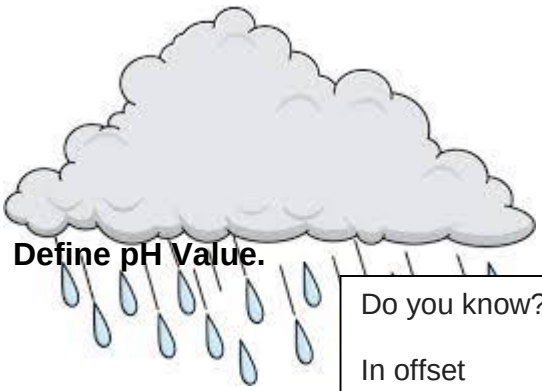
Water Chemistry:

Offset printing is a process with various variables that can affect the quality of the production output.

Water chemistry is at the heart of everything that we do in offset printing. During the printing we consume significant amount of water. Just like all the other consumables, the quality of the water that we use has a direct impact on our printing quality. A machine operator should be able to control the printing process by diagnosing the reason for the problems that they encounter and then suggest a suitable solution to resolve them.



The quality of water that we require for good printing is much more different from the one that we get in our taps. It contains various amount of dissolved substances, many that can be harmful for offset printing. To understand this even better, we should consider the source of the water that we are getting. The tap water may contain a large amounts of magnesium, sodium, calcium, and iron. All these factors will result in changing the p**H Value** of water and making it inadequate for offset printing.



Define pH Value.

Do you know?

In offset Printing the recommended pH value is in between 4.5 to 5.5

pH stands for power of hydrogen or **potential of hydrogen**. It is a numerical value assigned to a solution that tells us how acidic the water is. pH is a measurement of the hydrogen ion concentration in the water. The pH scale ranges from 0 to 14; a pH that is a perfect 7 is said to be neutral and is neither acidic nor basic. A pH less than 7 is said to be acidic and solutions with a pH greater than 7 are basic or alkaline.

In offset Printing the recommended pH value is in between 4.5 to 5.5 worldwide.

Importance of maintaining pH value

For the printing process, a pH-value of approx. 4.5- 5.5 is the proved range.

Dampening solution that is too acidic has the following effects:

- The printing layer of the plate is fretted resulting in sharp pointed halftone dots.
- The useful life of the plate is reduced.
- Ink drying is delayed. In extreme cases, ink does not dry at all.

The effects of alkaline solution are:

- High dot increase.
- Tendency towards scumming and emulating.

Method of pH Measurement

Around the world, pH is the most widely tested chemical parameter. From pH paper to popular pH meters, several methods are available for measuring this parameter.

Indicator paper or pH paper:

pH paper is an inexpensive method that provides an indication of acidity or alkalinity but not an accurate measurement. Using an organic dye, this coated paper changes color to indicate the presence of acid or base. Easy to use, the litmus papers are only for noncritical measurements.
Water quality test strips and papers make the task of measuring water quality quick and easy. Obtain test results within minutes! Simply dip the water test strip into the water sample and compare the resulting color to enclosed chart.

pH Indicators:

What if we didn't necessarily need to know the exact numerical value of the pH of a solution, but just if it were acidic or basic? A **pH indicator** is a compound that, depending on the nature of the solution environment it's in, causes the solution to be different colors. For example, **methyl orange** is an organic compound that turns the solution different colors based on the pH.

If the pH is strongly acidic (pH values less than 2), the color will be a bright, vibrant red. But if the solution is only weakly acidic and the pH is around 5, the solution color will turn a yellow or gold color.

pH Meter:

The modern way to determine the pH of a solution is by using a pH meter. A **pH meter** is very similar to a conductivity meter, however the pH meter specifically looks for and detects the hydrogen ion concentration within a solution. Usually a pH meter must be calibrated to ensure its accuracy, and this is typically done by using a standard solution whose exact pH is known. The meter is set to that specific value and then unknown pH values are determined in reference to the standard.

Before using a pH probe and meter to test pH, test the meter in a substance with a known pH rating to calibrate it. For example, pure or distilled water has a pH level of 7. If necessary, adjust the meter accordingly.

Conductivity Meter:

A **conductivity meter** is an instrument that detects the presence of electrical current within a solution. By definition, acids release hydrogen ions in solution, and bases release hydroxide (-OH) ions. Both of these species possess an electrical charge, and it's the job of the conductivity meter to not only detect the charge but also calculate the relative concentration of the ions. By knowing the concentration, the instrument is able calculate the pH of the solution

Class Activity:

Collect 100ml of tap and distilled (can use mineral) water samples. Measure the PH Value using pH strips or pH meter and fill the following table:

	Tap Water	Distilled Water
PH Value		

Practical Activity:

Module: B	Maintain graphic chemicals in machine

	Learning Unit: 2-1	Maintain pH value
	Practical Description:	Measure the pH value of water by using pH meter
Time:	30 min	
Equipment	pH Meter.	
Tools	Calibrated Beaker	
PPE	Proper dress code, safety shoes,	
Materials	Sample of tap water, Sample of RO water, pen, log book	
Key Point	Before using a pH probe and meter to test pH, test the meter in a substance with a known pH rating to calibrate it.	
Learning Outcome:	The learner will be able to measure the pH value by using pH meter.	
Precautions:	Before performing pH test, rinse the probe and meter with clean water and dry with a clean tissue. Temperature of water must be checked before starting the test because temperature affects the sensitivity of the probe	

Instructions	**Illustrations**
1. Collect 100 ml samples of tap and RO (can use mineral) water in clean containers that is deep enough to cover the tip of the probe.	

2. Use a thermometer to check the temperature of the sample, and then adjust the meter to match the sample temperature.	
3. Insert the probe into the sample and wait for the measurement to become steady, which indicates the meter has reached equilibrium.	
4. Record pH level of the sample.	

Learning Unit 2-2:

Maintain conductivity

Overview:

This learning unit describes the importance and standard of conductivity in printing process.

Conductivity:

Conductivity is the ability to conduct electricity. In solutions it is caused by breaking down molecules into ions/electrons. The more the number of ions/electrons, the higher the conductivity will be. Conductivity is determined by the water quality and the used fountain solution additive.

Standard conductivity for Printing

There is no standard range of conductivity for offset printing, i.e. unlike for pH value there is no favorable range for conductivity. Conductivity will give us a base number to refer back to regardless of the pH and it is recommended to change your water solution at whatever point this reading is doubled. Conductivity can be measured with the help of conductivity meter.

Class Activity:

Collect 100ml of tap/RO water (can use mineral) water sample. Measure the Conductivity by using conductivity meter and fill the following table:

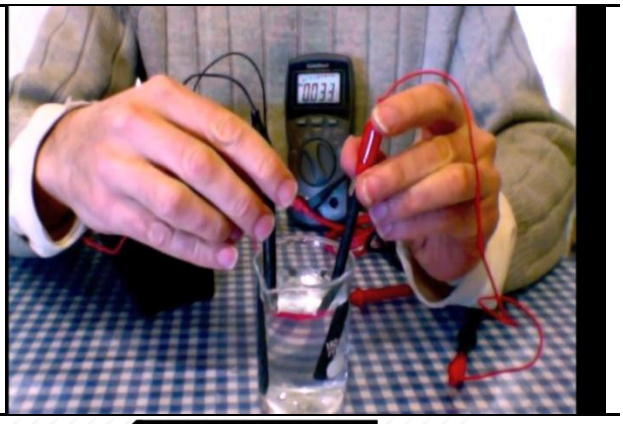
	Tap Water	**Distilled Water**
Conductivity		

Practical Activity:

Module: B	Maintain graphic chemicals in machine

	Learning Unit: 2-2	Maintain conductivity
	Practical Description:	Measure the conductivity of water by using conductivity meter
Time:	30 min	
Equipment	Conductivity Meter.	
Tools	Calibrated Beaker	
PPE	Proper dress code, safety shoes, safety gloves	
Materials	Sample of tap water, Sample of RO water, pen, log book	
Key Point	Conductivity must be checked within the specified time intervals	
Learning Outcome:	The learner will be able to measure the conductivity by using meter.	
Precautions:	Before performing conductivity test, rinse the probe and meter with clean water and dry with a clean tissue. Temperature of water must be checked before starting the test because temperature affects the sensitivity of the probe	

Instructions	Illustrations
1. Collect 100 ml samples of tap and RO water in clean containers that is deep enough to cover the tip of the probe.	

2. Use a conductivity meter to check the conductivity of the sample. Insert the probe into the sample and wait for the measurement to become steady	
3. Steady reading indicates that the meter has reached equilibrium.	
4. Record the data.	

Learning Unit 2-3:

Maintain chiller temperature

Overview:

This learning unit states the function of water temperature and its standard during offset printing process.

Importance of adequate water temperature:

It is important to control the water temperature to reduce the evaporation of IPA in water, thus control the consumption of IPA.

Maintaining water temperature helps in overcoming scumming and proper ink transfer.

Standard range of temperature:

In Alcohol based printing, temperature of water should be in a standard range of 10 -12 °C.

Temperature:

The fountain water temperature should preferably be about 10 -12 °C. The constant temperature equalization will help to stabilize the production process by cooling the machine at ambient temperature

Calculating the water temperature:

The water temperature should be recorded according to the reading on the chiller tank or by using a standardized thermometer.

Material required

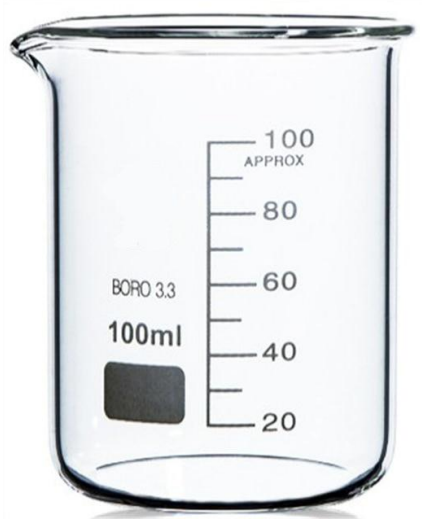
- Sample of water
- Thermometer

Class Activity:

Take 100 ml sample of water and by using a thermometer, record the temp of water at after different intervals.

Intervals	Temp
First reading	
After 15 mins	
After 30 mins	
After 1 hour	

Practical Activity:

<table>
<tr><td rowspan="3">Module: B</td><td colspan="2">Maintain graphic chemicals in machine</td></tr>
<tr><td>Learning Unit: 2-3</td><td>Maintain chiller temperature</td></tr>
<tr><td>Practical Description:</td><td>Measure the temperature of water</td></tr>
<tr><td>Time:</td><td colspan="2">30 min</td></tr>
<tr><td>Equipment</td><td colspan="2">Thermometer</td></tr>
<tr><td>Tools</td><td colspan="2">Calibrated beaker</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code, safety shoes</td></tr>
<tr><td>Materials</td><td colspan="2">Sample of water.</td></tr>
<tr><td>Key Point</td><td colspan="2">Maintaining water temperature helps in overcoming scumming and proper ink transfer</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to check the temperature of water</td></tr>
<tr><td>Precautions:</td><td colspan="2">Ensure the tip of thermometer must be covered with water</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Collect 100ml samples of water in clean containers that is deep enough to cover the tip of the thermometer.</td><td> 
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2. Use a thermometer to check the temperature of the sample	
3. Record the data.	

Learning Unit 2-4:

Maintain Water level in chiller tank

Overview:

During printing, it is observed that lots of water is consumed. Due to which, lots of print operators make mistake of refilling their tanks with raw water rather than using a premixed solution. This routine disturbs the entire water chemistry. In this module we are going to discuss how we can overcome this issue.

Raw water vs. Formulated water chemistry:

The largest component of fountain solution is **water**, and it is important that the water used be as free from impurities as possible. Water with a high concentration of magnesium and calcium ions is known as **"hard"** water; water free of such substances is known as **"soft"** water. Water straight from the tap can be fairly unpredictable, especially in a large metropolitan area. Water hardness is measured in terms of the water's electrical conductivity, as a higher ion concentration in the water increases its conductivity. The higher the water hardness, the more it can raise the solution's pH. But more important than actual water hardness is the consistency of water hardness, which is ensured by mixing "raw" water with purified water of a predetermined and consistent hardness. It is imperative that a print operator understands the importance of maintaining the recommended readings of pH and conductivity in water tank. For this he should always maintain the recommended dosage of both fountain solution and IPA.

Using raw water to refill water tank will disturb the readings and printer will face issues in identifying the source of the problems that he is facing.

Water fountain system in offset printing machine:

It is important to note that both pH and conductivity are equally important components of water chemistry. There is no greater emphasis on one over the other and thus neither can be ignored. Both must be used according to the recommended ratios.

Formulation of water chemistry and its usage:

Normally it is recommended that the fountain solution and IPA consumption should not exceed 4% and 10% respectively (although proper testing should be done before determining the exact ratio. As stated earlier quality of water and supplier recommendations should be taken into account). To make this entire process easier, print operators must follow the following steps:

1. Take a 10 or 20 ltr capacity of can.
2. Add 75% raw water of its total capacity.
3. Add Fountain Solution according to the prevailing press conditions
4. Add IPA according to the prevailing press conditions
5. Refill chiller tanks using this premixed formula.
6. Ensure tightness of can at all times.

Class Activity

Take 1 ltr of water. Record its Ph and Conductivity readings and enter in the log below. Then add 4% of fountain solution and 10% of IPA, calculate the reading again and record in the log below

	Ph	Conductivity
Raw Water		
Formulated solution		

Material Required

1 ltr Sample water
500 ml IPA
100 ml Fountain Solution
beaker
measurement syringe
conductivity meter
pH meter

Learning Unit 2-5:

Maintain IPA in water

Overview:

This learning unit explains function and behavior of IPA after mixing in water.

What is IPA?

IPA Stands for Isopropyl alcohol. The role of IPA is to reduce the surface tension of water and control the conductivity. It ensures lower roller temperature through evaporation. IPA further increases viscosity of the water which is necessary in successful transfer of water to the plate in Continuous film dampening systems (also known as alcohol dampening system)

Effect of Isopropyl Alcohol (IPA):

- Quick, stable ink-water balance
- lowers the surface tension
- Cools by latent heat
- Avoids germ formation
- Self-cleaning effect
- Increases the fountain water viscosity
- impedes the formation of foam
- Decreases ink build-up on the damping rollers

If a considerable reduction or even an elimination of IPA in fountain water is to be carried out, an increased degree of care and sensitivity is needed. The success of alcohol reduction depends on the optimization of the whole printing process. The mentioned functions of the IPAs will mainly bring about an increased production safety and stability, or expressed in another way, with IPA smaller deficiencies and a little carelessness within the production process can be concealed.

The behavior of IPA in water:

IPA Controls the conductivity in our water chemistry. The below given table shows the impact of IPA.

Conductivity	IPA Dosage
2000 mho	0%
1600 mho	4%
1400 mho	6%
1200 mho	8%
1000 mho	10%

What happens if we do not ensure correct dosage of IPA in the mix?

Conductivity is a Quality Control (QC) tool to tell how much contamination is being run. And IPA is the agent that ensures that level of contaminations remains in control. If IPA dosage is too weak, then poor plate restarts or scum. If IPA dosage is too strong, then you'll have ink emulsification, blinding/stripping, or poor print quality.

Activity 1:

Take 1 liter sample of water and calculate the conductivity after adding the below mentioned dosage of IPA.

IPA Dosage	Conductivity
0%	
2%	
4%	
6%	
8%	
10%	

Material Required

1 ltr Sample water
500 ml IPA
beaker
measurement syringe
conductivity meter

Activity 2

Take 1-liter sample of water and calculate the conductivity after adding 6% IPA. After that add 50g of salt and check the conductivity. Then add IPA and check the conductivity. Fill your findings in the below mentioned table

IPA Dosage	Conductivity
0%	
6%	
Add 50g of salt	
4%	
6%	

Material Required

1 liter Sample water
500 ml IPA
salt
beaker
measurement syringe
conductivity meter

Learning Unit 2-6:

Maintain Fountain solution in water

Overview:

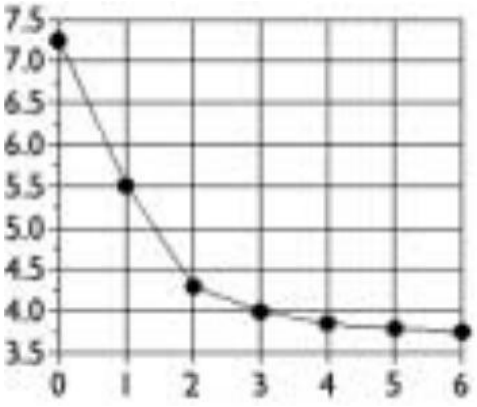
Fountain Solution plays a paramount role in making an adequate quality water mix. In this learning unit we are going to study the relationship between a fountain solution and Ph, how important it is to choose a buffered fountain solution, how to calculate the correct dosage required, the relationship between fountain solution and conductivity and also look into some of the mistakes press operators make and how to avoid them.

Relationship between Fountain Solution and pH:

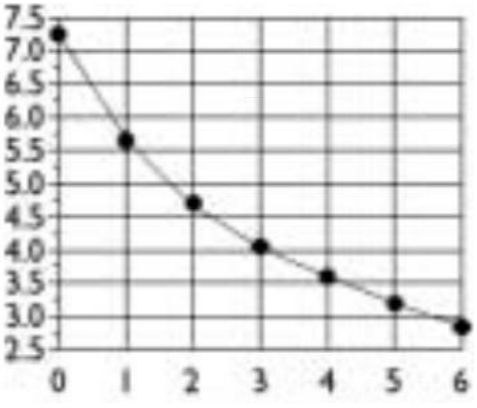
We have studied that for good quality printing, pH value of our water chemistry should be between 4.5 and 5.5. But the raw water that we get is a lot harder with higher pH value. So in order to bring our mix in accordance to the established standards we need to add fountain solution in correct dosage.

Buffered fountain Solution:

Buffered solutions resist changes in pH from the effects of containments. For reference, look at the graphs below. On the left, a buffered solution; on the right, an older design which was poorly buffered



BUFFERED



NON-BUFFERED

The buffered curve levels out near pH 4.0 and then changes slowly. Whereas with the non-buffered fount, pH is not very stable and as more concentrate is added the pH keep going down.

In this case, simply put, buffer solution to keep the pH stable. Keeping a constant pH is paramount due to various reasons:

1. Moderate changes in the amount of fountain concentrate used will not produce radical changes in pH.
2. These solutions tend to resist the effects of acid or alkaline contamination from paper, ink, plate cleaners, etc.

3. A constant pH, at the desired level, will maintain optimum desensitizing.

Dosage of Fountain Solution

The optimum dosage of fountain solution will always differ from press to press and the quality of raw water available will have a huge influence on this. Harder the water, higher the dosage required. To identify how much fountain solution, we require to bring the pH of our water chemistry between 4.5-5.5 do the following:

- Take 1 litre sample of water
- Check its pH value using a pH meter.
- Note down the values
- Add fountain solution
- Recheck the pH values using a pH meter.
- Note down the values.
- If readings are showing pH of your water between 4.5 and 5.5 then do not add any more fount. If not, then add 1% more fountain solution.
- Recheck the pH values using a pH meter.
- Note down the values.
- If readings are showing pH of your water between 4.5 and 5.5 then do not add any more fount. If not, then add 1% more fountain solution.
- Recheck the pH values using a pH meter. At this point, pH should be between 4.5 and 5.5
- Take a 20 liter can and add 15 liter of water.
- Add the percentage of fountain solution at which previous sample was showing the recommended values. For example, if it was at 3% that pH had come down between 4.5 and 5.5, add 3% fountain solution in 15 liters of water (which will be 450 ml) to the mix.
- Now you have your press-ready solution which you can use to refill your fountain tanks.

It is always recommended to choose a fountain solution in which there is minimum dosage required to achieve establish pH values of water.

Relationship between Fountain Solution and Conductivity

As we increase the dosage of our fountain solution, the conductivity of our water also keeps on increasing. Below is a table showing relation between the two:

Fountain Dosage	Conductivity
0%	**800 mho**
1%	**1000 mho**
2%	**1200 mho**
3%	**1400 mho**
4%	**1600 mho**
5%	**1800 mho**
6%	**2000 mho**

Few mistakes shall be avoided

- Make sure you choose a buffered fountain solution
- At no point during the printing add fountain solution separately to the mix. Always use your press-ready mix whenever you need to.
- Change your water chemistry every week. If you are running double or triple shifts, the frequency of changing your mix might increase.

Activity 1

Take 1 liter of water and fountain solution and record the pH Values in the below mentioned table. Also determine that whether or not the fountain solution being used is buffered?

Fountain Dosage	pH Value
0%	
1%	
2%	
2.5%	
3%	
3.5%	
4%	
5%	
6%	

Based on our findings we can correctly establish that our Fountain solutions is _____

Material Required

1 liter Sample water
500 ml Fountain Solution
beaker
measurement syringe
pH meter/pH strips

Activity 2

Take 1 liter of water and add Fountain Solution and IPA to record the pH Values and conductivity readings in the below mentioned table. Also establish the optimum dosage of Fount and IPA required achieving satisfactory results.

Fountain Dosage	pH Value	IPA Dosage	Conductivity
0%		**0%**	
1%		**2%**	
2%		**4%**	
2.5%		**5%**	
3%		**6%**	
3.5%		**7%**	
4%		**8%**	
5%		**9%**	
6%		**10%**	

According to our findings, the required dosage of Fountain Solution and IPA should be ____ & _____ respectively.

Material Required

1 ltr Sample water
500 ml Fountain Solution
500 ml IPA
beaker
measurement syringe
pH meter/pH strips
conductivity meter

Summary of the module:

- Offset printing is a chemical process with various variables that can affect the quality of the production output.
- Water chemistry is at the heart of everything that we do in offset printing. A machine man will be better able to control the printing process by diagnosing the reason for the problems that they encounter and then suggest a suitable solution to resolve them.
- pH stands for power of hydrogen or potential of hydrogen. It is a numerical value assigned to a solution that tells us how acidic or basic that solution is. A pH that is a perfect 7 is said to be neutral and is neither acidic nor basic, less than 7 is said to be acidic and solutions with a pH greater than 7 are basic or alkaline.
- In offset Printing the recommended pH value is in between 4.5 to 5.5. There are several methods available for measuring this parameter, from pH paper to popular pH meters,
- Conductivity is the ability to conduct electricity. In solutions it is caused by breaking down salts in electrically loaded particles, called ions. If the salt concentration is higher, then the conductivity will also higher the. The conductivity is determined by the water quality and the used fountain solution additive.
- A conductivity meter is an instrument that detects the presence of electrical current within a solution. As discussed, water is the main consumable in printing industry, it is also important to control the water temperature to reduce the evaporation of IPA in water, thus control the consumption of IPA. Maintaining water temperature helps in overcoming scumming and proper ink transfer.
- In Alcohol based printing, temperature of water should be in a standard range of 10 - 12 °C.
- During printing, lots of water is consumed. Refilling of water tank with raw water rather than using a premixed solution will disturb the readings and printer will face issues in identifying the source of the problem.
- Normally, it is recommended that the fountain solution and IPA consumption should not exceed 4% and 10% respectively.
- IPA Stands for Isopropyl alcohol. The role of IPA is to reduce the surface tension of water and control the conductivity. It ensures lower roller temperature through evaporation.
- IPA further increases viscosity of the water which is necessary in successful transfer of water to the plate in continuous film dampening systems (also known as alcohol dampening system).
- Fountain Solution plays a paramount role in making an adequate quality water mix.
- Buffered solutions resist changes in pH from the effects of containments.
- So in order to bring our mix in accordance to the established standards we need to add fountain solution in correct dosage.
- It is always recommended to choose a fountain solution in which there is minimum dosage required to achieve establish pH values of water.

Frequently Asked Questions

(FAQs)

Question	Answer
1. What should be the adequate pH Level of water for printing?	4.5- 5.5
2. Is tap water without adjusting its pH is recommended to be used?	Not recommended
3. How do we measure water pH?	By using pH meter
4. Why is it important to control the pH of water?	It is important so that the dampening solution does not get too acidic or alkaline.
5. What is conductivity?	Ability of water to conduct electricity
6. When shall we change our water chemistry?	At whatever point the starting reading is doubled
7. How can we measure the conductivity reading?	Using a conductivity meter
8. What is the standard range of temperature in a chiller?	10-12 degrees C
9. What issues can be face if temperature is not maintained properly?	Issues of scumming and improper ink transfer
10. How can we record the temperature?	Through observation of the chiller reading or manually with the help of a thermometer
11. What impact will water temperature have on our IPA consumption?	Higher the temperature, faster the IPA will evaporate

12. Can we use raw water rather than the premixed chemistry in our chiller tanks?	Not without regulating pH
13. What will happen if we use raw water instead of premixed chemistry?	It will result in incorrect levels of pH and conductivity in the water tank
14. What will be the result if we add raw water to refill our tanks	Scumming
15. Can we use plate cleaner instead of fountain solution and/or IPA	No, it will result in wastage of plates.
16. What does IPA Stand for?	Isopropyl alcohol
17. Is the consumption of IPA related to scum?	Yes it is
18. What should be the ideal dosage of IPA?	This varies from conditions to conditions but normally should not exceed 10%
19. What problems do we face if we run too strong IPA?	It results in poor print quality
20. What problems do we face if we run too weak IPA?	Scumming
21. What is the role of fountain solution?	It brings down the pH value between 4.5 and 5.5
22. Is it important to choose a buffered fountain solution?	Yes, it is

23. Why is it important to choose a buffered fountain solution?	Because buffered solutions are immune to the factors that can result in changes in pH level.
24. Will the dosage of fountain solution required vary from press to press?	Yes every press needs to establish their own testing mechanism keeping in mind prevailing press conditions.
25. Is there any link between dosage of fountain solution and conductivity in a press	Yes, conductivity increases with high dosage of fountain solution

Self-Assessment

MCQs

Mark the correct one from the given options. You can check your answer with the Answer Key at the end of this module.

1. What should be the adequate pH Level of water for printing?
    a) 5.5- 6.5
    b) 4.5- 5.5
    c) 4.0 – 5.0
    d) Neutral
2. Can we directly use tap water for printing without adjusting its pH?
    a) Yes, we can.
    b) No we cannot.
    c) Depends upon the substrate.
    d) Depends upon the quality of ink.
3. How can we measure water pH?
    a) By using spectrophotometer.
    b) By using thermometer
    c) By using pH meter
    d) None of the above

4) Why is it important to control the pH of water?
    a) It is not important to control the pH of water.
    b) So that the dampening solution does not get too alkaline.
    c) So that the dampening solution does not get too acidic.
    d) b & c
5) What does pH stands for?
    a) Power of Hydrogen
    b) Positive Hydrogen
    c) B & c
    d) None of the above
6) Conductivity can be measured ____
    a) By looking at the state of the water.
    b) By using a conductivity meter.
    c) a&b.
    d) none of the above

7) Conductivity is determined by
    a) Quality of water.
    b) Quality of ink.
    c) Fountain solution being used.
    d) a & c

8) When shall we change our water chemistry?
    a) Every month

b) Every day
c) Whenever the starting conductivity reading is doubled
d) None of the above

9) Standard range of temperature of chiller should be__

a) 14-16 degrees
b) 10-12 degrees
c) 18-20 degrees
d) none of the above

10) Issues that we can face if temperature is not properly maintained
a) Scumming
b) Pilling on blankets
c) Proper ink not being transferred
d) a & c

11) What is the relationship between consumption of IPA and Temperature of chiller
a) Higher the temperature, lower the evaporation rate of IPA and thus lower the consumption.
b) Higher the temperature, faster the evaporation rate of IPA and thus higher the consumption.
c) There is no relationship between the two
d) None of the above

12) What issue can arise if we add raw water to refill our tanks
a) Scum
b) Short circuit
c) injury
d) All of the above

13) Does the quality of raw water have an impact on the formulation of our chemicals mix
a) Yes, it does
b) No it does not
c) Yes, it does but the impact is very insignificant
d) Not always

14) What should we add in our raw water to make an affective water chemical mix
    a) IPA
    b) Fountain Solution
    c) a & b
    d) Plate cleaner

15) IPA Stands for
    a) Intense propyl Alcohol
    b) Isopropyl alcohol
    c) Isopropyl Additive
    d) None of the above

16) With good fountain solutions, IPA Dosage should not exceed
    a) 16%
    b) 13%
    c) 10%
    d) 15%

17) If we run too weak IPA we might encounter
    a) Machine feeder issue
    b) Change in color printing
    c) Double printing
    d) Scum

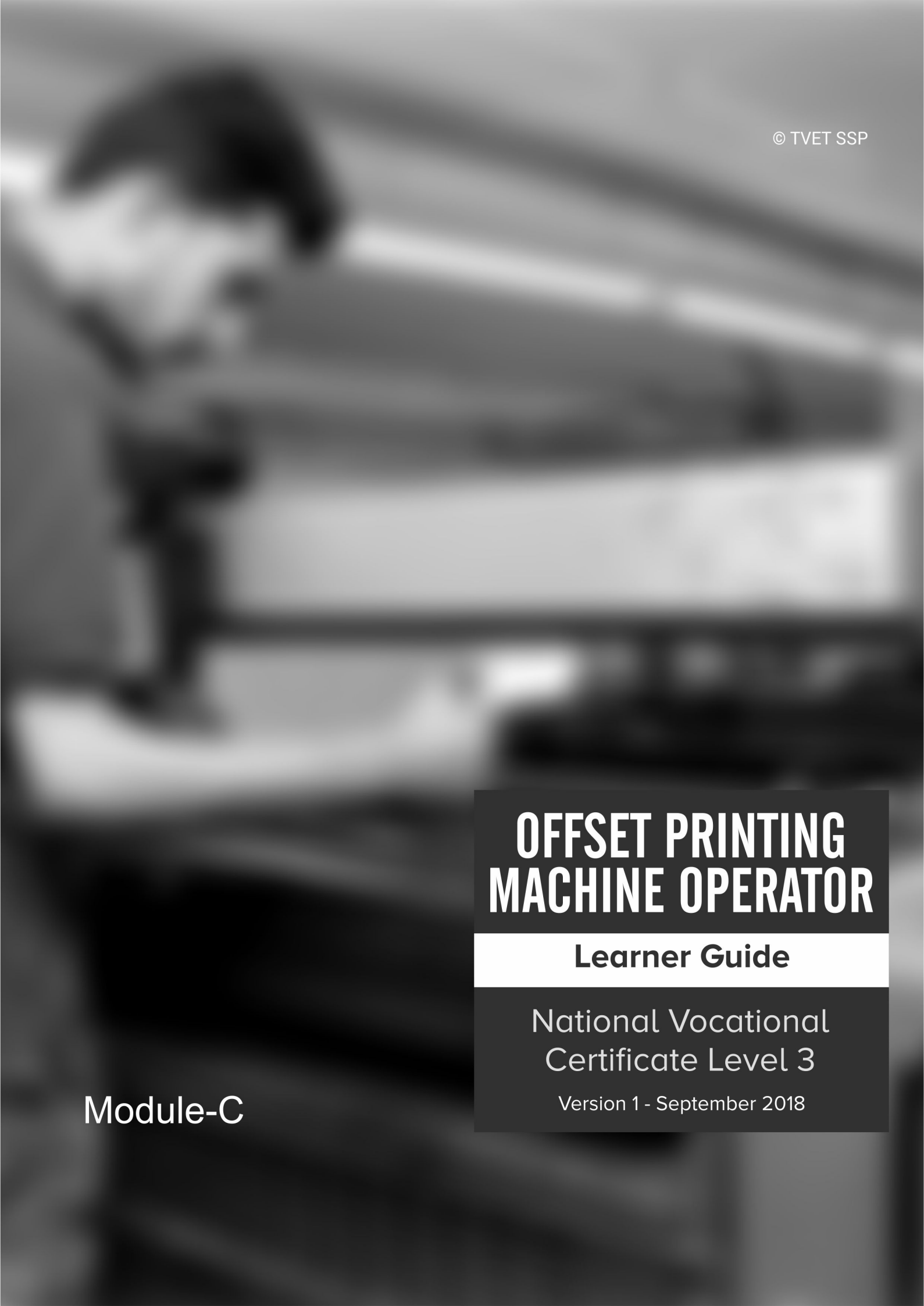
18) What affect does the IPA have on the viscosity of water
    a) No affect
    b) Increases the viscosity
    c) Decreases the viscosity
    d) Increases on the viscosity and also changes the colour of the water.

19) What is the role of fountain solution:
    a) To control the conductivity
    b) To control the pH
    c) A & b
    d) none of the above

20) what are the effects Fountain Solution on conductivity?
    a) Higher the dosage of fountain solution, lower the conductivity.
    b) Higher the dosage of fountain solution, Higher the conductivity.
    c) Remains constant.
    d) There is no link between the two.

Answer Key

MCQ No.	Correct Answer
1	b
2	b
3	c
4	d
5	a
6	b
7	d
8	c
9	b
10	d
11	b
12	a
13	a
14	c
15	b
16	c
17	d
18	b
19	c
20	b



OFFSET PRINTING MACHINE OPERATOR

Learner Guide

National Vocational Certificate Level 3

Version 1 - September 2018

Module-C

Module C: Develop professionalism

Learning Outcomes:

After completion of this module the learner will be able to:

- Identify latest training needs according to recent printing industry demands.
- Get enrolled in advance press training course
- Follow training institutes policies for professional development.
- Perform training task mentioned in TLM.
- Promote kaizen in printing industry.
- Implement of 5S at work place.
- Maintain schedule chart according to organizational policies.
- Provide logistic support for press room machinery during maintenance.
- Adopt upcoming market trends/technological innovations in printing industry.
- Participate in skill competitions for professional development and exposure.
- Participate in skill up-gradation courses with devotion.
- Participate in professional workshop/seminars to be familiar with the emerging market trends.
- Pay scheduled industrial visits.
- Consult seniors/experts.
- Watch videos/documentaries related with printing and packaging industry.
- Perform internet browsing related to printing industry.
- Interpret production plan as per supervisor’s instruction.
- Create daily schedule according to priority of production plan.
- Comprehend material priorities to enhance production.
- Identify list of required tools for off-set machine.
- Calculate time required for production.
- Prioritize sequence of activities.
- Report production delays to supervisor.

Learning Unit 3-1:

Participate in in-house training

Overview:

This learning unit describes the importance of Industrial Kaizen and housekeeping through check sheet. It also emphasizes to applying basic mathematical and Basic English skills in the pressroom with the identification of TLM /curriculum. Finally it describes the importance of being a good team player.

Importance of Industrial Kaizen:

KAI ZEN

改善

Change for Good

> Remember:
> Job training empowers people to realize their dreams and improve their lives

Kaizen is a manufacturing tool which improves quality, productivity, safety, and workplace culture. This occurs by applying small daily changes that yield major improvements over time. Kaizen comes from two Japanese words: Kai (change) and Zen (good). Over time, it became known as “continuous improvement.” Unlike many business practices Kaizen’s strength comes from requiring all workers—from the CEO to the shop floor assistant—to contribute suggestions to improve the business.

Kaizen provides one simple principle: look at how things can be improved, improve them, and then improve them again and again. You can do this by using Plan-Do-Check-Act (PDCA), empowering workers to find problems, develop solutions and apply solutions in a continuous cycle.

Using Kaizen will result in many benefits. Some of the expected benefits will be:

- Increased productivity
- Improved quality
- Better safety
- Lower costs
- Improved customer satisfaction

What is 5S?

5S is the foundation of all improvements and it is the key component of establishing a visual Workplace.

A 5S program focuses on having visual order, organization, cleanliness and standardization. The results you can expect from a Five S program are: improved profitability, efficiency and safety.

The principles underlying a 5S program at first appears to be simple and obvious. However, when implemented in a disciplined manner can be very beneficial for the organization.

Housekeeping:

To work efficiently, checklist is important so that steps are carried out in the intended sequence. Pressroom housekeeping means to keep the offset printing workstation clean and organized. The following steps may be taken:

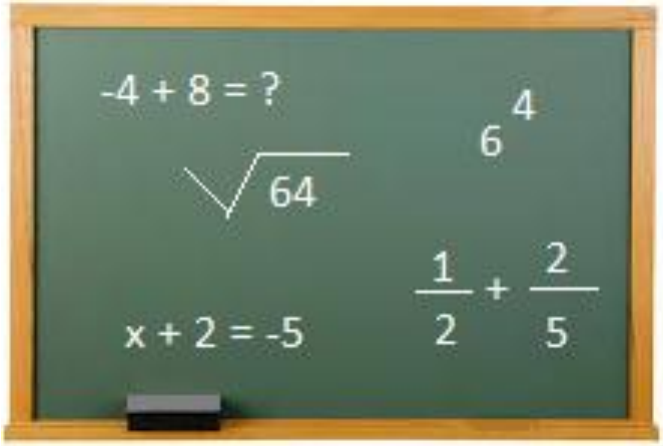
- Labeling of tools and equipment so that they do not get mixed with other machine operators
- Organizing tools in order for an easy Access.
- Ensure routine Cleaning of the work table and machine.
- Dispose-off waste in the designated area.

BEFORE

AFTER

Press room mathematical skills during training:

Understanding of basic arithmetic skills like addition, subtraction, multiplication and division is necessary to perform better role of press room operator.

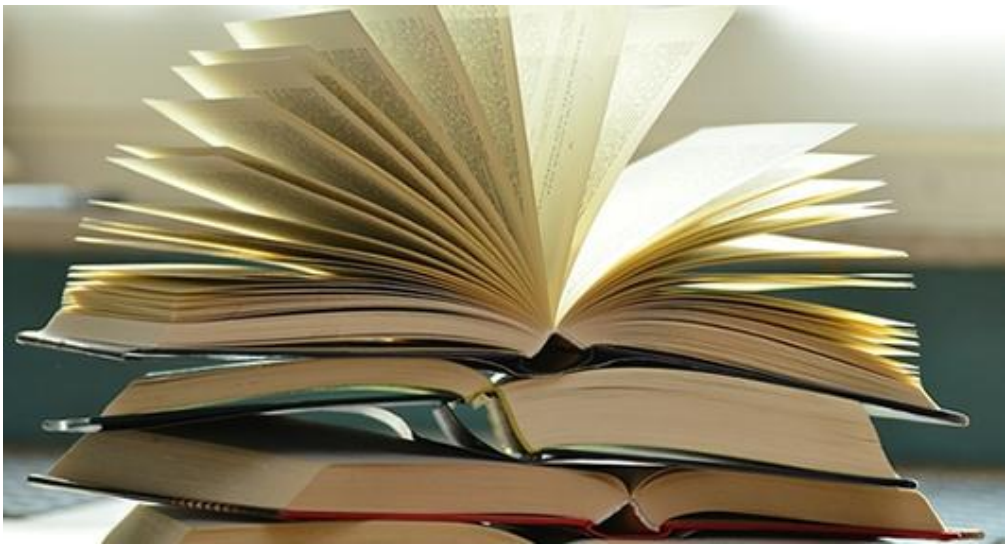


Basic English skills during training:

An eligible pressroom operator should also have basic English skills, since most of the machine manuals and instructions are in English. This skill will also be beneficial to him/her for better understanding during training sessions.

Teaching Learning Material (TLM):

Teaching learning materials (TLMs) are, tools, which are used by teachers to help learners to learn concept with ease and efficiency. TLMs also help learners achieve the learning outcomes after classroom teaching and learning.



Examples

Teaching materials can refer to a number of teacher resources; however, the term usually refers to concrete examples, such as worksheets or manipulative (learning tools or activities that students can handle to help them gain and practice facility with new knowledge). Teaching materials are different from teaching “resources”, the latter including more theoretical and intangible elements.

> Teaching material can support student’s learning and increase their success.

Students Learning Support

Learning materials are important because they can significantly increase student achievement by supporting student learning.

Curriculum:

A **curriculum** is the combination of instructional practices, learning experiences, and students' performance assessment that are designed to bring out and evaluate the target learning outcomes of a particular course.

Typically refers to the knowledge and skills trainees are expected to learn, which includes the leaning standards or learning objectives they are expected to meet; the units and lessons that teacher teach. The assignments and projects given to learners; the books, materials, videos, presentations and readings used in a course and the tests, assessments and other methods used to evaluate learners.

Importance of being a good team player:

Pressroom is run by a team; if one fails performance decline has a cascading effect. A team player does not only do his/her task well but also helps his/her fellow team members to do well. In a pressroom your inputs are someone else’s output and your output is someone else’s input, if one deliverable in this chain is flawed the final result is flawed thus rendering all the hard work useless.

Effective teamwork in the workplace helps drive the organization towards success.

Remember:

In a pressroom your inputs are someone else's output and your output is someone else's input

Here are some qualities that can make a team player outstanding in the workplace:

1. **Show Genuine Commitment**

   Team players are genuinely committed to their cause. Good team players might make sure they are in the work place when needed, but great team players will make ”work” time worth it and contribute as much as possible. They always strive for excellence.

2. **Be flexible**

   Instead of sitting on the bench watching the rest of the crew perform, an outstanding team player wants to see the magic happen through his/her efforts as well. They are flexible to the situations thrown their way, and they participate and tackle challenges without showing too many signs of stress or pressure.

3. **Don't stay in the shadows**

   It is not in your interest to just sit quietly and get your work done. It's a good thing to involve others, as long as you are not bothering people with questions you already know the answer too. Great team players come to their teammates having prepared their ideas clearly.

4. **Be reliable and responsible**

   An excellent team player will be reliable and responsible. They complete the tasks in order of priority, not necessarily in order that they're given. When you're not sure of what should take priority, ask your supervisor.

5. Actively listen

You are only a team player if you respectfully consider the viewpoints and ideas of other people as well. This is why diverse teams have the potential to be so effective, and it all depends on active listening.

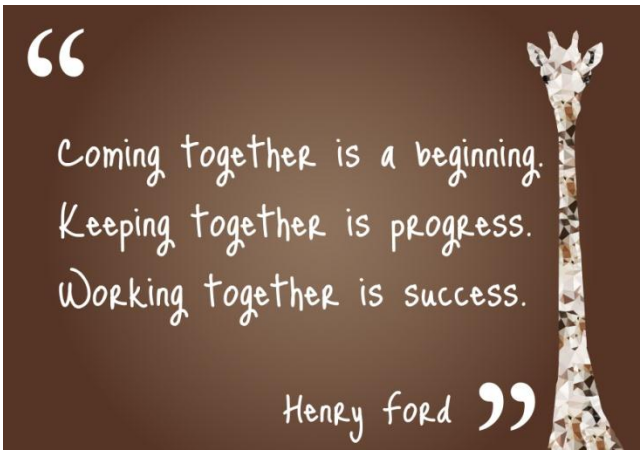
6. Keep your team informed

Share your opinion, ideas and expertise without trying to come up with a plan for taking credit for it.

Transparency is a key on a team, so keep your team members informed. Planning for your own success is important, but your career progression may have a lot to do with how you communicate with other team members.

7. Always be ready to help

Even if it is not in your job description, be generous with advice to help team members. For example, if a member is having trouble with a technology tool that is easy for you, offer to sit down with him and show him what you know.



8. Support and respect others

It is important to become more self-aware of how you treat others. Remember, you'll receive respect when you give it to others. An ideal team player knows how to have fun, but he would never do it at someone else's expense.

9. Be a problem-solver

Your team leader may be working on solving problems, but there is no reason why you cannot offer solutions yourself. Your teammates will appreciate your skills and this may pay off later when your supervisor is assessing your progress.

10. Recognize when you are wrong

A good team player will back off an idea when it becomes clear it's not the right path. If you believe strongly that your team is making a mistake, you can find a way to come back to the issue when the time is right, but being a stubborn stick in the mud is not quality of a good team player.

Practical Activity:

Module: C	**Develop professionalism**	
	Learning Unit: 3-1	Participate in indoor training
	Practical Description:	Clean workstation
Time:	45 min	
Equipment	N/A	
Tools	Cleaning cloth, Dustpan	
PPE	Proper dress code, safety gloves, safety shoes	
Materials	Cleaning agent, caution signs	
Key Point	Oil and water on the floor should be properly cleaned so that no residue is left	
Learning Outcome:	Clean and organized workstation	

Precautions:	When using hazardous chemicals, read manufacturer's instructions for safety

Instructions	**Illustrations**
1. Check for dust, debris, water and oil spill around the work floor	
2. Pick up a clean cloth and wipe the floor	
3. Collect the dust and debris in a dustpan	
4. Ensure cleanliness of oil spots on the floor/working table	 

5. Perform drying of wet floor with the help of cloth.	
6. Mark the freshly cleaned area with a caution sign	

Learning Unit 3-2:

Participate in outdoor training

Overview:

This learning unit focuses on keeping in touch with press training providers. It states importance and methods of time management and also helps the learner to identify press room Key Performance Indicators (KPIs)

Keep in touch with press training providers:

To keep on progressing, you need to upgrade your knowledge and skill which can be acquired through trainings. You should keep in touch with your supervisor and inform him about your eagerness to learn, so he/she may remember your name for next training session organized by the industry.

Skills above and beyond the basics of printing, can give you a professional advantage.

Here are the five ways to keep your knowledge, skills and abilities up-to-date.

1. Take Professional Development Courses

Professional development courses can help you expand your professional skill set e.g. Supply chain workshop, Total Quality Management workshop etc.

> Remember:
> Purpose of training is to tighten up the slack, toughen the body and polish the spirit.
>
> **Morihei Ueshiba**

2. Utilize Online Resources

The Internet is a limitless source of information and training resources (Like You Tube and Lynda.com etc). Online training courses are particularly convenient because they are affordable and flexible some OEMs published tutorial videos online which particularly useful.

3. Attend Professional Events

Professional events are valuable ways to learn about growth and development in printing industry. Local companies, business associations, and professional groups often host seminars, exhibition, forums, or workshops that can give you direct access and insight to experts in your profession. Print Pak is the largest printing exhibition organized by Pakistan Association of Printing and Graphic Arts Industry which also includes free training workshop and seminars by local and international resource persons.

4. Use Social Media

Look for domestic and international industry experts on social media platforms (Facebook, Twitter etc.) and seek their professional advice for career development and workplace problems.

5. Participate in Continuing Education and Certification

Becoming proficient in a new technology platform before it becomes mainstream, committing to upholding industry standards through a certification program, or staying on top of market trends by taking a class can help you position yourself well in the workplace.

No matter which tactic you choose, maintaining expertise in your field shows your supervisor that you are well informed and dedicated.

Press room Key Performance Indicators (KPIs)

Key Performance Indicator (KPI) is a tool, used in a workplace to measure that how effectively they are achieving their goals. KPI is a way for businesses to quantify their business objectives so they can regularly check up on their performance and determine where they are successful and where they need to improve.

In a press room KPIs may be as follows.

- Percentage of defective prints compared to total number of units produced

- Percentage of on-time deliveries
- Consumable efficiency
- Job turn over

Importance and methods of time management:

Time Management refers to managing time efficiently so that the right time is allocated to the right activity. Effective time management allows individuals to assign specific time slots to perform activities as per their importance. Time Management refers to making the best use of time as time is always limited.

Ask yourself which activity is more important and how much time should be allocated to the same in consultation with supervisor? Know how to prioritize the jobs. Time Management includes:

i. Effective Planning
ii. Setting goals and objectives
iii. Setting deadlines
iv. Prioritizing activities as per their importance
v. Spending the right time on the right activity

For Effective Time Management one needs to be:

i. **Organized –** Reduce pending tasks. Put important documents, tools and consumables in their respective place with proper labeling so that your equipment do not get mixed with other colleague's equipment. It saves time which goes on unnecessary searching

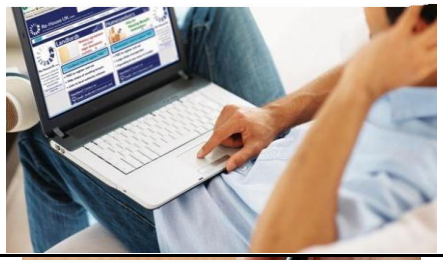
ii. **Don't misuse time -** Do not kill time by loitering or gossiping around. Concentrate on your work and finish assignments on time. Remember what you are being paid for, it is our social as well as religious obligation to 'Halal' your earnings. Don't wait till the last moment to submit your work.

iii. **Be Focused -** One needs to be focused for effective time management.

Develop the habit of using planning documentation for better time management. Set reminders for periodical maintenance and tools check.

Practical Activity:

<table>
<tr><td rowspan="3">Module: C</td><td colspan="2">Develop professionalism</td></tr>
<tr><td>Learning Unit: 3-2</td><td>Participate in outdoor training.</td></tr>
<tr><td>Practical Description:</td><td>Collect information about the new printing training courses available</td></tr>
<tr><td>Time:</td><td colspan="2">2 hrs</td></tr>
<tr><td>Equipment</td><td colspan="2">Computer with internet</td></tr>
<tr><td>Tools</td><td colspan="2">Training brochures</td></tr>
<tr><td>PPE</td><td colspan="2">N/A</td></tr>
<tr><td>Materials</td><td colspan="2">Tools/equipment list, Training provider’s brochures, TLM</td></tr>
<tr><td>Key Point</td><td colspan="2">Stay focused when browsing for new training opportunities</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">Learner will be able to collect information about the new training courses available</td></tr>
<tr><td>Precautions:</td><td colspan="2">Identify a field of work to get your advanced training in.</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Make a list of your current activities in the pressroom and identify your weak points which needs to be improved</td><td>  </td></tr>
<tr><td colspan="2">2. Take input from your classmates and trainer and ask them what should be your next training</td><td>  </td></tr>
</table>

3. Ask your trainer which institutes offer training in the mentioned functions collect brochures if available	
4. Browse the internet for specific printing training institutes	
5. Note down the contact information for the course being offered	
6. Call the institute and ask for the timing and duration of the course	
7. Inform your trainer/supervisor about the available course and timings and ask them if you can join advance course without disrupting current activities or you will need an exemption from current training/work	

8. Join the advance training course	

Learning Unit 3-3:

Attend trade shows, workshop, seminars

Overview:

After completion of this learning unit the learner will be able to understand the benefits of latest printing technologies by getting involved in seminars/workshop and by reading related books/magazines.

Trade show:

An industrial event where different or same trade organization show case their latest products, services and techniques. it is a platform to meet industry partners and customers and to understand recent market trends and explore new technologies.

It is necessary for an offset printing machine operator that he/she prepare himself / herself for the requirements of new techniques in printing industry. It is very important to attend seminars with devotion and concentration to get a wide variety of informative topics related to printing industry.

Industrial visit:

It is also a part of professional courses, during which students pay visit to the relevant industry to get exposure to the real working environment.

Other best way to get knowledge and information is through watching videos/documentaries, and browsing on internet related to your interest areas.

Benefits of latest machining techniques and developments:

The offset technology has been the standard in the printing world since 1903. It is a traditional solution perfect for customers looking for high volume printings, cost effective methods, flexibility and the most important thing: top quality results.
A really impressive degree of details and clarity is one of the most major benefits of offset printing.

Getting the latest knowledge of the technology and evolving with the market trends are the key factors to progress.

Off-set Printing technology is continuously improving in:

- **Production speed**
- **Production quality**
- **Production efficiency**

Need of skill sets by getting involved in seminars:

Professional personnel attend following events to enhance their knowledge and skills:

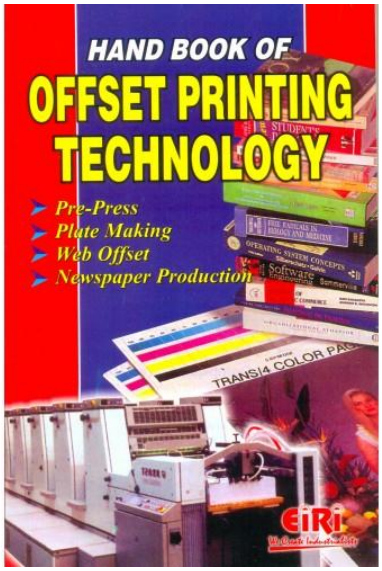
- Seminar
- Workshops
- Meetings
- Discussions
- Competitions
- Exhibitions

Attending such kind of above programs can improve the following skill sets:

- Improving communication skills
- Gaining expert knowledge
- Networking with others and renewing motivation
- Enhance confidence level

Read books/magazines related with mechanical manufacturing trade:

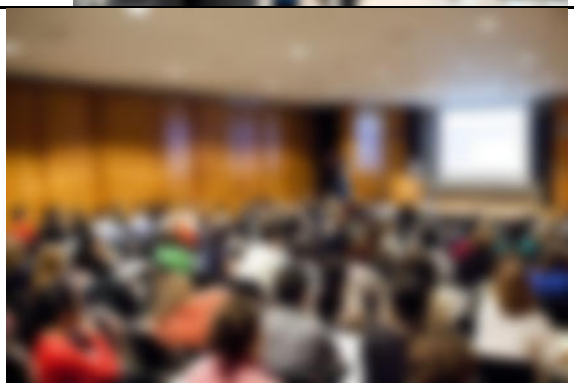
Reading the related books and magazines to get the knowledge a person can get much information out of it according to the area of interest. Books or industrial magazines are the best way to be updated of the market trends.



Practical Activity:

Module: C	Develop Professionalism

	Learning Unit: 3-3	Attend trade shows, workshop, seminars
	Practical Description:	Attending the shows related to the printing industries. Seminars and workshops for knowledge on latest printing techniques and innovative technologies.
Time:	6 hours	
Equipment	N/A	
Tools	N/A	
PPE	N/A	
Materials	National and International Magazines and Operation Manual	
Key Point	Ensure access to the relevant offset printing information	
Learning Outcome:	Get aware to the upcoming market trends in printing trade by attending trade shows, workshops and seminars	
Precautions:	Gain first hand industrial knowledge by participating in professional seminars.	

Instructions	Illustrations
1. Visit offset printing exhibition to get exposure of latest techniques and technologies.	
2. Attend seminars to get updated with the latest printing techniques.	

3. Read printing magazines and improve the knowledge up to date with all the news and innovative technologies.	
4. Attend workshops related to the printing press for knowledge of the workflow of a printing press	

Learning Unit 3-4:

Prioritize job schedule

Overview:

Production planning and control is a tool, available with management to achieve desired production/target. Thus, a production system is comprised of four factors i.e. quantity, quality, cost and time. This learning unit describes the production plan and its advantages.

Remember:

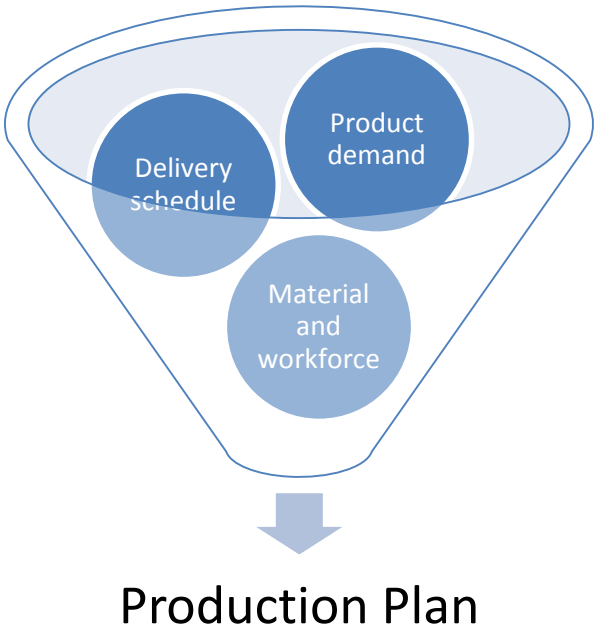
The key is

"Not to prioritize what's on schedule, but schedule your priorities".

Stephen Covey

Production plan:

Production planning starts with the analysis of the given data, i.e., demand for products, delivery schedule, availability of required material and availability of workforce etc. On the basis of the information available, a scheme of utilization of firm's resources like machines, materials and manpower are worked out to achieve the target in the most efficient way.



The objective of production planning and control is **to manage the materials and organizational capacities based on the customer needs**. Thus production planning enables the industry professionals to deliver high quality products and fulfill customer demand efficiently.

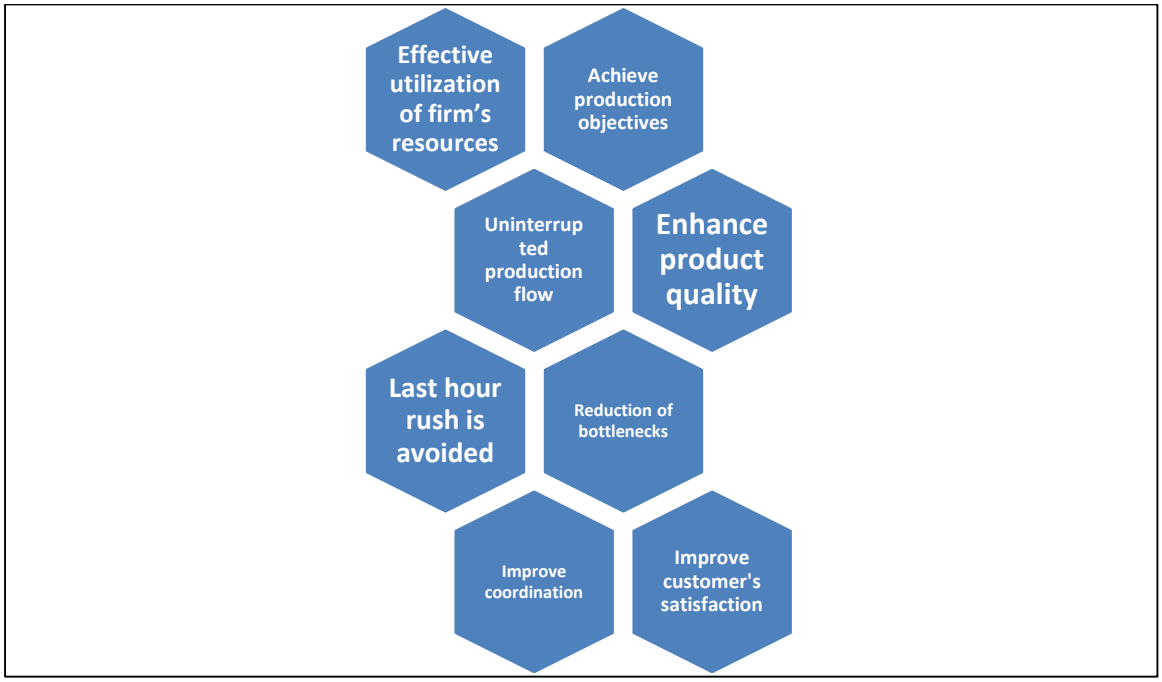
> Do you know?
>
> Production planning and control can be defined as the “direction and coordination of firm’s resources towards attaining the prefixed goals”.

Production Plan Example:

Production Plan									
SORK-1					**SORK-2**				
Shift	**Job No**	**Job Name**	**Time (Hours)**	**Delivery date**	**Shift**	**Job No**	**Job Name**	**Time**	**D.D**
MACHINE AND WORKSTATION CLEANING									
21A	G-166A		3.00	10.11.17	21A	G-004A		4	30.11.17
23A	G-134 G-135		1.00	10.11.17					
1 HOUR LUNCH AND PRAYER BREAK									
24A	G-262A		1	10.11.17	24A	G-008A		3	30.11.17
24A	G-262 B , D		2	10.11.17	25A	G-0066A		3	30.11.17
24A	G-263A		2	10.11.17	26A	G-0023A		1	30.11.17
MACHINE AND WORKSTATION CLEANING									

Advantages of maintaining production plan:

The implementation of production planning yields various advantages to any industry for functional activities, which includes the following:



Practical Activity:

<table>
<tr><td rowspan="3">Module: C</td><td colspan="2">Develop Professionalism</td></tr>
<tr><td>Learning Unit: 3-4</td><td>Prioritize job Schedule</td></tr>
<tr><td>Practical Description:</td><td>Interpret docket / job card</td></tr>
<tr><td>Time:</td><td colspan="2">45 min</td></tr>
<tr><td>Equipment</td><td colspan="2">N/A</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">N/A</td></tr>
<tr><td>Materials</td><td colspan="2">Docket / job card, log book</td></tr>
<tr><td>Key Point</td><td colspan="2">It is important to correctly interpret the job card in order to avoid confusion</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to interpret the job from docket or job card</td></tr>
<tr><td>Precautions:</td><td colspan="2">Read carefully, do not miss out information.</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Collect the docket/job card</td><td> 
</td></tr>
</table>

2. Match the details with the provided equipment, materials and tools	
3. Match the size of substrate and number of plates provided with the docket/ job card.	
4. If found any error, report to the supervisor	
5. Note the time required for the job and the time available in the shift	
6. Start the printing process	

Summary of the module

- To keep on progressing, you need to upgrade your knowledge and skill which can be acquired through trainings.
- A pressroom operator must have basic Math's knowledge for better material handling and calculation.
- A good pressroom operator should also have Basic English since most of the machine manuals and instructions are in English.
- A team player does not only do his/her task well but also helps his/her fellow team members to do well.
- Teaching learning materials (TLMs) are, tools, which are used by teachers to help learners to learn concept with ease and efficiency. TLMs also help learners to achieve the learning outcomes after classroom teaching.
- A curriculum is the combination of instructional practices, learning experiences, and students' performance assessment that are designed to bring out and evaluate the target learning outcomes of a particular course.
- Kaizen comes from two Japanese words: Kai (change) and Zen (good). Over time, it became known as "continuous improvement." Using Kaizen will result in many benefits. Some of the expected benefits will be:

    - Increased productivity
    - Improved quality
    - Better safety
    - Lower costs
    - Improved customer satisfaction

- 5S is the foundation of all improvements and it is the key component of establishing a work friendly press room. 5S stands for: Sort, Set in order, Shine, Standardize and Sustain.
- Key Performance Indicators (KPI) is a way for businesses to quantify their business objectives so that they can regularly check up on their performance and determine where they are successful and where they need to improve.
- Time Management refers to managing time efficiently so that the right time is allocated to the right activity. Effective time management allows individuals to assign specific time slots to perform activities as per their importance.
- Pressroom housekeeping means to keep the offset printing workstation clean and organized.
- Trade show is a platform to meet industry partners and customers and to understand recent market trends and explore innovative technologies. Professional personnel attend following events to enhance their knowledge and skills:
    - Seminars
    - Workshops
    - Meetings
    - Discussions
    - Competitions
    - Exhibitions
- Books or industrial magazines are the best way to be updated of the market trends.
- Production planning and control can be defined as the direction and coordination of firm's resources towards attaining the prefixed goals
- The objective behind the production planning and control is **to plan and manage the materials and organizational capacities based on the customer needs**. Thus production planning enables the industry's professionals to fulfill demands of customer.

Frequently Asked Questions

(FAQs)

Question	Answer
1. What will be the timing of training delivered at the workplace?	Training would be delivered in the routine working hours.
2. Why is English important for a machine operator?	A machine operator has to consult the machine manuals or instructions on products which are usually in English.
3. Why basic Arithmetic operations (Addition, subtraction, multiplication and division) are important for machine operator?	In a pressroom, machine operator has to do some basic mathematical operations, like production time calculation and substrate measurement.
4. How can I be a team player if I concentrate on my job only?	Printing is a team work. Being good at your own job is not the only key to success. Helping coworkers and working as a team is equally important.
5. Why kaizen is important?	Kaizen is important to ensure improvement and to remain competent in the modern workplace
6. Does my KPI ensure my progress?	Achievement of KPIs will ensure your career progress.
7. Is time management of the workplace is responsibility of the machine operator?	Yes, because time management is an integral part of a production plan.
8. Why should machine operator indulge in housekeeping?	Housekeeping is part of machine operator's duty which results in provision of work friendly environment.
9. Why labeling of the tools is important?	By labeling tools and equipment, they cannot be mixed with other machine operators

10. Why participation in trade shows, workshops and seminars is important?	Participation in the trade shows, workshops and seminars is important as it familiarize the participants with new printing techniques and knowledge.
11. What do you mean by latest techniques in printing?	Latest printing techniques means ways to perform the job in a smarter and faster manner.
12. What are the benefits of latest printing techniques?	Benefits of latest printing techniques are • Good quality printing • Faster work flow • Less wastage of time and material
13. Who should attend trade shows, workshops and seminars?	Everyone who is related to the industry must attend trade show, workshops and seminars because they are very useful.
14. Why it is important to read printing related books and magazine?	It keep updated with the news in the industry and knowing what other competitor and business institutions are doing.
15. What is production planning	Direction and coordination of firms' resources towards attaining the prefixed goals.
16. What does production plan demand?	Product and Delivery Schedule
17. What is the advantage of production planning?	Production planning helps the company to supply quality products efficiently.

Self-Assessment
(MCQs)

Please mark the correct one from the given options. You can check your answer with the Answer Key at the end of this module.

Q 1: With whom should you keep in touch in order to know about the new training opportunities in your organization?

a) Family
b) Supervisor
c) Current affairs
d) Other companies

Q 2: Most product descriptions and machine manuals are in:

a) English
b) Russian
c) Binary code
d) American

Q 3: In a pressroom, it's important to be a:

a) Fast talker
b) Religious preacher
c) Good team player
d) Runner

Q 4: KPI means?

a) Kilo per inch

b) Knowledge press integration
c) Potassium per Induim
d) Key Performance Indicator

Q 5: What is Kaizen?

a) A Japanese sword
b) A management method
c) Judo technique
d) Lab chemical

Q 6: What are the 5 S's?

a) Sort, set in order, shine, standardize and sustain
b) Solar, sunshine, substance, solution and solvent
c) Sub-ordinate, socializes, sustain, sort and Short
d) None of the above

Q 7: To do good time management, one needs to be:

a) Lawful
b) Fit
c) Organized
d) Tough

Q 8: What are trade shows?

a) Dinner gathering
b) Where companies show their new technology and techniques.
c) Game shows
d) Class.

Q 9: Benefit of workshops:

a) Enhance skills
b) Develop healthy life style.
c) Develop eating habit.
d) Meeting friends.

Q 10: Who should attend trade shows?

a) People related to same industry
b) Hotel staff.
c) Cricket team.
d) Teachers

Q 11: Benefits of adopting new techniques?

a) Good hand writing.
b) Good quality/smart work
c) Good health.
d) Build up stamina

Q 12: Utilization of firm's resources like machines, materials and men are worked out to obtain the target in the most economical ways called _____.

a) Time table
b) Production Plan
c) Event Plan
d) None of the above.

Q 13: Which of the following is objective of production planning?

a) Meetings

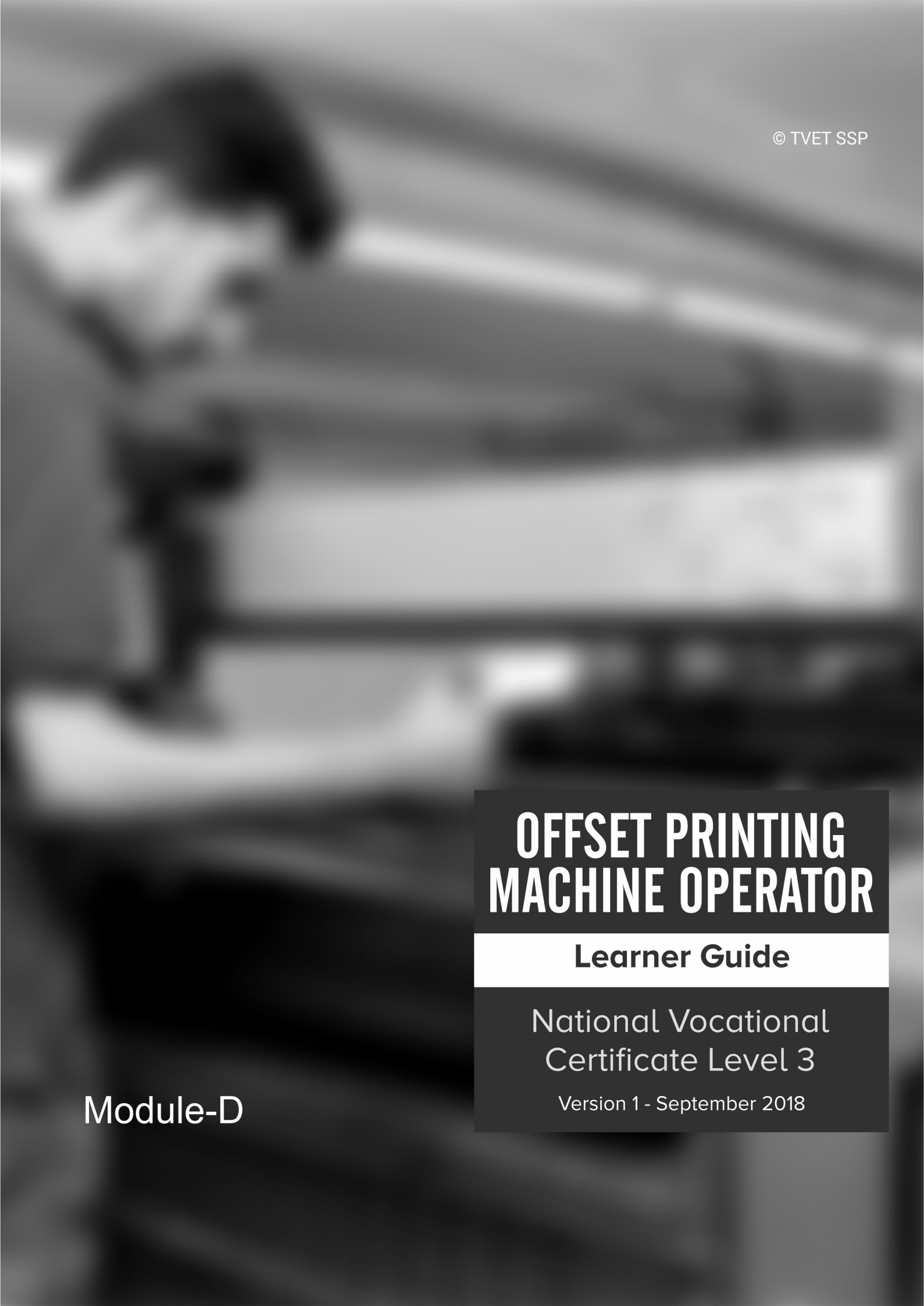
b) Result
c) Quality
d) None of the above

Q 14: Match the size of _____ and number of plates provided with the docket/ job card:

a) Substrate
b) Plate
c) Product
d) None of the above

Answer Key

MCQ No.	Correct Answer
1	b
2	a
3	c
4	d
5	b
6	a
7	c
8	b
9	a
10	a
11	b
12	b
13	c
14	a



OFFSET PRINTING MACHINE OPERATOR

Learner Guide

National Vocational Certificate Level 3

Version 1 - September 2018

Module-D

Module D: - Perform communication

After completion of this learning unit the learner will be able to:

- Determine communication styles,
- Investigate issue /problem through relevant questions,
- Demonstrate courteous behavior while listen to the people,
- Perform phone conversation applying time management concisely.
- Display body language while communicating to a customer to show attention,
- Communicate within department as per sops.
- Opt language for commanding.
- Develop a strategy for using communication skills,
- Convey ideas to the supervisor precisely,
- Report safety hazards to supervisor urgently,
- Maintain good working relation with supervisor.
- Communication with other departments,
- Communicate effectively with colleagues, peers, the community and other related personals to exchange information,
- Interact with other professionals through effective teamwork,
- Enlist names and address of printing press related people and organization.
- Interpret e-mail received on personal e-mail address,
- Prepare e-mail for vendor applying e-mail writing ethics,
- Send e-mail to vendor enclosed with picture of print design.

Learning Unit 4-1:

Make telephone calls

Overview:

This learning unit deals with listening practice, adopting questioning techniques to lead actual problem, demonstrating ethics and moral techniques to deal with all the stack holder related to the printing trade.

Necessity of phone calls:

Even in these days of texting and email, the phone is still most business's primary point of contact with customers and the way your company's phone is answered will form your customer's first impression of your business.

If the person answering the call is unprofessional, it may be that customer's last impression, too! Here's how to answer the phone properly and win business instead of losing it.

How to handle customer complaints/enquiry over the phone:

Anybody who comes in contact with you is a customer.

Making the customer feel good doesn't mean that you have to cave in to their demands but it does mean that you have to show them respect and let them know that you appreciate their call. And you can genuinely do this if you believe that customer complaints are a good thing.

If someone phones up and complains we have a chance of doing something about it or influencing the caller's opinion in a positive way.

Following are the process and tactics for dealing with difficult telephone calls from customer;

1. **Recognize there is a problem**
   You don't get a different ring tone when a caller is going to complain or act in an unpleasant manner. Difficult calls can catch you with your defenses down. Recognize if someone is agitated. Pick up the vocal signs that alert you to potential difficulties.

2. **Acknowledge their issue or frustration**
   Show your appreciation and use blameless apologies e.g.
   "Thanks for taking the time to call"
   "I'm sorry to hear that"

3. **Actively listen**
   Don't start thinking about how to respond. Instead, focus on the caller. Make notes and don't interrupt

4. **Clarify and confirm understanding of their issue**
   Be patient with them even if they aren't patient with you. Often people don't explain themselves coherently and clearly when they are emotional. If necessary, ask further questions and restate your understanding of the problem.

5. **Find out what your customer wants**
   some customers simply need to blow off steam (perhaps justifiably) but don't

really expect anything to be done. In this case, you have helped simply by listening respectfully. If a solution is required, ask what they would like you to do. Sometimes, customers aren't clear about their expectations and by answering your questions it helps them to clarify or analyze what they really want to happen.

Remember: While attending a complaint call from customer; **Be curious rather than defensive.**

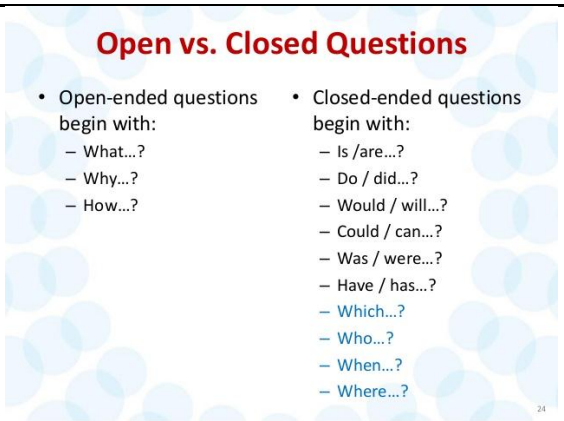
6. **Share information and suggest alternatives**
   now is not the time to dictate terms to the customer – they have just calmed down. Yet this is a mistake some people make. The danger words here are *"You'll have to...."* or *"You can't...."*

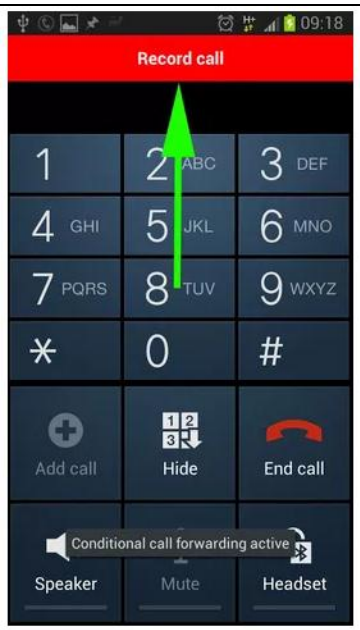
There may be occasions when your organization's policy or procedures prevent you from doing exactly what your caller would like. It's important at those times to share that information with them.

7. **Close the call with confidence**
   Take responsibility for the follow up and.... follow up.

Practical Activity:

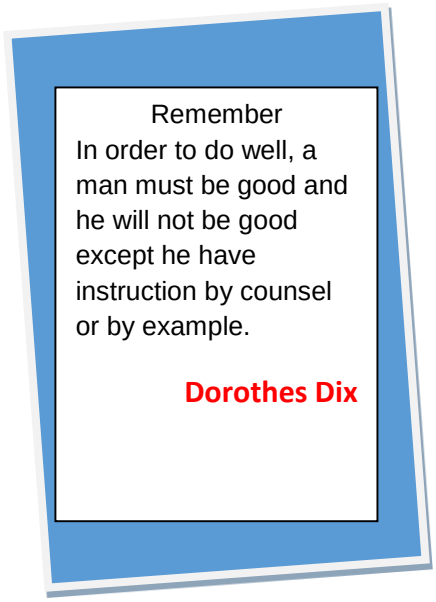
<table>
<tr><td rowspan="3">Module: D</td><td colspan="2">Perform Communication</td></tr>
<tr><td>Learning Unit: 4-1</td><td>Make telephone calls</td></tr>
<tr><td>Practical Description:</td><td>This practical activity helps how to record information on telephone call</td></tr>
<tr><td>Time:</td><td colspan="2">2 Hours</td></tr>
<tr><td>Equipment</td><td colspan="2">Telephone</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code</td></tr>
<tr><td>Materials</td><td colspan="2">Note pad, Pencil</td></tr>
<tr><td rowspan="2">Key Point</td><td colspan="2">To make telephone calls company’s policy must be considered</td></tr>
<tr><td colspan="2">Adopt courteous behavior</td></tr>
<tr><td rowspan="3">Learning Outcome:</td><td colspan="2">Communication styles</td></tr>
<tr><td colspan="2">Investigate issues/problems</td></tr>
<tr><td colspan="2">Perform phone conversation applying time management concisely
Be polite and brief over the phone call.</td></tr>
<tr><td>Precautions:</td><td colspan="2">Be professional.</td></tr>
</table>

Instructions	Illustrations
Communication style on telephone call: Telephone calls may be broken into three major parts. (1) the introduction, in which both parties establish their identity and the convenience of the call (2) the purpose, which involves communicating needs by asking well-constructed questions (3) the conclusion, whereby both parties reach a verbal agreement on the points made during the call and any specific action that needs to be taken	
Open questions: These questions call for more than a yes/no answer and often begin with who, what, where, when, why or how. Closed questions: These questions are used primarily to verify information. Often these questions begin with are you, do you, can, could, did, will, or would.	

Call Record for: Enquiries Complaints	

Learning unit: 4-2

Instruct labors



Overview:

This leaning element deals with how to communicate with labors, Vendors and other organization(s). This unit covers how to control the emotions, what should be the language to instruct the labors.

Factors required to communicate effectively and precisely within same organization:

Here are some factors that promote effective communication with labors and other coworkers:

- Instructions should be clear.
- Behavior with the labors should be serious
- Speak with labors respectfully
- Selection of language for communication should be appropriate

Elements required to deal with vendors and the other organizations:

The businesses and individuals that provide goods and services to an organization are considered its vendors. A company could work with a few, dozens, or even hundreds of different vendors, all with different contract terms, pay rates, and points of contact.

You need good and reliable vendors/suppliers. When you find them, treat them like gold. Work as hard on building a good supplier relationship as you do building a relationship with your customers.

Let's briefly look at all the ways vendors/suppliers can impact your company.

- **Quality:** Supplier components can positively or negatively affect the quality of your product. Higher quality increases customer satisfaction and decreases returns.
- **Timeliness:** Their timely deliveries are crucial to how customers view your reliability. A quick turnaround can become the key to minimizing your inventory, which in turn translates to less risk of inventory obsolescence and lower cash needs.
- **Competitiveness:** They can give you the one-up on your competition based on their pricing, quality, reliability, technological breakthroughs and knowledge of industry trends.
- **Innovation:** Suppliers can make major contributions to your new product development. Remember, they love their product more than you do; they're working to be on the cutting edge of innovation for their product. The good ones will understand your company, its industry and needs, and can help you tweak your new idea.

Methods to overcome the sentiment:

During work, manager or supervisor should control the emotions for better performing result of labors. If any worker makes a mistake during work, his manager/supervisor should deal it calmly and solve the problem in a good manner.

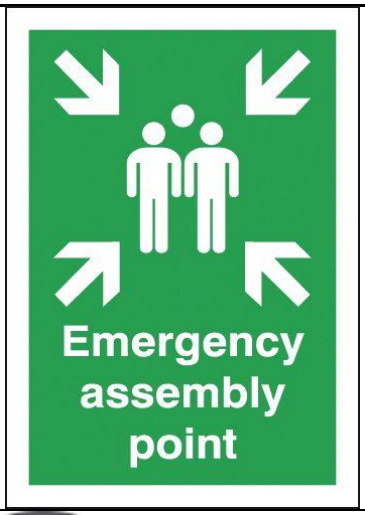
In situation of emergency manager should guide his worker for safe exit and inform the situation to emergency department.

Language which labor could understand elegantly:

Use easy language to instruct the labors so that they can understand the instructions of any specific job. It will help in getting proper work results.

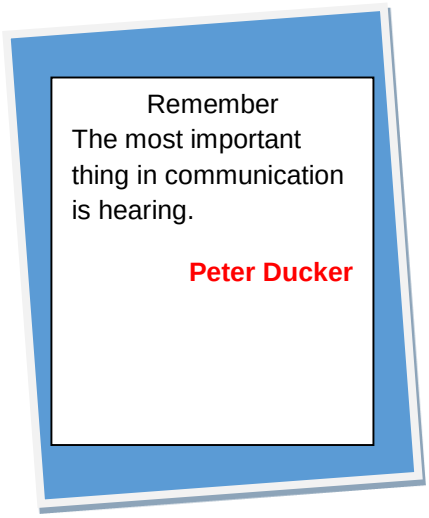
Practical Activity:

<table>
<tr><td rowspan="3">Module: D</td><td colspan="2">Perform Communication</td></tr>
<tr><td>Learning Unit: 4-2</td><td>Instruct labors</td></tr>
<tr><td>Practical Description:</td><td>Prepare labor to handle emergency situation.</td></tr>
<tr><td>Time:</td><td colspan="2">4 Hours</td></tr>
<tr><td>Equipment</td><td colspan="2">Telephone set</td></tr>
<tr><td>Tools</td><td colspan="2">-</td></tr>
<tr><td>PPE</td><td colspan="2">-</td></tr>
<tr><td>Materials</td><td colspan="2">Emergency contact list</td></tr>
<tr><td>Key Point</td><td colspan="2">Maintain Safety at the workplace</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">Communicate effectively during emergency situation</td></tr>
<tr><td rowspan="3">Precautions:</td><td colspan="2">Do not make panic during emergency situation</td></tr>
<tr><td colspan="2">Do not loose courage during emergency situation</td></tr>
<tr><td colspan="2">Follow company emergency policy</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Assess the situation</td><td>  </td></tr>
<tr><td colspan="2">2. Adopt emergency exit to evacuate the floor</td><td> 
</td></tr>
</table>

3. Gather at assembly point away from danger area.	
4. Contact relevant authorities for further assistance	

Learning unit: 4-2

Communicate with supervisor



Overview:

This learning unit will explain the key aspects of both verbal and non-verbal communication, how to listen to and understand others, and how to make the best possible first impression on the people you encounter in and around your business.

Best Skills:

Success in any conversation is likely to be achieved through both parties listening to and understanding each other.

Key communication skills

Useful communication skills for building positive interpersonal relationships include:

- active listening
- understanding non-verbal signals
- maintaining eye contact
- assertiveness
- being mindful of people's individual space
- using positive body language
- Dealing with different point of views.

Personal awareness skills that help with communication include:

- understanding the benefits of a positive attitude
- awareness of how others perceive you
- self-confidence
- Presentation - dressing appropriately

It also helps to consider the circumstances surrounding your communications, such as the situational and cultural context.

Importance of accurate communication:

Effective communication is a vital tool for any individual. You should be able to clearly explain company policies to customers and clients and answer their questions about your products or services. It is crucial to communicate effectively in negotiations to ensure you achieve your goals.

Communication is also important within the business. Effective communication can help to foster a good working relationship between you and your staff, which can in turn improve morale and efficiency.

Indent form (Bill of Material):

Indent form or BOM (Bill of Material) is a company's internal document, which is used to authorize the requisition of materials prior to initiating a purchase order.

Preparation of Indents (BOM):

1. Calculations/Specifications and/or particulars given in the indents must be clear & complete and must be accompanied with all drawings, models and samples & all information necessary for an accurate and complete comprehensive of the demand so that difficulty is not experienced at the time of filling specifications in the Notice Inviting Tender/Purchase Order/Contract agreement.

2. Whenever the quantity of materials indented for, is in excess of quantity used during either of two preceding half years, a clear explanation in support of such increase in demand should be furnished in the remarks column.

3. The maximum and minimum limits proposed for each item of store should be taken into account.

4. The quantities indented should be limited to the barest minimum essential for satisfactory and efficient working.

5. As far as possible, separate indents should be prepared for each category of material.

6. A definite date, by which delivery of stores is required should be given. Even for urgent and immediate indents, It will not suffice to mark 'Urgent' and Immediate' but a definite date by which material is required should be given.

7. Complete dispatch instructions should be given.

8. The following information should also be furnished with the indents:

    a) Quantities available in stock.

    b) Quantities on order.

    c) Quantities indented for.

    d) Consumption during the preceding 12 months as per stock issue registers.

INDENT FORM (BOM)

Indent Number: _____ Date: _____

Sl #	Item Name	Description (includes specification, make, etc)	Qty Required	Qty Available in Stock	Qty Indented For	Remarks

	Name	Signature
Indenter		
Approved By		
Authorized By		

Note: *Indent Number has to be filled by Store Department.*

Maintain work history

Your work history, also known as your work record or employment history, is a detailed report of all the jobs you have held, including the company name, job title, and dates of employment.

Learning unit: 4-3

Maintain relations with people

Overview:

This learning unit is about to maintain occupational relations with coworkers, departments, Printing industry and other professionals in order to function effectively.

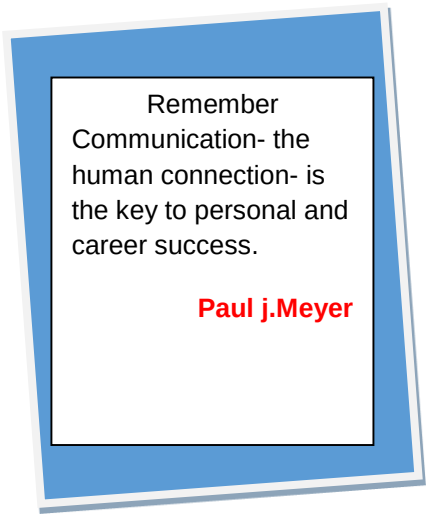
Advantages of maintaining good occupational relations with printing industry people:

Good occupational relation plays vital role in maintaining good business deal with customer as well as coworkers. Making good relation with others printing industry also give advantage to company.

Good workplace relationships and a positive work environment is critical for a successful business, as unhappy staff have a negative impact on productivity and customer service. Good communication makes it easier to address individual problems or concerns between employees and supervisors when they arise.

Learning unit: 4-4

Perform E-mail communication



Overview:

This learning unit deals with effective communication by the use of Internet. It will help trainee to understand the procedure of creating new email, E-mail writing ethics and email sent confirmation.

Creating a new e-mail account:

What is an E-mail?

Electronic mail (email or e-mail) is a method of exchanging messages between people using electronic devices.

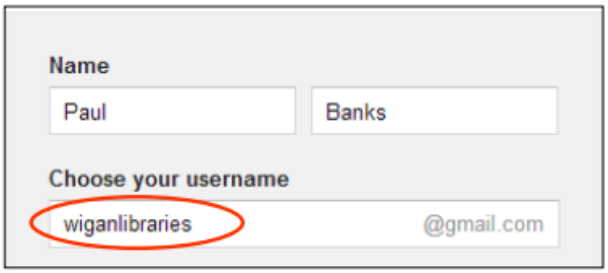
An e-mail account is an arrangement with a company which allows you to send and receive emails.

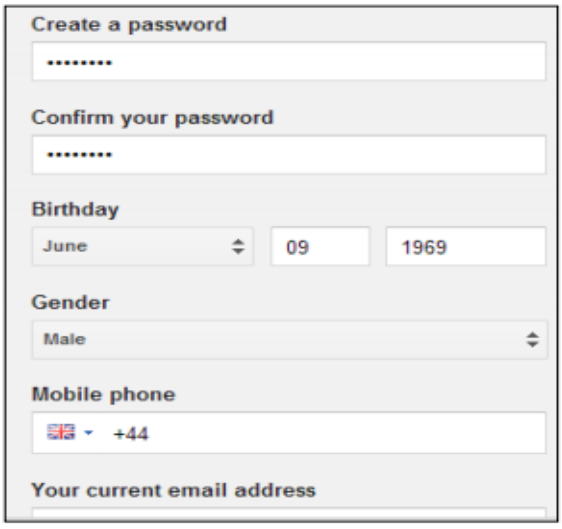
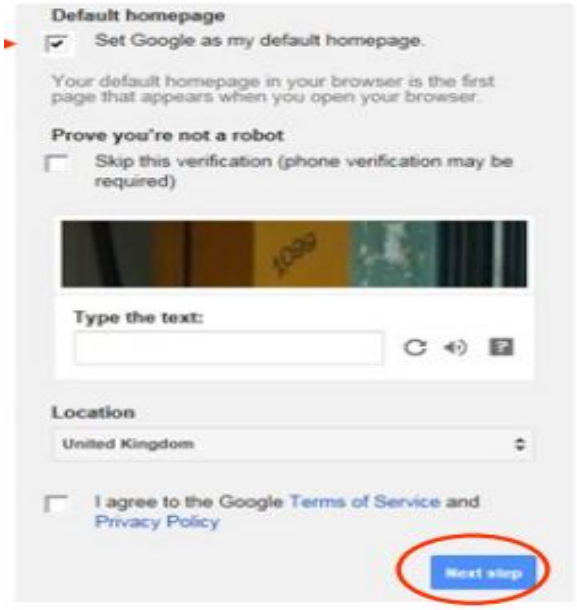
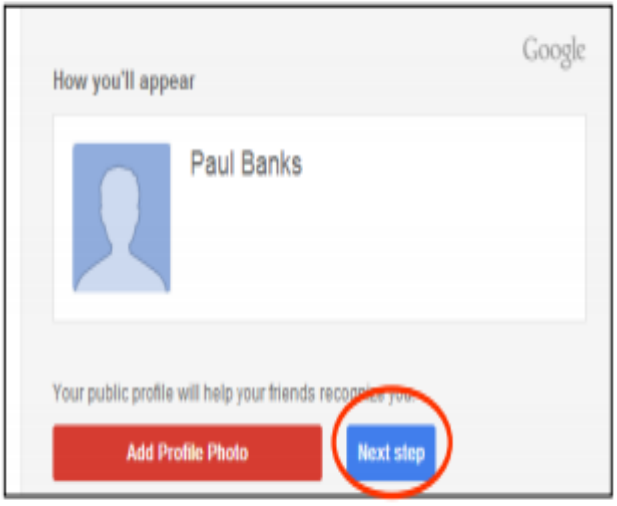
An email address is a unique identifier for an email account. It is used to both send and receive email messages over the Internet. Similar to physical mail, an email message requires an address for both the sender and recipient in order to be sent successfully.
Every email address has two main parts: a username and domain name. The username comes first, followed by an (@) symbol, followed by the domain name. In the example below, "mail" is the username and "techterms.com" is the domain name.

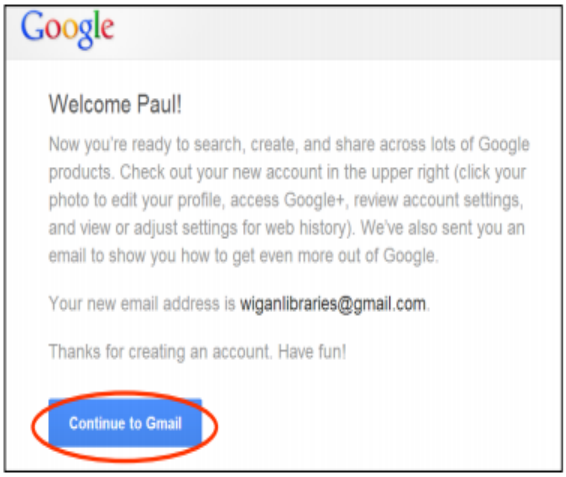
mail@techterms.com

Procedure of creating E-mail account:

Module: D	**Perform Communication**	
	Learning Unit: 4-5	**Perform E-mail communication**
	Practical Description:	This practical helps how to register for an email account.
Time:	2 Hours	
Equipment	Computer with Internet	
Tools	-	
PPE	-	
Materials	-	
Key Point		
Learning Outcome:	Perform required communication via internet with in specified time	
Precautions:		

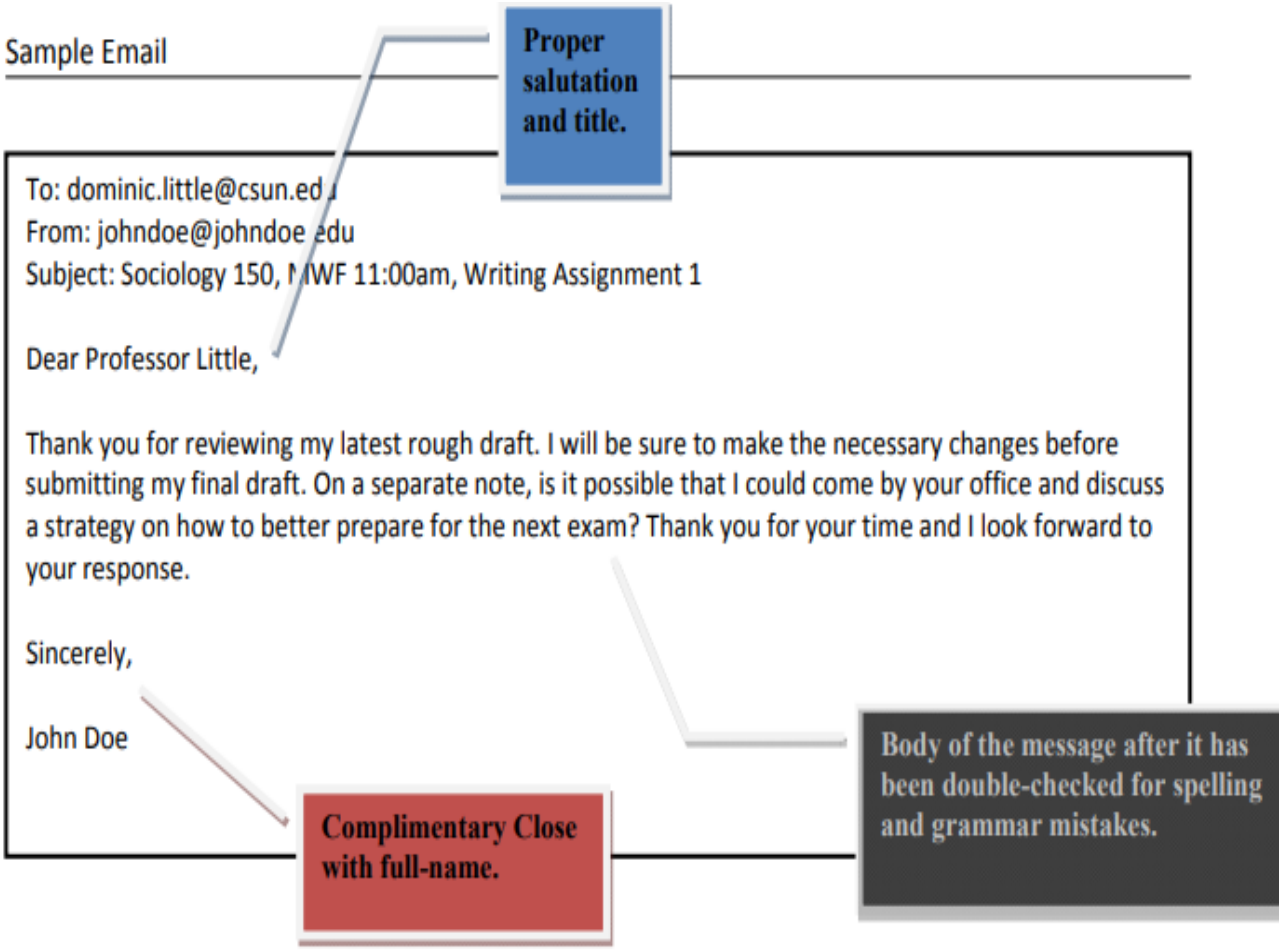
Instructions	Illustrations
Step 1: Click on the google link on the people's network. Then click on the Gmail link near the top left of the page. If using a computer elsewhere perform an Internet search for Gmail. Click on create an account.	
Step 2: Choosing your email address to set up your new account, Google needs some information about you. Type your first and last names. To create an email, you need to choose a username. Your email address will be your username followed by '@gmail.com'.	

Step 3: Choosing your password that is 8 characters or more. Make sure your password is secure and one that you can remember! Secure passwords include combinations of upper and lowercase letters and numbers. Verifying your Gmail account type your birthday and gender. Enter your mobile telephone number or an alternative email address if you have one.	
Step 4: Prove you're not a Robot! You may want to uncheck the box next to set Google as my default homepage'. Type in the letters or digits as they appear on the screen. Agree to the terms of service by checking the box.	
Step 5: Click on next step. (you can add a profile picture at a later stage)	

Congratulations! You have created an email account! To start using email click on continue to Gmail.	

E-mail Writing Ethics:

It is imperative that you remain professional during email communication and also ensure that information shared is approved by your supervisor as email can access at any time in the future.



Answer swiftly

Your customers send you email because they want quick responses. The golden rule for email is to reply within 24 hours

Use a meaningful Subject line

Try to use a subject that is meaningful to the recipient as well as yourself

Use the BCC Field

When you want to keep recipients hidden from people on the To: field, then you add them to the Bcc field.

Read your email

Before you send the email treat it like any other official company document. Read it before you send it. Spelling and grammar errors are just as unfortunate in email as anywhere else in your corporate correspondence

Don’t attach unnecessary files

Wherever possible try to compress attachments and only send attachments when they are productive.

Method of e-mail sent confirmation:

By using suitable phrases, we can make the confirmation of email received at receiver end. Following are the phrases we can use in E-mails:

- I’d like to confirm …
- Just writing to confirm …
- Tuesday is good for me. Please send me an email by 5 pm today to confirm this…
- Looking forward to seeing/meeting …

Summary of the module

- Communication skills are abilities, use when giving and receiving different kinds of information. Communication skills involve listening, speaking, observing and empathizing. It is also helpful to understand the differences in how to communicate through face-to-face interactions, phone conversations and digital communications, like email and social media.
- The businesses and individuals that provide goods and services to an organization are considered its vendors. You need good and reliable vendors/suppliers. When you find them, treat them like gold. Work as hard on building a good supplier relationship as you do building a relationship with your customers.
- During work, manager or supervisor should control the emotions for better performing result of labors. If any worker makes mistake during work, his manager/supervisor should deal it calmly and solve the problem in good manner.
- In situation of emergency manager should guide his worker for safe exit and inform the situation to relevant authority.

- Use easy language to instruct the labors so that they can understand the instructions of any specific job. It will help in getting proper work results.

- Success in any conversation is likely to be achieved through both parties listening to and understanding each other
- Indent form/BOM is a company's internal document, which is used to authorize the requisition of materials prior to initiating a purchase order.
- Good workplace relationships and a friendly work environment is critical for a successful business,
- An email address is a unique identifier for an email account. It is used to both send and receive email messages over the Internet.
- Your customers send you email because they want quick responses. The golden rule for email is to reply within 24 hours

Frequently Asked Questions

(FAQs)

Question	Answer
1. How should the supervisor behave with his labors?	He should behave respectively and politely.
2. What should be the ways of communicating with labors by supervisor?	Supervisor should adopt every available method to communicate with labors
3. How supervisor should act in emergency situation?	The supervisor should act wisely, should contact to emergency service when needed.
4. How to behave with vendor and other organization?	It should be respectful relation to maintain good purchase and sell activities
5. What does body language mean?	Face expression, eye contact, sound effects and body postures.
6. How to communicate effectively at work place?	Success in any conversation is likely to be achieved through both parties listening to and understanding each other
7. What do you mean by specification in indent form (Bill of Material)	Calculations/specifications and/or particulars given in the indents must be clear & complete and must be accompanied with relevant design.
8. What information should also be furnished with the indents?	• Quantities available in stock. • Quantities on order. • Quantities indented for. • Consumption during the preceding 12 months as per stock issue register
9. What are the methods of communication?	• Verbal • Non Verbal (Written)
10. What does mean by team work?	For achieving common goal, work with multiple person.

11. What does it mean by written communication?	• Email • Books • Magazines
12. What are email ethics?	Email ethics involves the proper subject line, proper salutation etc.
13. What is subject line in E-mail	Subject line is the covering of an email body

Self-Assessment
(MCQs)

Please mark the correct one from the given options. You can check your answer with the Answer Key at the end of this module.

Q 1. Which of the following factor is required to communicate effectively and precisely

a) Shouting
b) Instruct clearly
c) Not talking
d) None of the above

Q 2. Which of the following element is required to deal with vendors

a) Call Vendor
b) Reject vendor
c) Negotiate with vendor
d) None of the following

Q 3. By using appropriate _____, manger can communicate easily.

a) Language
b) Worker
c) Press
d) Teachers

Q 4. _____ is the act or process of directing a person or group of people

a) Report
b) Supervision
c) Meeting
d) None of the above

Q 5. What does it mean by Sentiment?

a) Passion
b) Emotion
c) Feeling
d) All of the above

Q 6. Which of the following is Useful communication skills for building positive interpersonal relationships

a) Dinner gathering
b) Active listening
c) Speak slow
d) None of the above

Q 7: Which of the following is personal awareness skills that help with communication

a) Develop Skills
b) Develop healthy life style
c) Awareness of how others perceive you
d) Meeting friends

Q 8: _____ form is used for purchase and procurement of material by a specific procedure

a) Indent form
b) Work history form
c) Report writing
d) All of the above

Q 9: Which of the following is the tool of keeping in touch with professionals of same industry, vendor and other industries

a) Contact information
b) Personal information
c) Both (a) & (b)
d) None of the above

Q 10: Which of the following is the occupational relation parameter?

a) Good hand writing.
b) Good Quality/smart work
c) Polite behavior
d) Build up stamina

Q 11: What is abbreviation of E-Mail?

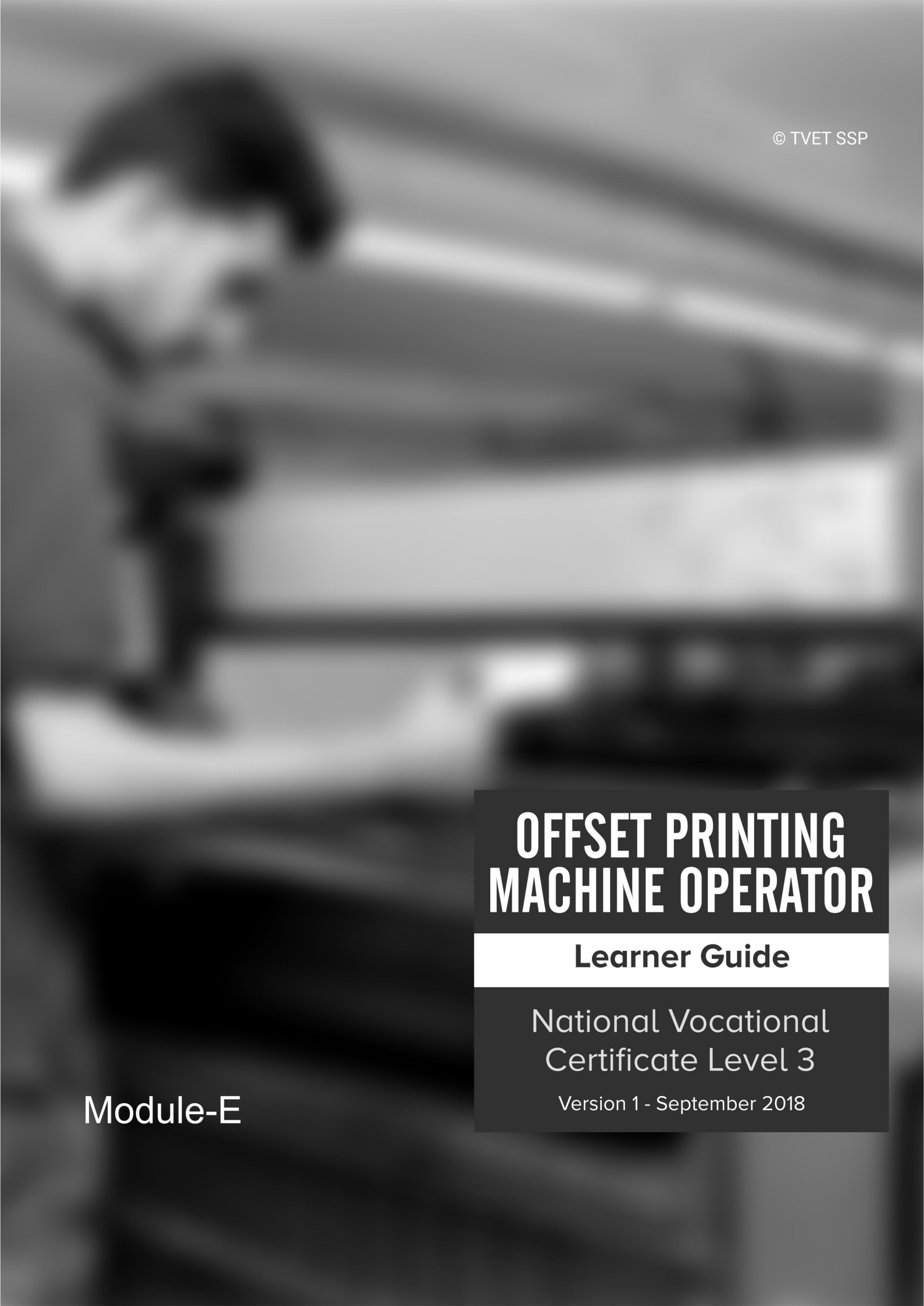
a) Emerging mail
b) Evaluate mail
c) Electronic mail
d) None of the above

Q 12: What is the meaning of composing email?

a) Sending email
b) Receiving email
c) Sharing email
d) Writing email

Answer Key

MCQ No.	Correct Answer
1	b
2	c
3	a
4	b
5	d
6	b
7	c
8	a
9	a
10	c
11	c
12	d



OFFSET PRINTING MACHINE OPERATOR

Learner Guide

National Vocational Certificate Level 3

Version 1 - September 2018

Module-E

Module E: - Manage press room waste

After completion of this module the learner will be able to:

- Sort the waste generated at the workplace according to usability
- Tag the reusable components/item of the waste
- Maintain record of reusable components of the waste
- Segregate the scrap according to material properties
- Follow safety precautions related to waste handling
- Reduce the waste generation in routine work by reuse the categorized waste as per requirement
- Handle hazardous waste according to SOPs
- Tag containers of toxic chemical as per SOPs
- Store toxic waste at a designated place as per printing press SOPs
- Manage inflammable toxic chemical waste as per printing press SOPs
- Manage non-inflammable toxic chemical waste as per printing press SOPs
- Tag containers of non-toxic chemical as per SOPs
- Store non-toxic waste at place designated to as per printing press SOPs
- Dispose-off inflammable non- toxic chemical waste as per printing press SOPs
- Dispose-off non-inflammable non-toxic chemical waste as per printing press SOPs
- Sort paper waste according to disposable categories
- Put paper waste in waste papers container as per printing press SOPs
- Store paper waste container at place designated to this purpose
- Sort solid waste according to disposable categories
- Put solid waste in waste bin as per printing press SOPs
- Store solid waste bin at place designated-to this purpose

Learning Unit 5-1:

Manage printing press waste

Overview:

This learning unit describes the types of printing press waste and safety precautions which have to be in consideration to manage printing waste. It also defines the methods of printing press waste control.

Printing press waste:

It is important to note that waste differ from process to process and the methods of reducing waste in one printing process do not necessarily apply to other printing processes.

There are three major waste streams found in the printing industry:

i. **Solid waste** – in general printing environment solid waste could consist of the following: empty containers, used film packages, outdated materials, damaged plates, developed films, test production, bad printing or spoilage, damaged product, and scrap paper

ii. **Water waste** – water waste from printing operations may contain lubricating oils, waste ink, clean-up solvents, photographic chemicals, acids, alkaline, and plate coatings

iii. **Air emissions** – some printing operations produce volatile organic compound emissions from the use of cleaning solvents and inks, as well as alcohol and other wetting agents used in offset printing.

Safety precautions to manage printing waste:

Printing industry can use a variety of ways to reduce the amount of waste they generate while increasing their operational efficiency. Best management practices create the most cost-effective way to decrease the amount of waste generated from operations. This includes a careful control of raw materials, practical scheduling, and job management.

Another potential hazardous waste reduction technique for printing presses, requires good housekeeping. Good housekeeping measures can greatly decrease the amount of waste that a press generates.

To reduce excess waste production, printing presses should:

(a) Make sure container lids are tight fitting whenever they are not in use to prevent loss of chemical through evaporation or spoilage. Keeping lids on containers also prevents contamination with water, dirt, or other materials

(b) Use spigots and pumps when dispensing new materials and funnels when transferring waste to storage containers to reduce the possibility of spills

(c) Store products in locations that will preserve their shelf life. For instance, solvents should be kept in locations protected from extreme temperatures

(d) Never mix different types of waste together. Mixing wastes may make recycling impossible or make waste disposal more expensive

(e) Keep printing floor clean and orderly to prevent accidents and spills.

Methods of printing press waste control:

Waste avoidance generally delivers the best financial and environmental outcomes. The waste management provides a framework for managing waste: avoid; reduce; reuse; recycle; and dispose.

Following are various methods to reduce waste in print presses:

1. Management Commitment

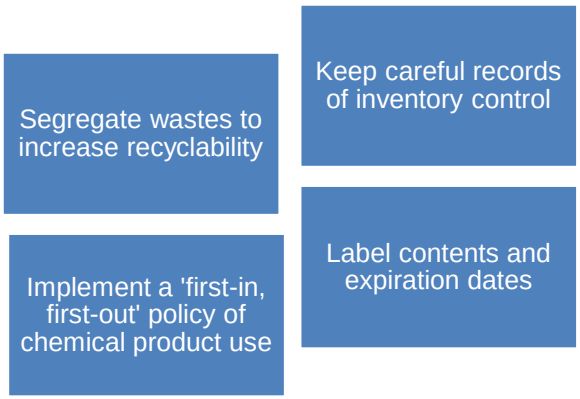
An important aspect of any waste reduction program is management commitment. Commitment shows employees that managers place a high priority on waste reduction.

2. Employee Awareness

Hazardous waste reduction efforts should be emphasized to each employee, from the general manager to machine operators.

3. Good Housekeeping

Good housekeeping comprises of:



4. Waste Reduction Alternatives for Inks

- Fill ink duct only enough for a single run or shift
- Run similar jobs simultaneously to reduce waste generation between cleanup and start of the next run
- Use water-based inks whenever possible to cut down on the use of solvent based inks that cause employee and environmental hazards
- Clean ink fountains only when changing colors or when the ink might dry out between runs to reduce waste ink generation

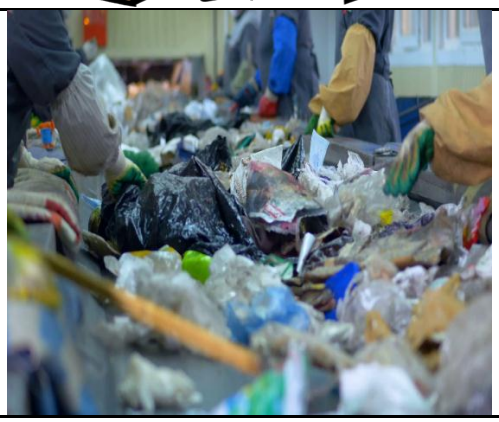
5. Solvent Alternatives

- Use soap or detergent solutions wherever possible
- Use solvents only for cleaning inks and oils
- Minimize spills and use dry methods for cleanup wherever possible

6. Substrate waste reduction

- Optimize substrate size to minimize excess trim
- Manage stock and ordering to minimize waste
- Use the blank side of used papers for press set up instead of new sheets

Practical Activity:

<table>
<tr><td rowspan="3">Module: E</td><td colspan="2">Manage press room waste</td></tr>
<tr><td>Learning Unit: 5-1</td><td>Manage printing press waste</td></tr>
<tr><td>Practical Description:</td><td>Sort and maintain the waste generated at the workplace according to usability</td></tr>
<tr><td>Time:</td><td colspan="2">2 hours</td></tr>
<tr><td>Equipment</td><td colspan="2">Tagging machine</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress, safety gloves, safety shoes</td></tr>
<tr><td>Materials</td><td colspan="2">Waste bin</td></tr>
<tr><td>Key Point</td><td colspan="2">Maintain record of reusable items</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">Sort the waste according to usability
Tag & maintain the record of reusable items</td></tr>
<tr><td>Precautions:</td><td colspan="2">Sort & Handle the waste material carefully</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Collect all the waste generated at workplace.</td><td>  </td></tr>
<tr><td colspan="2">2. Sort out unusable articles</td><td>  </td></tr>
</table>

3. Place unusable articles at appropriate place and label it.	
4. Dispose of waste in a proper way.	
5. Record all reusable waste articles in a register	

Practical Activity:

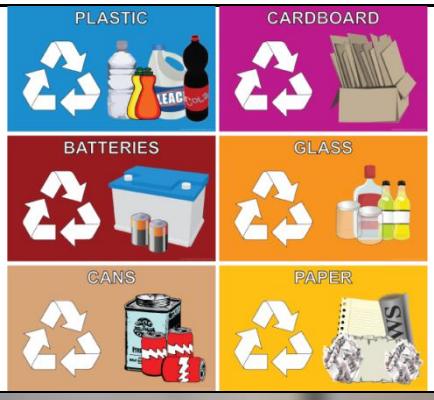
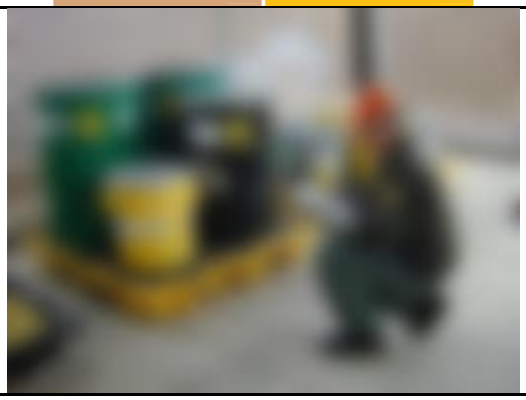
Module: E	**Manage press room waste**	
	Learning Unit: 5-1	**Manage printing press waste**
	Practical Description:	**Segregation of scrap**
Time:	2 hours	
Equipment	N/A	
Tools	N/A	
PPE	Proper dress, safety gloves, safety shoes	
Materials	Waste bin	
Key Point	Maintain record of reusable items	
Learning Outcome:	Sort the waste according to usability Tag & maintain the record of reusable items	
Precautions:	Handle the waste material carefully	

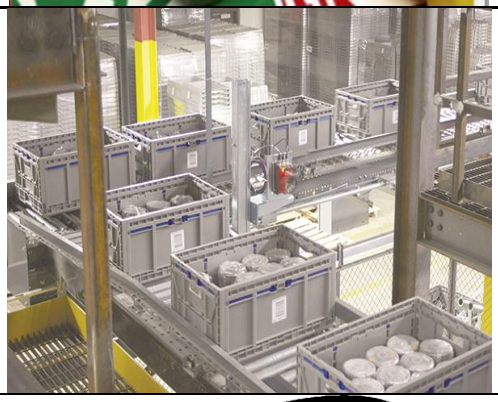
Instructions	**Illustrations**
1. Compile all waste and scrap at one place.	
2. Segregate waste papers from the pile of waste and scrape.	

3. Segregate solid waste materials from pile of waste and scrape.	
4. Segregate cloth and cotton.	
5. Wear gloves, safety shoes tight cloth, while handling waste and scrape.	 
6. Label and tag all segregated items according to properties.	

7. Dispose of waste and scrap according to SOPs.	

Practical Activity:

<table>
<tr><td rowspan="3">Module: E</td><td colspan="2">Manage press room waste</td></tr>
<tr><td>Learning Unit: 5-1</td><td>Manage printing press waste</td></tr>
<tr><td>Practical Description:</td><td>Reduce the waste generation in routine work by reuse the categorize waste as per requirement</td></tr>
<tr><td>Time:</td><td colspan="2">2 hours</td></tr>
<tr><td>Equipment</td><td colspan="2">Tagging Machine</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code, safety shoes, safety gloves</td></tr>
<tr><td>Materials</td><td colspan="2">Waste bin</td></tr>
<tr><td>Key Point</td><td colspan="2">Keep record of reusable items</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to reuse the waste as per requirement</td></tr>
<tr><td>Precautions:</td><td colspan="2">Ensure safety</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Segregate all waste and scrap according to their properties.</td><td> 
</td></tr>
<tr><td colspan="2">2. Put tags on all segregated items according to their properties.</td><td>  </td></tr>
</table>

3. Examine carefully the segregated waste and scrap materials.	
4. Arrange all articles and materials in order, which are reusable.	
5. Handle carefully the hazarded waste.	
6. Disposed of waste and scrap according to SOPs.	

Learning Unit 5-2:

Handle toxic chemicals

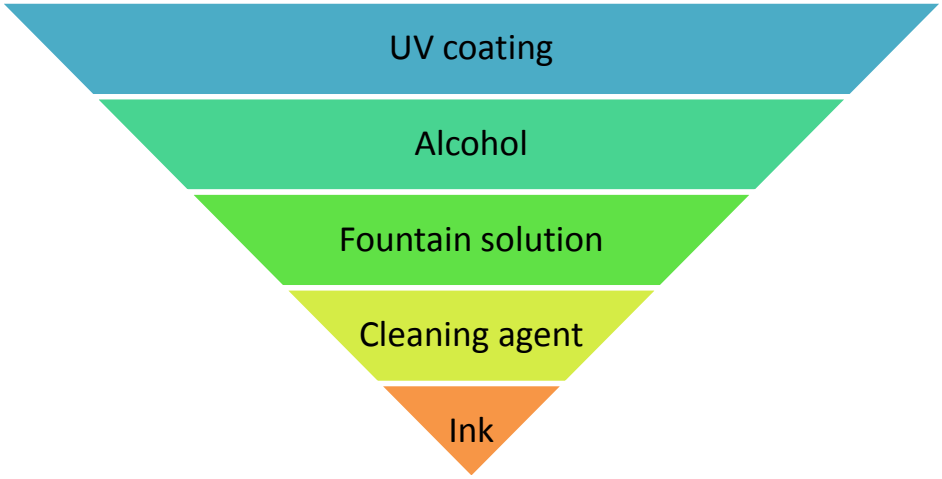
Overview:

This learning unit defines about the different types of toxic materials, and their respective management techniques.

Toxic chemical:

A toxic substance is a substance that can be poisonous or harmful on human contact. Products that we use daily, such as cleaners, alcohol, oil can also be toxic. Any chemical can be toxic or harmful under certain conditions.

Potentially harmful chemicals used in Printing:



Procedure of toxic chemical management:

Here are some ground rules that can be useful to have while at work to ensure safe handling of toxic chemicals:

- Follow all established procedures and perform job duties as per training.
- Be cautious and plan ahead. Think about what could go wrong and pay close attention to what you're doing while you work.
- Always use required PPE (Personal Protective Equipment) and inspect them carefully before each use to make sure it's safe to use. Replace worn out or damage PPE; it won't provide adequate protection.
- Make sure all containers are properly labeled and that the materials are contained in an appropriate container. Report any damaged containers or illegible labels to your supervisor.
- Read labels and the material safety data sheet (MSDS) before using any material to make sure you understand hazards and precautions.

- Use all materials solely for their intended purpose. Don't, for example, use solvents to clean your hands, or gasoline to wipe down equipment.

- Never eat or drink while handling any materials, and if your hands are contaminated.

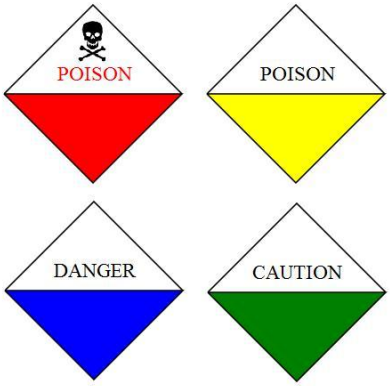
- Keep yourself and your work area clean. After handling any material, wash your hands thoroughly with soap and water. Clean work surfaces at least once a shift so that contamination risks are minimized.

- Learn about emergency procedures and equipment. Understanding emergency procedures means knowing evacuation procedures, emergency reporting procedures, and procedures for dealing with fires and spills. It also means knowing what to do in a medical emergency if a co-worker is injured or overcome by chemicals.

- Learn the appropriate use of safety equipment provided. For example; which fire extinguisher is used for which class of fire.

Type (Fire / Extinguisher)	CLASS A **Combustible materials** (e.g. paper & wood)	CLASS B **Flammable liquids** (e.g. paint & petrol)	CLASS C **Flammable gases** (e.g. butane and methane)	CLASS D **Flammable metals** (e.g. lithium & potassium)	Electrical **Electrical equipment** (e.g. computers & generators)	CLASS F **Deep fat fryers** (e.g. chip pans)	Comments
Water	✓	✗	✗	✗	✗	✗	Do not use on liquid or electric fires
Foam	✓	✓	✗	✗	✗	✗	Not suited to domestic use
Dry Powder	✓	✓	✓	✓	✓	✗	Can be used safely up to 1000 volts
CO2	✗	✓	✗	✗	✓	✗	Safe on both high and low voltage
Wet Chemical	✓	✗	✗	✗	✗	✓	Use on extremely high temperatures

Practical Activity:

<table>
<tr><td rowspan="3">Module: E</td><td colspan="2">Manage press room waste</td></tr>
<tr><td>Learning Unit: 5-2</td><td>Handle toxic Chemicals</td></tr>
<tr><td>Practical Description:</td><td>Tagging and storing of toxic waste chemical containers at designated place</td></tr>
<tr><td>Time:</td><td colspan="2">2 hours</td></tr>
<tr><td>Equipment</td><td colspan="2">Tagging machine</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code, Safety shoes, gloves & safety mask</td></tr>
<tr><td>Materials</td><td colspan="2">Toxic Chemical waste containers</td></tr>
<tr><td>Key Point</td><td colspan="2">Keep tagging and storing of toxic material carefully</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to handle toxic materials</td></tr>
<tr><td>Precautions:</td><td colspan="2">Ensure safety</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Prepare tags for waste chemicals.</td><td> 
</td></tr>
<tr><td colspan="2">2. Place containers of toxic waste at a safe place carefully.</td><td>  </td></tr>
</table>

3. Tag the toxic containers accordingly	
4. Store the toxic waste at its proper place.	
5. Wash hands thoroughly	

Module: E	**Manage press room waste**	
	Learning Unit: 5-2	Handle toxic chemicals
	Practical Description:	Manage inflammable and non-inflammable toxic chemical waste
Time:	**2 hours**	
Equipment	Tagging machine	
Tools	N/A	
PPE	Proper dress code, safety gloves, safety mask and safety shoes	
Materials	Toxic chemical waste container	
Key Point	Handle toxic material carefully	
Learning Outcome:	The learner will be able to manage inflammable and non-inflammable chemicals	
Precautions:	Ensure safety	

Instructions	**Illustrations**
1. Prepare tags for all inflammable and non-inflammable toxic waste chemicals.	

2. Place containers of inflammable and non-inflammable toxic waste at a safe place carefully.	
3. Tag the inflammable and non-inflammable toxic waste containers according.	
4. Store the inflammable and non-inflammable toxic waste at its proper place accordingly.	
5. Dispose-off all waste as per SOPs of press room.	

6. Wash hands thoroughly	

Learning unit 5-3:

Handle non-toxic chemicals

Overview:

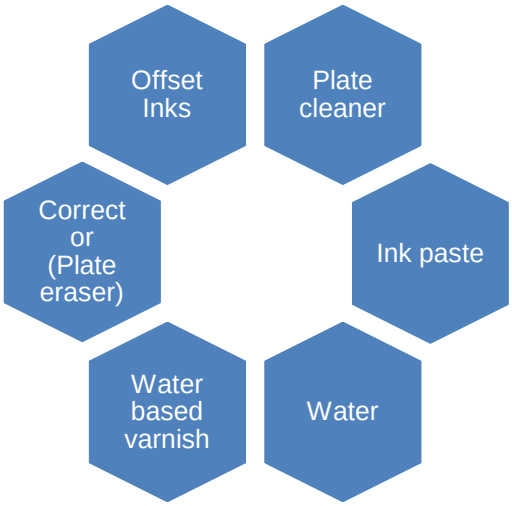
This learning unit defines about the different types of non-toxic chemicals, and procedure of their waste disposal.

Non-toxic chemicals:

Nontoxic materials are not considered to be harmful to human health. The toxicity must be evaluated in terms of quantity of material. If the quantity of a substance that causes harm is less, its toxicity is determined to be higher.

Similarly, there is a minimum dose for nearly all substances below which toxic effects are not seen, called the toxicity endpoint. Toxic waste poisons the groundwater or makes nearby animals sick, but nontoxic waste tends to break down without any negative consequences.

Non-toxic materials used in Printing:



Procedure of non-toxic waste disposal:

Liquid non-hazardous (chemical) wastes with a pH between 6 and 10 may be flushed to the sanitary sewer (down the sink).

An aqueous (water-based) solution of any of the compounds in the list below is considered a **liquid non-hazardous chemical waste** and can be poured down the sanitary sewer.

Waste generators must perform a hazardous waste determination prior to disposal of all chemicals

Solids: Collect **solids** in disposable, non-leaking containers, labeled with contents, clearly marked as non-hazardous, and prepared for disposal

Liquids: Solutions containing only non-hazardous, water miscible **liquid** materials, pH between 6 and 9.5, can be disposed through the sewer system

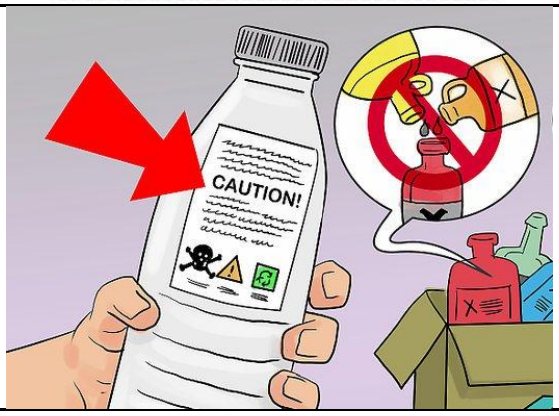
An aqueous (water-based) solution of any of the compounds in the list below is considered a **liquid non-hazardous chemical waste** and can be poured down the sanitary sewer

Remember:

"Hazardous" includes flammable liquids even if water soluble

Practical Activity:

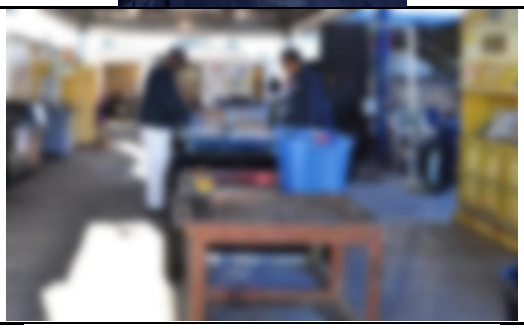
Module: E	**Manage press room waste**	
	Learning Unit: 5-3	Handle non-toxic chemicals
	Practical Description:	Tagging of containers of non-toxic chemical and storage of non-toxic waste to designated place.
Time:	**2 hours**	
Equipment	Tagging machine	
Tools	N/A	
PPE	Proper dress code, Safety gloves, mask, safety shoes	
Materials	Liquid dispose of container	
Key Point	Keep tagging and storing of non-toxic material carefully	
Learning Outcome:	The learner will be able to handle non-toxic material	
Precautions:	Ensure safety	

Instructions	**Illustrations**
1. Prepare tags for non-toxic waste chemicals.	
2. Put the nontoxic waste in the container carefully.	

3. Store the nontoxic waste container at its proper place thoroughly.	
4. Wash hands gently	

Module: E	**Manage press room waste**	
	Learning Unit: 5-3	Handle non-toxic chemicals
	Practical Description:	**Disposal of inflammable and non-inflammable non-toxic chemical waste**
Time:	**2 hours**	
Equipment	Tagging machine	
Tools	N/A	
PPE	Proper dress code, safety gloves, safety mask, safety shoes	
Materials	Container for inflammable non-toxic chemical, Container for non-inflammable non-toxic chemical, Waste bin.	
Key Point	Handle the chemicals carefully	
Learning Outcome:	The learner will be able to Dispose of inflammable, non-inflammable non-toxic chemicals	
Precautions:	Ensure safety	

Instructions	**Illustrations**
1. Segregate inflammable and non-inflammable non-toxic chemicals waste	
2. Dispose of flammable non-toxic chemical.	

3. Dispose of non-inflammable non-toxic chemical as pre SOPs.	
4. Remove gloves, mask	
5. Recheck no waste is left to dispose-off.	
5. Wash hands gently	

Learning Unit 5-4:

Handle Substrate waste

Overview:

This learning unit describes the correct usage of waste substrates and procedures of proper waste paper disposal.

Waste Paper:

Substrate/paper waste is generally the largest waste stream and should be segregated to make sure it is being recycled to its fullest extent.

Roughly 15 % of the paper used by the printing industry ends up as waste. In newspaper production, the total paper waste is about 10 % of the amount of paper used. In magazine printing, paper waste is usually 15 - 20 %, and in book production up to 30 %.

White and printed waste

Paper waste can be divided into white waste and printed waste. White waste consists of paper wasted before printing, like reel wrappings, reel ends, damaged sheets, etc. Printed waste is mainly produced in the make ready stage. Running waste appears during the production, and can be minimized with careful process control.

White waste is normally about 25 % of the total paper waste, while printed waste accounts for 75 %. Another type of waste paper is the ream cover paper. Paper reams or card packets are covered in another paper sheet which is also disposed-off.

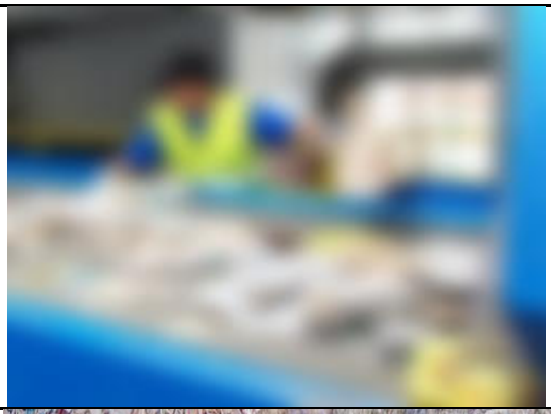
Disposal of paper waste

The first step when considering waste substrate disposal is to identify which materials can be recycled and which must be destroyed. Some of the material being disposed-off may contain copyright material or brand names of customers which must be destroyed.

Once identified, which substrate is to be recycled, paper waste is collected from printing companies and sent to deinking. Paper is broken into fibres, and ink and other impurities are removed by chemical and physical processes. Deinked pulp is used in many paper products, like newsprint, packaging papers, folding boxboards and tissue papers.

Some paper grades, like metallized or wet-strength label papers, cannot be recycled. Incineration is often the best treatment for these grades.

Practical Activity:

<table>
<tr><td rowspan="3">Module: E</td><td colspan="2">Manage press room waste</td></tr>
<tr><td>Learning Unit: 5-4</td><td>Handle paper waste</td></tr>
<tr><td>Practical Description:</td><td>Sort paper waste according to disposable categories, its placement in containers and storage at designated place</td></tr>
<tr><td>Time:</td><td colspan="2">2 hours</td></tr>
<tr><td>Equipment</td><td colspan="2">N/A</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code</td></tr>
<tr><td>Materials</td><td colspan="2">Waste paper container</td></tr>
<tr><td>Key Point</td><td colspan="2">Careful sorting of paper waste</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to sort paper waste, put paper waste in designated waste bin and store the waste bin at designated place</td></tr>
<tr><td>Precautions:</td><td colspan="2">Ensure safety</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Sort out waste paper and reusable waste paper accordingly.</td><td>  </td></tr>
<tr><td colspan="2">2. Ask supervisor if all the sorted substrates can be recycled or some needs to be destroyed</td><td>  </td></tr>
</table>

3. Put paper waste in the designated container.	
4. Put reusable paper to appropriate place.	
5. Place waste paper container at the designated place.	

Learning Unit 5-5:

Manage solid waste

Overview:

This learning unit defines types of solid waste and procedures to dispose it.

Reducing solid waste

To reduce solid waste, consider the following options:

Paper and board

• Keep your presses well-maintained to avoid spoilage.

• Set up the presses for optimum performance and train your staff to achieve minimum make-ready waste.

• Seek out the causes of spoilage and try to eliminate them.

• Make sure each job is fully signed-off by the pre-press area to avoid waste from proofing, copy or artwork mistakes.

• Consider improving efficiency by using better press maintenance.

• Find out if you can recycle paper or board in two grades. Non-inked or less inked paper can be worth more to recyclers, and if so, could bring you a better return.

Find out if it's easier and more economical to have your recycling contractor sort out the different grades of paper for you. Make blank pads from excess paper.

Non-paper substrate (plastics, metals, wood, flexible, glass, fabric, laminates)

If you don't print on paper but use another substrate, the recyclability of that material will be critical to reducing the costs of your operations.

Consider reusing or recycling screen printing frames where possible.

Plastics

Many plastics can be recycled, including shrink-wrap, but some contractors require the plastic types to be separated. Inks can be supplied in plastic cartridges that are reusable.

Metals

Metals are easily recycled. Separate them into different types to increase their value. Aluminum printing plates are commonly recycled as scrap metal.

Wood

Wood is a common printing waste. Some of it is reusable, such as pallets in good condition. You can also reuse wood as packaging for your products. Ask your suppliers if they can take back non-standard pallets.

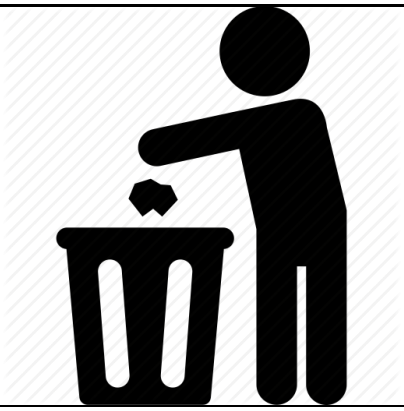
Containers

Purchase products from suppliers that provide a collection, reuse or refill service for containers. Purchase ink and other products in containers that are made from easily recyclable materials.

Glass and some plastic containers may be able to be recycled. Check with your waste service contractor or your local Council. Segregating recyclable materials as much as possible from other waste streams will increase their value and reduce your waste disposal costs.

Practical Activity:

<table>
<tr><td rowspan="3">Module: E</td><td colspan="2">Manage press room waste</td></tr>
<tr><td>Learning Unit: 5-5</td><td>Manage solid waste</td></tr>
<tr><td>Practical Description:</td><td>Sort and put solid waste in waste bin according to disposable categories, and store waste bins at designated place</td></tr>
<tr><td>Time:</td><td colspan="2">2 hours</td></tr>
<tr><td>Equipment</td><td colspan="2">N/A</td></tr>
<tr><td>Tools</td><td colspan="2">N/A</td></tr>
<tr><td>PPE</td><td colspan="2">Proper dress code</td></tr>
<tr><td>Materials</td><td colspan="2">Waste bin</td></tr>
<tr><td>Key Point</td><td colspan="2">Carefully sorting of solid waste</td></tr>
<tr><td>Learning Outcome:</td><td colspan="2">The learner will be able to sort paper waste, put solid waste in designated waste bin and store the waste bin at designated place</td></tr>
<tr><td>Precautions:</td><td colspan="2">Safety first</td></tr>
<tr><td colspan="2">Instructions</td><td>Illustrations</td></tr>
<tr><td colspan="2">1. Sort out solid waste according to disposable categories.</td><td> 
</td></tr>
</table>

2. Put solid waste in waste bin carefully.	
3. Store solid waste bin to its designated place.	
4. Wash your hands gently.	

Summary of the module:

- Waste management is one of the biggest environmental issues faced by printing industry today.
- The printing industry uses a variety of valuable raw materials many of which can be recycled.
- There are three major waste streams found in the printing industry:
    a) **Solid waste** – in general printing environment solid waste could consist of empty containers, damaged plates
    b) **Water waste** – water waste from printing operations may contain lubricating oils, waste ink, and clean-up solvents
    c) **Air emissions** – printing operations produce volatile organic compound emissions from the use of cleaning solvents and inks,
- Best management practices create the most cost-effective way to decrease the amount of waste generated from operations. This includes a careful control of raw materials, practical scheduling, and job management
- The waste management provides a framework for managing waste: avoid; reduce; reuse; recycle; and dispose. Following are various methods to reduce waste in print presses.
- A toxic substance is a substance that can be poisonous or cause health effects. Products that we use daily, such as cleaners, alcohol, oil can also be toxic. Any chemical can be toxic or harmful under certain conditions.
- Nontoxic materials are not considered to be harmful or destructive to human health. It is to be noted that at some level, every substance is toxic.
- Substrate/paper waste is generally the largest waste stream and should be segregated to make sure it is being recycled to its fullest extent.
- Creation of waste - in the printing industry as well as at home - should be avoided as much as possible. If waste is nevertheless produced, it should be recycled, incinerated or treated appropriately.
- With careful choice of materials and good control of production processes, waste can be minimized to benefit both the printing company and the environment.

Frequently Asked Questions

(FAQs)

Question	Answer
7. Why should I work safely with toxic material?	Toxic materials are substances that may cause serious harm to an individual if it enters the body.
8. Why should good ventilation system necessary for working with toxic chemicals?	well-maintained ventilation systems remove toxic vapors, fumes or airborne dusts from the workplace
9. How should store containers of toxic material?	• Keep the amount of toxic material in storage as small as possible. • Inspect storage areas and containers regularly • Ensure that containers are tightly closed
10. How dispose of waste toxic material safely?	• Do not mix hazardous waste materials with regular garbage • Do not overfill liquid waste containers.
11. Why good housekeeping is important when working with toxic chemical?	Good housekeeping is a very important way to prevent exposure to toxic materials.

Self-Assessment
(MCQs)

Please mark the correct one from the given options. You can check your answer with the Answer Key at the end of this module.

Q 1. Waste management are all the activities and actions required to manage waste from its inception to its:

a) packing
b) burning
c) final disposal
d) Storage

Q 2. All of the following are categories of waste, except:

a) industrial
b) Litter
c) Hazardous
d) Municipal

Q 3. Hazardous waste.

a) Is flameable
b) Is corrosive
c) Is toxic
d) all choices are correct

Q 4. The key component of waste management is:

a) Safety
b) keeping an eye on waste
c) waste reduction
d) All of these

Q 5. The sum of all the waste produced by individuals, industries, mining, and agriculture is referred to as:

a) the waste stream
b) trash
c) municipal solid waste
d) Recycling

Answer Key

MCQ No.	Correct Answer
1	c
2	b
3	d
4	d
5	a

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