15. **परीक्षा शुल्क भुगतान करने की प्रक्रियाः—**

परीक्षा शुल्क जमा करने के लिए Submit To Proceed Payment Click करें। एक नया पेज खुल जायेगा जिसमें Term & Condition को टिक (√) कर Proceed बटन दबाकर आगे बढ़ें। इसके बाद Select Payment category के सामने JIIOCE-2022 Select करें तथा अपना Registration Number डालकर अपना परीक्षा शुल्क का भुगतान करें।

16. **पदों का विकल्प** :—

विभिन्न शैक्षणिक योग्यताधारी आवेदकों को अपनी शैक्षणिक योग्यता के अनुसार उपलब्ध पदों के लिए अधिमानता क्रम में विकल्प देना अनिवार्य होगा।

17. **परीक्षा का स्वरूप** :— आयोग द्वारा कम्प्यूटर आधारित परीक्षा **(CBT)** ली जायेगी तथा किसी विषय की परीक्षा यदि विभिन्न समूहो में लिया जाता है तो अभ्यर्थियों के प्राप्तांक का Normalisation किया जायेगा। Normalisation का सूत्र अलग से आयोग के वेबसाईट पर प्रकाशित है। कम्प्यूटर आधारित परीक्षा के आधार पर अभ्यर्थियों की मेधा सूची उनके प्राप्तांक के Normalised अंक के आधार पर तैयार किया जायेगा तथा परीक्षाफल प्रकाशन के पश्चात उन्हें Normalised अंक ही दिया जायेगा।

परीक्षा का स्वरूप एवं पाठ्यक्रम :—परीक्षा एक चरण (मुख्य परीक्षा) में ली जायेगी।

18 **प्रशिक्षण अधिकारी के पदों के लिए सीधी नियुक्ति हेतु मुख्य परीक्षा के विषय एवं पाठ्यक्रम** :—

लिखित परीक्षा :— लिखित परीक्षा अन्तर्गत (03) तीन पत्र होंगे। लिखित परीक्षा में सभी प्रश्न वस्तुनिष्ठ एवं बहुविकल्पीय उत्तर आधारित होंगे। परीक्षा का माध्यम हिन्दी/अंग्रेजी भाषा में होगा। प्रत्येक पत्र की परीक्षा अवधि 02 (दो) घंटे की होगी। तीनों ही पत्रों के प्रत्येक प्रश्न 03(तीन) अंक के होंगे। सही उत्तर के लिए तीन अंक प्रदान किये जायेंगे एवं प्रत्येक गलत उत्तर के लिए 01 (एक) अंक की कटौती की जाएगी।

18.1 पत्र — 1 : विषय : (भाषा एवं सामान्य ज्ञान)

भाशा ज्ञान :—	(क) हिन्दी भाषा ज्ञान	—	25 प्रश्न
	(ख) अंग्रेजी भाषा ज्ञान	—	25 प्रश्न
सामान्य ज्ञान :—	(क) झारखण्ड राज्य से संबंधित ज्ञान	—	30 प्रश्न
	(ख) सामान्य विज्ञान	—	10 प्रश्न
	(ग) सामान्य गणित	—	10 प्रश्न
	(घ) मानसिक क्षमता जाँच	—	10 प्रश्न
	(ड़) कम्प्यूटर का ज्ञान	—	10 प्रश्न
		कुल प्रश्न	**— 120**

नोटः– यह पत्र अर्हक (Qualifying) होगा एवं उत्तीर्ण होने के लिए न्यूनतम अर्हतांक 30 प्रतिशत निर्धारित रहेगा। न्यूनतम अर्हतांक से कम अंक प्राप्त करने वाले अभ्यर्थी नियुक्ति के लिए चयन हेतु असफल/अयोग्य माने जाएँगे। परीक्षा पाठ्यक्रम अनुसूची–1 पर द्रष्टव्य है।

18.2 पत्र – 2 : विषय : (चिन्हित क्षेत्रीय/जनजातीय भाषा ज्ञान)

उर्दू/संथाली/बंगला/मुण्डारी(मुण्डा)/हो/खड़िया/कुँडुख(उराँव)/कुरमाली/खोरठा/नागपुरी/पंचपरगनिया/उड़ीया में से किसी एक भाषा की परीक्षा विकल्प के आधार पर अभ्यर्थी दे सकेंगे। इस परीक्षा में संबंधित भाषा के एक सौ (100) बहुविकल्पीय उत्तर आधारित प्रश्न पूछे जायेंगे।

नोटः– यह पत्र अर्हक (Qualifying) होगा एवं उत्तीर्ण होने के लिए न्यूनतम अर्हतांक 30 प्रतिशत निर्धारित रहेगा। न्यूनतम अर्हतांक से कम अंक प्राप्त करने वाले अभ्यर्थी नियुक्ति के लिए चयन हेतु असफल/अयोग्य माने जाएँगे। परीक्षा पाठ्यक्रम अनुसूची–2 पर द्रष्टव्य है।

18.3 पत्र – 3 : विषय : (तकनीकी ज्ञान)

इस पत्र में पूछे जाने वाले प्रश्नों की संख्या 120 (एक सौ बीस) होंगी एवं इसका पाठ्यक्रम किसी विषय विशेष के लिए वही होगा जो प्रशिक्षण महानिदेशालय, नई दिल्ली (DGT, New Delhi) के वेबसाईट https://dgt.gov.in/cts_details पर उपलब्ध है। तद्नुसार परीक्षा पाठ्यक्रम अनुसूची–3 पर उपलब्ध है।

टिप्पणी– पत्र–3 तकनीकी ज्ञान की परीक्षा में निम्न न्यूनतम अर्हतांक होगाः–

- अनारक्षित – 40 प्रतिशत
- आर्थिक रूप से कमजोर वर्ग (EWS) – 40 प्रतिशत
- पिछड़ा वर्ग (अनु–II) – 36.5 प्रतिशत
- अत्यंत पिछड़ा वर्ग (अनु–I) – 34 प्रतिशत
- अनुसूचित जाति/अनुसूचित जनजाति/महिला –32 प्रतिशत
- आदिम जनजाति समूह – 30 प्रतिशत

नोटः– पत्र 3 (तकनीकी ज्ञान) में प्राप्त अंक के आधार पर आयोग द्वारा व्यवसायवार मेधा सूची का निर्माण किया जायेगा।

19. लिखित परीक्षा के आधार पर मेधा सूची का निर्माण :

(i) **प्रश्न पत्र 1 (भाषा एवं सामान्य ज्ञान) में 30 प्रतिशत अंक प्राप्त करना अनिवार्य होगा। प्रश्न पत्र 2 (चिन्हित क्षेत्रीय/जनजातीय भाषा ज्ञान) में 30 प्रतिशत अंक प्राप्त करना अनिवार्य होगा। परीक्षा के दोनों प्रश्न पत्रों (प्रश्न पत्र 1 एवं प्रश्न पत्र 2) में प्राप्त अंक मात्र अर्हक *(Qualifying)* होंगे।** अभ्यर्थियों के प्रश्न पत्र 3

(तकनीकी ज्ञान) के प्राप्तांक के आधार पर आयोग द्वारा भिन्न–भिन्न व्यवसायों के प्राप्तांकों के आधार पर मेधा सूची तैयार की जायेगी।

(ii) **मेधा सूची में एक से अधिक उम्मीदवारों के प्राप्तांक समान (बराबर) रहने पर मेधा का निर्धारण उम्मीदवारों की जन्म तिथि के आधार पर किया जायेगा तथा अभ्यर्थी, जिनकी उम्र ज्यादा होगी, उन्हें अपेक्षाकृत उपर स्थान मिलेगा। यदि एक से अधिक उम्मीदवारों के प्राप्तांक और जन्म तिथि समान पायी जाती है, तो ऐसी स्थिति में उनके नाम के अंग्रेजी वर्त्तनी के वर्णक्रम के अनुसार मेधा का निर्धारण किया जायेगा और इसके निर्धारण के लए आवेदन में अंकित अंग्रेजी में लिखे गये नाम को आधार माना जायेगा।**

(iii) **मेधा सूची गठित करने के पश्चात् विज्ञापित पदों पर नियुक्ति के लिए चयन हेतु निर्धारित पात्रता/अर्हता संबंधी प्रमाण पत्रों की प्रारंभिक जांच की जायेगी। प्रमाण पत्रों की जाँच के क्रम में यदि किसी कोटि के उम्मीदवार के आवेदन पत्र में अंकित दावों का सत्यापन नहीं हो पाता है और उनकी उम्मीदवारी रद्द हो जाती है, तो ऐसी स्थिति में आयोग द्वारा सम्बन्धित कोटि में रिक्त पदों की उपलब्धता के आलोक में मेधा सूची से क्रम के अनुसार उम्मीदवारों को प्रमाण पत्रों की प्रारंभिक जाँच के लिए आमंत्रित किया जायेगा।**

(iv) **प्रारंभिक जाँच उपरान्त अधियाचना के अनुरूप सफल अभ्यर्थियों की अनुशंसा एवं अनुशंसित अभ्यर्थियों का मूल आवेदन पत्र एवं स्व–अभप्रमाणित/हस्ताक्षरित प्रमाण–पत्र आयोग द्वारा प्रशासी/अधियाची विभाग को भेजी जायेगी।**

(v) **अनुशंसित अभ्यर्थियों के सभी प्रमाण पत्रों की जाँचोपरांत संतुष्ट होने पर नियुक्ति प्राधिकार द्वारा नियुक्ति की कार्रवाई की जायेगी।**

20. अभ्यर्थियों के प्रमाण पत्रों का सत्यापन

विवरणिका की कंडिका–18 के आधार पर मेधा–सूची प्रारूप गठित करने के पश्चात् यथा संभव अपनी सुविधा के अनुसार आयोग के द्वारा अंतिम रूप से सफल अभ्यर्थियों का पात्रता/ अहर्त्ता से सम्बन्धित प्रमाण पत्रों की प्रारम्भिक जाँच की जायेगी।

प्रमाण पत्रों की जांच के क्रम में यदि किसी कोटि के उम्मीदवार के आवेदन पत्र में अंकित दावों का सत्यापन नहीं हो पाता है और उनकी उम्मीदवारी उक्त कोटि की रिक्ति के लिए स्थापित नहीं होती है तो ऐसी स्थिति में सम्बन्धित कोटि में रिक्त पदों के विरूद्ध मेधासूची में उपलब्धता के आलोक में निचले क्रम के उम्मीदवारों को आयोग द्वारा प्रमाण–पत्रों की जाँच के लिए आमंत्रित किया जायेगा।

नोटः–आयोग द्वारा अनुशंसित अभ्यर्थियों के सभी प्रमाण पत्रों की जाँचोपरांत संतुष्ट होने पर नियुक्ति प्राधिकार द्वारा नियुक्ति की कार्रवाई की जायेगी।

पत्र – 1 (भाषा ज्ञान)

(क) हिन्दी भाषा ज्ञान :–

(i) हिन्दी अनुच्छेद पर आधारित प्रश्न – 10 प्रश्न

(ii) हिन्दी व्याकरण पर आधारित प्रश्न – 15 प्रश्न

इस विषय में हिन्दी अपठित अनुच्छेद (Unseen Passage) तथा हिन्दी व्याकरण पर आधारित प्रश्न रहेंगे।

(ख) अंग्रेजी भाषा ज्ञान :–

(i) अंग्रेजी अनुच्छेद पर आधारित प्रश्न – 10 प्रश्न

(ii) अंग्रेजी व्याकरण पर आधारित प्रश्न – 15 प्रश्न

इस विषय में अंग्रेजी अपठित अनुच्छेद (Unseen Passage) तथा अंग्रेजी व्याकरण पर आधारित प्रश्न रहेंगे।

(सामान्य ज्ञान)

(क) झारखण्ड राज्य से संबंधित ज्ञानः–

झारखण्ड राज्य के भूगोल, इतिहास, सभ्यता, संस्कृति, भाषा–साहित्य, स्थान, खान खनिज, उद्योग, राष्ट्रीय आंदोलन में झारखण्ड का योगदान, विकास योजनाएँ, खेल–खिलाड़ी, व्यक्तित्त्व, नागरिक उपलब्धियाँ, राष्ट्रीय एवं अन्तर्राष्ट्रीय महत्त्व के विषय इत्यादि।

झारखण्ड राज्य की भौगोलिक स्थिति एवं राजनीतिक स्थिति की सामान्य जानकारी।

(ख) सामान्य विज्ञानः–

सामान्य विज्ञान के प्रश्न में दिन–प्रतिदिन के अवलोकन एवं अनुभव पर आधारित विज्ञान की सामान्य समझ एवं परिबोध से संबंधित प्रश्न रहेंगे। जैसा कि एक सुशिक्षित व्यक्ति से जिसने किसी विज्ञान विषय का विशेष अध्ययन नहीं किया हो, अपेक्षित है।

(ग) सामान्य गणितः–

इस विषय में सामान्यतः अंक गणित, प्राथमिक बीजगणित ज्यामिति, सामान्य त्रिकोणमिति, क्षेत्रमिति से संबंधित प्रश्न रहेंगे। सामान्यतः इसमें मैट्रिक/10वीं कक्षा स्तर के प्रश्न रहेंगे।

(घ) मानसिक क्षमता जाँचः–

इसमें शाब्दिक एवं गैर शाब्दिक दोनो प्रकार के प्रश्न रहेंगे। इस घटक में निम्न से संबंधित यथासंभव प्रश्न पूछे जा सकते हैं –सादृश्य, समानता एवं भिन्नता, स्थान कल्पना, समस्या समाधान, विश्लेषण, दृश्य स्मृति, विभेद, अवलोकन, संबंध अवधारणा, अंक गणितीय तर्कशक्ति, अंक गणितीय संख्या श्रृंखला एवं कूट लेखन तथा कूट व्याख्या इत्यादि।

(ङ) कम्प्यूटर का मूलभूत ज्ञानः–

इसमें कम्प्यूटर के विभिन्न उपकरणों, एम॰एस॰ विन्डो ऑपरेटिंग सिस्टम, एम॰एस॰ ऑफिस एवं इंटरनेट संचालन की विधि की जानकारी से संबंधित प्रश्न पूछे जा सकते हैं।

पत्र – 2 (चिन्हित क्षेत्रीय/जनजातीय भाषा ज्ञान)

उर्दू

1. **Urdu Literature Prose**

I.	Kafan	- Premchand
II.	Naya Qanoon	- Saadat Hassan Munto
III.	Aakhri Harba	- Elyas Ahmed Gaddi.

Poems

I.	Muflisi	- Nazeer Akbarabadi
II.	Subh-e-Azadi	- Faiz Ahmed Faiz
III.	Waladat Nabvi	- Hali.

Ashar

I. Aai Rashni-e-tabe jala kiyon Nahi deti - Siddque Mujeebi
II. Sabnam Bhigi Ghas per chalna kitna aachha lagta hai - Prakash Fikri
III. Tamannaon Main Uljhaya gaya Hoon - Shad Azimabadi.

2. Umraojan Ada - Mirza Hadi Ruswa.

3. **Grammar**

I. Gender
II. Opposite
III. Meaning
IV. Singular
V. Plural
VI. Similar.

संथाली

1. व्याकरण– संज्ञा, सर्वनाम, वचन, लिंग, पुरूष, क्रिया, काल, विशेषण, अव्यय, प्रत्यय, पहेलियाँ, मुहावरे, बुझोबोल

2. साहित्य–

(क) संताली लोक साहित्य – अर्थ, परिभाषा, भाग– विभाग, संतालों का उद्‌भव और विकास, गोत्र विभाजन, गाढ़ विभाजन।

लोक गीत– डाहार, बाहा, सोहराय, काराम दोङ, दाँसाय।

(ख) संताली शिष्ट साहित्य – कविता, कुङकुरूबुद, साँवहेंत्, मारांड़ो, सेंगेल, बिरसा मुण्डा, तुपुनघाट, साना, राहला रिमिल।

(ग) कहानी – माड़घाटी, तारा आञ्चार, आनखा लाहा, काथा रेनाङ गोनोङ।

(घ) निबंध – सिदो कानहू हुल, बाबा तिलका माँझी हुल, डिबा किसुन हुल, बिरसा आन्दोलन।

बंगला

1. Prose, Poetry, Drama

(A) Krishnakanter will - Bankim Chandra Chattopadhyay

(B) Pather Panchali - Bibhuti Bhushan Bandyopadhyay

(C) Chitra - Rabindranath Thakur (Selected)

(i) Sukh (ii) Urabashi (iii) 1400 sal (iv) Antarjami (v) Jibandebota

(D) Madhukari - Kalidas Roy (Selected)

(i) Mahakal (ii) Duiti Sattabani (iii) Mitrakkar (iv) Kalapahar

(v) Purano Kagajer Feriwala.

(E) Sajahan - Dwijendra Lal Roy

(F) Nananna - Bijon Bhattacharjee

(G) Sahityer Rup O Riti

(i) Mahakabya (ii) Gitikabya (iii) Tragedy (iv) Comdedy (v) Romanticism (vi) Classicism

मुण्डारी (मुण्डा)

1. व्याकरण–संज्ञा, सर्वनाम, वचन, लिंग पुरूष, क्रिया, काल, विशेषण, अव्यय, प्रत्यय, पहेलियाँ, मुहावरे, बुझौवल।

2. साहित्य –

(क) मुण्डारी लोक साहित्य– अर्थ, परिभाषा, भाग–विभाग, मुण्डाओं का उद्‌भव और विकास, गोत्र विभाजन, गढ़ विभाजन।

लेकगीत– बा, करम, सोहराई, अड़ान्दि।

(ख) मुण्डारी शिष्ट साहित्य – कविता, बिरसा मुण्डा, प्रेम प्रसंग, प्रकृति गीत।

(ग) कहानी–करम कथा, सृष्टि कथा, जीव जन्तु की कथा, सियार और बुढ़ा की कथा।

(घ) निबन्ध– बिरसा मुण्डा के अलगुलान, गया मुण्डा, चोट्टि मुण्डा, माघे परब, माडा परब, सोहराई परब इत्यादि।

हो

1. **व्याकरण** :– संज्ञा, सर्वनाम, विशेषण, लिंग, पुरूष, विलोम शब्द, काल, मुहावरे, पहेली, कहावत आदि।

2. **साहित्य** :–

(क) हो लोक साहित्य :– अर्थ, परिभाषा, हो आदिवासी के उद्‌भव और विकास, गोत्र। लोकगीत–मागे, बा, हेरोः जोमनमा आदि।

(ख) हो शिष्ट साहित्य

(ग) नाटक– गिरूनगर– चोम्पानगर

(घ) उपन्यास– होकुड़ि

(ड.) निबंध :– मागे पोरोब, हेरो पोरोब, हेरमुट, बा पोरोब, जोनोम, दोस्तुर, आंदि दोस्तुर, गोनोःय दोस्तुर।

(च) कविता :– हर्ताहसा, जोनोम दिसुम, अले दिसुमरे, अबुअः नमा भारत, दुल सुनुम जुलोः दिसुम लागिड।

खड़िया

1. व्याकरण– संज्ञा, सर्वनाम, वचन, लिंग, पुरूष, क्रिया, काल, विशेषण, अव्यय, प्रत्यय, पहेलियॉ, मुहावरे, बुझावल, उल्टा शब्द आदि।

2. (क) खड़िया साहित्य – अर्थ, परिभाषा, भेद–उपभेद, खड़िया जाति का उद्‌भव और विकास, गोत्र विभाजन, गढ़ विभाजन।

लोकगीत– जाङ कोर, कमर बंदोई, कदलेटा, जनम पर'ब, मुरड', बिहा (केरसोङ)

(ख) खड़िया शिष्ट साहित्य – गद्य–पद्य साहित्य।

(ग) कहानी – लोककथा।

(घ) निबंध – शहीद तेलेंगा खड़िया, गोपाल खड़िया, खड़िया महासभा, बंदोई, जाङ कोर, करम, जनम पर'ब'।

कुडूख (उराँव)

1. व्याकरण– संज्ञा, सर्वनाम, विशेषण, वचन, पुरूष, विलोम शब्द, काल, मुहावरे, पहेली, कहावत आदि।

2. साहित्य– (क) कुडुख़ लोक साहित्य– अर्थ, परिभाषा, उद्‌भव और विकास, गोत्र।

लोक गीत – बेंजा, लूझकी, तोकना डंडी, खद्दी करम, असारी, बरोया धुड़िया।

(ख) कुडुख़ शिष्ट साहित्य– नाटक, उपन्यास, कहानी, शहीद, निबन्ध, कविता, यात्रा वृत्तांत, आलोचना का उद्‌भव और विकास एवं विशेषताएँ।

कुरमाली

1. **व्याकरण** :– संज्ञा, सर्वनाम, वचन, लिंग, कारक, पुरूष, क्रिया, अव्यय, विशेषण, प्रत्यय, उपसर्ग, मुहावरे, लोकोक्तियाँ, पहेली (बुझौवल)।

2. कुरमाली लोकसाहित्य :–

   क. लोक साहित्य की परिभाषा, कुरमाली लोककथा, वर्गीकरण, लोकनाट्या लोकगीत : डाँइडधरा, एढ़ेइया, बाँदना, करम, बिहा, डमकच।

   ख. शिष्ट साहित्य : आधुनिक कविता की प्रवृतियाँ, कवित–रचना–विधान

   ग. कहानी : कुरमाली केहनी जड़ती की सभी कहानियाँ।

   घ. निबंध : महाकवि विनन्द सिंह, गौरांगिया, संतकवि सृष्टिधर, संतकवि महीपाल, डॉ नन्द किशोर सिंह

खोरठा

1. **गद्य भाग**

   (क) छॉइहर (कहानी संग्रह) – लेखक – चितरंजन महतो चित्रा

   (ख) सोंध माटी (कहानी संग्रह) – लेखक – डॉ0 विनोद कुमार

   (ग) खोरठा निबन्ध – लेखक – डॉ0 बी0एन0 ओहदार

2. **पद्य भाग :–**

   (क) दामुदेरक कोराञ् – लेखक – शिवनाथ प्रमाणिक

   (ख) ऑखीक गीत – लेखक – श्री निवास पानुरी

   (ग) खोरठा–कोठ पइदेक खेड़ी – लेखक – डॉ0 ए0के0झा

   (घ) एक मउनी फूल – लेखक – संतोष महतो

3. **नाटक**

   (क) डाह – सुकुमार

   (ख) अजगर – लेखक – विश्वनाथ दसौधी राज

   (ग) चाभी काठी – लेखक – श्री निवास पानुरी

   (घ) उदवासल कर्ण – लेखक – श्री निवास पानुरी

4. **साहित्य की अन्य विद्याएँ:–**

   (क) संस्मरण

   (ख) जीवनी

   (ग) यात्रा वृवांत

   (घ) शब्द चित्र

5. व्याकरण– खोरठा संज्ञा, सर्वनाम, लिंग, वचन, काल, कारक, समास, उपसर्ग।

नागपुरी

1. व्याकरण :– वर्ण, सज्ञा, सर्वनाम, लिंग, वचन, कारक, विशेषण, क्रिया विशेषण, अव्यय, समास, उपसर्ग प्रत्यय काल, क्रिया, वाक्य, उपसर्ग प्रत्यय, समास, अनेक शब्द के बदले एक शब्द, विलोम शब्द, समानार्थी शब्द, मुहावरे एवं कहावतें, वाक्य शुद्धि।

2. साहित्य :– (क) नागपुरी लोक साहित्य– लोक गीत, लोक कथा, पहेली, कहावत, मुहावरे

(ख) लोक गीत– डमकच, पावस, उदासी, फगुआ पंचरंगी, फगुआ पुछारी, झूमर, अंगनई, लहसुआ झुमआ, सोहराइ गीत।

(ग) नागपुरी लोक कथा–तिरियाँ चरित, वनाहरनी कर बेटा, सातभाई एक बहिन, छोटकी बोहोरिया, नवाँचाद आदर गोपीचांद।

(घ) नागपुरी शिष्ट साहित्य– वन केंवरा– भाग–एक–गद्य–पद्य संग्रह शकुंतला मिश्र एवं डॉ0 उमेश नन्द तिवारी

पंच परगनिया

1. व्याकरण – संज्ञा, सर्वनाम, विशेषण, क्रिया, वाक्य, काल समास, अव्यय, मुहावरा, पहेलि, बुझौवल आदि।

2. साहित्य – पंच परगनिया लोक साहित्य–अर्थ, परिभाषा, भाग, विभाग, पंच परगनिया भाषा साहित्य की विशेषतायें आदि।

3. लोकगीत – पुस लोक गीत, बिहा गीत, करम गीत, सँहरइ गीत, मंत्र गीत और बालगीत आदि।

4. मध्यकालीन कवियों की काव्य रचना – पाठयांश।

5. कहानी – पाठयांश से संबंधित कहानी।

6. निबंध– सामाजिक, राजनैतिक, आर्थिक, सांस्कृतिक भौगोलिक विषयों पर आधारित

उड़िया

1. **भाषा विभाग**

भाषा

उपभाषा

भाषार उत्पति सिधांत

भाषा परिबर्त्तनर कारण

भाषा परिबर्त्तनर दिग

ध्वनि परिबर्त्तनर कारण

उड़िया भाषा उपरे अन्यान्य भाषार प्रभाव

2. **<u>उड़िया साहित्यर इतिहास</u>**

आरम्भरु पंचसखा युग पर्यन्त

लोकगीत

लोक कहाणी

लोक नाट्क

लोक वाणी

शरला दास पंचसखा युग (बलराम दास, जगन्नाथ दाश, अच्युतानन्द दास, जशोवंत दास, अनंत दास)

<u>सहायक ग्रंथसूची</u>

(क) भाषा विज्ञानर रूपरेख – डॉ0 वासुदेव साहु

(ख) उड़िया भाषार उनमेश ओ विकाश – डॉ0 वासुदेव साहु

(ग) भाषा शास्त्र परिचय – डॉ0 गोलक विहारी धल

(घ) ध्वनि विज्ञान – डॉ0 गोलक विहारी धल

3. **<u>गल्प विभाग</u>**

गल्प ओ एकांकिका – Edition 2000 (OBSE)

(क) रेवती – फकीर मोहन सेनापति

(ख) तुमे कि सते पथर हेल – गोदावरीश महापात्र

(ग) बउला – राज किशोर राय

(घ) आईवुढ़ी – वंसत कुमार सतपथि

(ङ) अशुभ पुत्रर काहाणी – अच्युतानंद पति

4. **<u>एकांकिका विभाग</u>**

गल्प ओ एकांकिका Edition 2000 (OBSE)

(क) दूर पाहाड़ – प्राणवन्धु कर

(ख) फल्गु – मनोरंजन दास

5. **<u>व्याकरण विभाग</u>**

विशेष्य, विशेषण, संधि, समास, वाक्य रूपान्तर, भ्रम संशोधन, समच्चारित शब्द, एकपदरे प्रकाश, कुदन्त तद्धित।

1. Computer Operator and Programming Assistant (कोपा)

Safe working practices Scope of the COPA trade. Safety rules and safety signs. Types and working of fire extinguishers.

Introduction to Computer components Introduction to computer system. Concepts of Hardware and Software. Function of motherboard components and various processors. Various Input/ Output devices in use and their features.

Introduction Windows Operating System. Introduction to operating System. Main features of Windows OS. Concept of various shortcut commands.

Computer basics and Software Installation. Introduction to the booting process. Introduction to various types of memories and their features. Basic Hardware and software issues and their solutions. Usage of Application software and Antivirus.

Introduction to DOS Command Line Interface & Linux Operating Systems

Introduction to basic DOS Internal and External Commands. Introduction to Open Source Software. Introduction to Linux Operating System features, structure, files and processes. Basic Linux commands.

Word Processing Software. Introduction to the various applications in MS office. Introduction to Word features, Office button, toolbars. Creating, saving and formatting and printing documents using Word. Working with objects, macro, mail merge, templates and other tools in Word.

Spread Sheet Application. Introduction to Excel features and Data Types. Cell referencing and linking Sheets. Introduction to various functions in all categories of Excel. Concepts of sorting, filtering and validating data. Analyzing data using charts, data tables, pivot tables, goal seek and scenarios.

Image editing, Presentations. Introduction to Open Office. Introduction to the properties and editing of images. Introduction to different formats of images and their uses. Introduction to Power Point and its advantages. Creating Slide Shows. Fine tuning the presentation and good presentation technique.

Database Management Systems. Concepts of Data and Databases. Overview of popular databases, RDBMS, OODB and NOSQL. Rules for designing good tables. Integrity rules and constraints in a table. Relationships in tables. Introduction to various types of Queries and their uses. Designing Access Reports and Forms. Introduction to macros, designer objects controls, their properties and behaviour.

Networking Concepts. Introduction to Computer Networks, Necessity and Advantages. Client Server and peer to Peer networking concepts. Concept of Proxy Server and proxy firewall server. Concept of DHCP Server. Network topologies. Introduction to LAN, WAN and MAN. Network components, viz. Modem, Hub, Switch, Router, Bridge, Gateway etc. Network Cables, Wireless networks and Blue Tooth technology. Concept of ISO - OSI 7 Layer Model.

Overview of various Network protocols Viz. TCP/IP, FTP, Telnet etc. Concept of Logical and Physical Addresses, Sub netting and Classes of Networks.

Internet Concepts. Introduction to www, Concept of Internet, Web Browsers, internet servers and search engines. Concepts of Domain naming Systems and E mail communication. Introduction to video chatting tools and Social Networking concepts.

Web Design Concepts. Concepts of Static and Dynamic Web pages. Introduction to HTML and various tags in HTML. Concepts of different controls used in Web Pages. Concepts of CSS and applying CSS to HTML. Introduction to open source CMS viz, Joomla, Word press etc. and Web authoring tools viz. Kompozer, Front Page etc. Concept of good web page designing techniques.

Introduction to JavaScript. Introduction to Programming and Scripting Languages. Introduction to JavaScript and its application for the web. Introduction to Web Servers and their features. JavaScript Basics – Data types, Variables, Constants and Conversion between data types. Arithmetic, Comparison, Logical Operators in JavaScript. Operator precedence. Program Control Statements and loops in JavaScript. Arrays in JavaScript – concepts, types and usage. The String data type in JavaScript. Introduction to String, Math and Date. Introduction to Functions in JavaScript. Built in JavaScript functions overview. Concepts of Pop Up boxes in JavaScript. Introduction to the Document Object Model. Concepts of using Animation and multimedia files in Java Script.

Introduction to VBA, Features and Applications. Introduction to VBA features and applications. Properties, events and methods associated with the Button, Check Box, Label, Combo Box, Group Box, Option Button, List Box, Scroll Bar and Spin button controls.VBA Data types, Variables and Constants. Operators in VBA and operator precedence. Mathematical Expressions in VBA. Introduction to Arrays in VBA. Introduction to Strings in VBA. Conditional processing in VBA, using the IF, Else-if, Select Case Statements. Introduction to Loops in VBA.VBA message boxes and input boxes. Introduction to Creating functions and Procedures in VBA. Using the built in functions. Introduction to Object Oriented Programming Concepts. Concepts of Classes, Objects, Properties and Methods. The user forms and control in Excel VBA. Introduction to Debugging Techniques.

Using Accounting Software. Basics of Accounting, Golden Rules of Accounting, Voucher Entry, Ledger Posting, Final Accounts Preparation. Cash Book. Ratio Analysis, Depreciation, Stock Management. Analysis of VAT, Cash Flow, Fund Flow Accounting. Introduction to Tally, features and Advantages. Implementing accounts in Tally. Double entry system of book keeping. Budgeting Systems, Scenario management and Variance Analysis. Costing Systems, Concepts of Ratios, Analysis of financial statements. Inventory Basics, POS Invoicing, TDS, TCS, FBT, VAT & Service Tax. Tally Interface in Different Languages.

E Commerce Concepts. Introduction to E- Commerce and advantages. Building business on the net. Payment and Order Processing, Authorization, Chargeback and other payment methods. Security issues and payment gateways.

Cyber Security: Overview of Information Security, SSL, HTTPS, Security threats, information Security vulnerability and Risk management. Introduction to Directory Services, Access Control, Security, Privacy protection, Audit and Security. Introduction to IT Act and penalties for cyber crimes.

2. Information Technology (इन्फोरमे□ान टेक्नोलॉजी)

Safety of working personal and equipment. Safety while lifting and shifting of fragile and heavy equipments.

Safety precautions. Earthing, need and importance of Earthing, Types of earthing, Electrical safety.

Electrical safety precautions. First aid in case of physical injury. First aid in case of Electrical hazard. Electricity, Potential difference, AC &DC voltage, Current, Waveform.Measuring devices (meter). Conductors, Insulators and semiconductors, examples and applications. Domestic electrical wiring – requirements.Testing continuity of wires. Skinning and tinning of wires and cable ends. Resistors, types, specifications, applications, identification using colour code, Resistors in series, parallel and series parallel. Ohms law and its application. KCL & KVL Solder joint. Soldering requirement &practice, Common soldering defects. De soldering - Precautions & practice. Application of PCB's. Types of PCBs, specifications. List some Connectors used with PCB. Capacitor, types, specification, capacitors in series and parallel – applications Magnetism. Faradays Laws.Inductance, Inductor-types, specifications, applications. Measurement of inductance, Inductance in series and parallel. Inductive reactance. Self & mutual Inductance - properties, applications. Transformer, principle, construction, types, rating and applications.Testing a given transformer. Semiconductor device. Rectifier diodes, types, specifications and applications. Half wave rectifier, construction, working, output voltage, current rating and output ripple. Efficiency, limitations, applications. Full wave rectifier, construction, working, output voltage, current rating and output ripple. Efficiency, limitations, applications. Bridge rectifier, construction, working, output voltage, current rating, output ripple. Efficiency, limitations, applications. LED's, types, specification and applications. Using LED as indicator lamps. Principle of working of a transistor. PNP and NPN transistors. Specification of transistors. Identification of transistors, terminals. Referring to Data book for selecting a transistor. Biasing of transistors -types, advantages, and applications. Types of amplifiers, working and applications. Cascaded amplifiers, types and applications. Oscillators, types, Harmonic-LC, RC, Crystal and relaxation-UJT. Pulse, pulse parameters, implications. Pulse circuits, multi vibrators, applications. DIAC, SCR, TRIAC-principle of working, specifications, circuits and application. Differential amplifiers, OP- Amps, principle, characteristics, advantages, applications. List a few commonly used op-amps, Amplifiers in integrated circuit forms. IC oscillators -IC 555Other types of linear IC's and applications. Voltage regulator -zener diode, principle, application, limitations. Shunt and series regulators, applications, limitation. IC voltage regulators- fixed/variable, specifications, testing. Multiple output regulators, package details of some common IC regulator. Comparison of linear and Switch mode power supplies. Working of SMPS. Types, specifications and applications. Circuit tracing of SMPS. Fault finding and Troubleshooting approach of SMPS with emphasis on power supplies used in PC'sand its I/O devices. Primary and secondary batteries. Dry cells, specification. Button cells, types and applications - testing. Secondary battery types, specification, construction, Routine maintenance, Electrolyte- specific gravity, charging batteries. Maintenance free batteries. Use of batteries with UPS. Safety precautions. Comparing Analog and Digital signal. Application of Digital electronics. Number system, Binary, octal and hexadecimal. Boolean algebra, D'Morgans theorem. Simplification of logic circuit. Identification of Digital IC's, Types of packages, applications. Basic digital gates and truth tables. 1's & 2's compliment Flip- flop, register & counter. Making a logic circuit for any custom requirement. Basic blocks of a digital computer. Function of each

block. Personal computer organization. Introduction to various generations of PC's. Brief working and usage of I/O and memory devices used in a PC. Working with computer using windows operating system. Obtaining system information. Ports on a PC and its specifications. Hardware interface and driver. IRQ and DMA. Making startup/emergency diskette. Installing and setting keyboard, mouse, Display, Printer, multimedia, Modem, web camera and other devices. Memory Types and uses. Computer main memory, specifications, compatibility, expandability, types, manufacturers. SMPS used in PC, Specifications, types of connectors, testing. Mother board, types, specifications, components on the motherboard and its functions. BIOS, CMOS setup. FDD/HDD, principle of working, types, capacity, manufacturers, connecting to motherboard. Jumper setting. Partitioning, formatting. Non DOS partitions. Loading operating system. Loading multiple OS. Loading application packages. CDROM drive, principle of working, types, specifications, manufacturers, connecting, jumper setting. COMBO drives. Identifying and Troubles hooting software related problems. Identifying and Troubles hooting hardware related problems. Disassembling precautions and procedure. Assembling of PC for a given requirement. Upgrading of PC in respect of main memory, HDD, ZIP, DAT and other special devices. Serial data communication, principle, standards/protocols and devices/ applications. Parallel data communication, principle, standards/protocols and devices/ applications. Features of Networked computers. Components required for networking. Network Topologies. Comparison. Network Protocols, applications. Physical components planning for a small LAN. Network operating systems and features. Network cables, types, specifications, standards, application. Peer- to peer connection. Client server connection, comparison, applications. What is router, its function, configuration table. Concept of work groups and uses. UTP Cross cable for testing connection between two computers. UTP straight cable and connecting through N-port Switch. Allocation of IP address and Subnet. Cabling procedures and introduction to structured cabling. Creating users in Widows server. Resource sharing and Security. Sharing a single internet connection in LAN, with or without the use of Proxy. Multi user OS. Linux Operating system, OS commands. Installing devices. Setting up LAN in Linux environment.

Microsoft WORD:- Text editing software's. Introduction to MSOffice. Features and application of Microsoft word. Concept of word processing. Menu bar features. Standard toolbar features. Editing the text, use of different tools, formatting the text. Creating, Document, non- documents files. Creating templates. Creating tables. Inserting pictures and videos. Mail merge. Book marks. Bullets and numbering. Hyperlinks. Creating broachers. Creating bookwork

Microsoft EXCEL:- Use of Microsoft Excel features for creating worksheets with mathematical formulae and graphs.

Microsoft POWERPOINT:-Use of Microsoft Power point features for creating multimedia presentations.

Microsoft OUTLOOK:-Customizable quick e-mail, calendar, and tasks. Create a short cut in the Outlook Bar to any file, folder or Webpage. Send and receive-mail in HTML format. Find tool to quickly find messages, appointments or tasks using a Web-style search to specify the desired information. Publish personal or team calendar as a Web page using a single command. Create and store personal distribution lists along with contacts in your Contacts folder. Manage mass mailings with Mail Merge for e-mail, fax or print distribution to select or all contacts based on any set of contact

fields. Use the Activities tab on a contact item to dynamically track and view all activity related to a contact such as e-mail, appointments and tasks.

Adobe PageMaker:- Use of Page Maker features for creating Pamphlets, broachers, reports, illustrative works and long book works.

Corel draw:-Use of features of Corel draw. Create artistic characters and shapes for use with page maker. (07 hrs)

Internet:- Networking of Computers. LAN, MAN, WAN. Intranet. Interconnected computers. LAN, MAN, WAN. Intranet. Internet, Websites, WWW, URL. Internet protocols, HTTP, FTP, Client end software - Browsers. Requirements for Internet access, browser, modem, ISP. Getting internet count and settings. Types of browsers, basic principle, features. Setting of browser features, security levels. Getting connected to a website- site name & its URL, Domain name server. Saving websites, favorites, printing web pages/sites. Meaning and use of Search engines. Searching tips. Webmail account, Email, providers- free and paid. Creating free Email ID, sending and receiving Email. Sending and receiving attachments using Email. Chatting over Web. News groups. Down loading of software's – FTP. Getting connected to a distant computer and Telnet.

MS Outlook Express:- Setting-up outlook express for sending and receiving mails using multiple ID's. Features provided by Outlook express.

HTML :- Source code of Web pages, meaning of HTML, its features and advantages. Programming using HTML. Using Scripts for active web pages. Use of Java scripts.(Simple scripts only). Use of VB script for interactive pages.(Simple scripts only). Picture formats, animated files and its usage in web pages. Web page design using Front page. Procedure for Hosting of web sites.

Adobe Photoshop:- Different composition of colors. The colors of the visual spectrum. Evidence of color theory implementation from existing graphics found in print media. Picture formats, Color use and implementation on the web. Introduction to some of the most common graphics and image file formats, and its restrictions to particular hardware/operating system platforms. Image formats and incorporation of compression technique for large storage size of Image files. Creating Vector Graphics. Using tools for publishing artwork on the Web & in print. Exploring new creative options and producing high quality images for print & web. Creating exceptional imagery with easier access to file. Streamlined web design. Photo re-touching, colorful image collages,

MULTIMEDIA –Audio:- Sound recording basics, various formats of sound files, Converting analog audio to digital audio. Digital audio editors that include powerful audio processing tools, effects for recording and manipulating audio. Edit files nondestructively down to the sample level with extreme speed and accuracy.

Multimedia –Video:- Introduction to the concept of 3D.Orthographic and Perspective views. Creating basic objects in 3D. Introduction to command panel. Working with "Properties" of 3Dobjects. Editing 3D objects using modifiers. Elements of View Port controller. Creating objects with Standard Primitives and Extended Primitives. Creating objects using "Shapes" panel. Re-shaping of objects using Compound Objects like Boolean, Terrain and Loft. Creating symmetrical objects using Lathe option. Simple Animation of basic objects. Introduction to Particle Systems. Low Polygon Modelling. Database concepts -data, object and properties: Definition. Elements of database in Access: table, form,

query, report. Creating tables in Datasheet and design view, setting field properties. Editing data in table. Developing customized form for data entry and editing. Data validation and verification. Developing and generate queries. Developing and generating reports. Relational Database systems. Its advantages and applications Using Multiple table, data entry, and generating reports. Concept of Front end for database. Software's used as Front- end. Use of Visual basic as front end with access. Development cycle. Steps for developing simple software using Access and VB for a given application. Database back up and retrieval.

Linux operating system:- Basic Linux commands. Linux file system, The Shell, Users and file permissions, vi editor, X window system, Filter commands, Processes, Shell Scripting.

Laptop PCs:- Introduction of laptop and comparison of various Laptops. Block diagram of laptop & description of all its sections. Study of parts of a laptop. Input system: Touchpad, Trackball, Track point, Docking station, Upgrade memory, hard disk, replacing battery, Configure wireless internet in a laptop, Latest Tools & Gadgets for Desktop/Laptop Repairs.(09hrs)

Printers & Plotters:- Types of printers, Laser printer, Ink jet printer, line printer. Block diagram and function of each unit head assembly, carriage, and paper feed mechanism. Front panel controls and interfaces. Pin details of interface port. Installation of a printer driver. And self test. Working principle of LASER printer. Toner cartridge, types, replacing toner cartridges. Refilling toner cartridges, equipment available for refilling and procedure. Printer drum, function, cleaning and replacing procedure. Power supply in laser printers, circuit, defects, servicing. Mechanical parts and sensors on laser printer, function, replacement procedure. Control board(s) in laser printer, circuit diagram, defects and servicing procedure. Working principle of INK JET/Desk jet printers. Type of ink used and replacement of ink cartridge. Refilling of ink, equipment available, quality of refilled cartridges. Printer drum, function, cleaning and replacing procedure. Power supply in inkjet printers, circuit, defects, servicing. Mechanical parts and sensors on inkjet printer function. Working principle of Plotter and its common faults.

Scanner & MFD:- Working principles of Scanner, Barcode Scanner, Network Scanner. Working principles of Multifunction Printer, Passbook printer, High Speed Printer, Line Printer, Network Printer. Print Server.

Monitor, Display card and Driver:- Types of monitor, Monochrome. And colour, CGA, EGA, VGA, SVGA, Digital and Analogue, interlaced none interlaced. Specifications and comparison Of Monitors. Front panel controls, brightness, contrast, horizontal and vertical height settings. Display cards, bus standards, types CGA, EGA VGA, SVGA, AGP, memory and drivers. Main components and connectors on display cards, display controller IC, RAM chips and dual port feature principle of working and use of display memory. Installing display drivers, setting features. Information required before changing the display driver card and precautions to be taken while installing a display driver card. LCD and TFT Monitors. Understanding the difference between flat screens and CRT display systems. Understanding the displays memory and its effect on quality and performance. Working principle of LCD Projector, its specification, configuration and common faults. Working Principle of Touch Pad.

Upgrading of System:- Understand the limitation of a PC and scope for upgrading. Understand technical specifications for PC upgrading.

Practice on Backup Drives: Introduction to removable storage devices, Bulk data storage devices-magnetic, optical, magneto optical drives, WORM drives. Minor repairs and maintenance of CDROM drives. Important parts and functions of DVD ROM drive. Minor repair works on a DVD ROM drive. Minor repair works on a CD/DVD WRITER. Technology, working principle, capacity, media of Magneto- Optical Disk (MOD)drives. Applications. Important parts and functions of MOD drive. Minor repair works on MOD. Latest trends in backup devices/media.

Maintenance and Troubleshooting of PC:- Safety precautions in handling PC, sub assemblies and components, Important points to be considered while purchasing and replacing components. Concept of Preventive and corrective maintenance. Tools required, Active & Passive Maintenance, Maintenance scheduling. Need of diagnostics program. Features, limitations. Examples of commonly used diagnostic programs. Probable defects in PC. Localizing faults through its observable visual or audio symptoms and possible methods for rectification/servicing. Understanding serviceability of component. Economy in repair/replacement. Block diagram of a KB, function of controller, LED driver Sample circuit. Defects related to Keyboard and its related ports (DIN,PS/2,USB) . Discontinuity in cable, and bad keys. Servicing procedure. Defects related to Mouse and its related ports (COM, PS/2, USB) and servicing procedure. Working principle, electro mechanical circuits of Light pen scanner and digitizer. Defects and symptoms related to HDD and its cable, connector and servicing procedure. Defects related to CD ROM Drive jamming of mechanical assembly malfunction of control circuit. and its cable, connector and servicing procedure. Defects related to Ports jumper setting on motherboard and servicing procedure. Defects related to processor, its socket, cooling and servicing procedure. Defects related to RAM memory module connector and servicing procedure. Defects related to BIOS, upgrading and servicing procedure. Defects related to CMOS, COMS setup and servicing procedure. Defects related to battery and servicing procedure.

Tablet / Smart Devices:- Motherboard Introduction. Study of parts of a tablet PC / smart devices. Testing of various parts with multimeter. Steps of repairing various hardware problems. Advanced troubleshooting techniques. Introduction of various software faults. Flashing of various brands of tablets / smart devices. Upgrading operating systems .Locking &unlocking of handsets. Concept of iOS, Android, Ice-cream sandwich, jellybeans. Concept of Phone Gap.

Configuration of Data communication equipments:-Network Components - Modems, Firewall, Hubs, Bridges, Routers, Gateways, Repeaters, Transceivers, Switches, Access point, etc. - their types, functions, advantages and applications. IP Routing in Network RIP, IGRP

Network Protection and troubleshooting:-Collaborating using wired and wireless networks. Protecting a Network. Network performance study and enhancement.

Server Installation, Configuration & Backup:-Server concepts, Server Hardware, Installation steps, configuration of server. Concept of Active Directory. ADS Overview, ADS Database, Active Directory Namespace, Logical & Physical Elements of AD. Introduction to Web Server Introduction to Messaging Services Concept of Backup and Recovery of Server.

Install & configure DNS:-Concept of DNS. Name resolution-Host names, NetBIOS names.DNS Overview. DHCP Overview. DHCP Clients and Leases.

Routing and Remote Access:-Remote Access Overview VPN Concepts. Remote Access Authentication Protocol RRAS Policies IAS TCP/IP Routing

Planning and Implementing User and Group Strategies:-Concept of User and Group. Planning Security Group Strategy, AGDLP Process, Planning User Authentication Strategy, Planning OU Structure, Planning a Group Policy Strategy, Deploying Software Through GPO

Managing Server Network & Infrastructure:-Security Baseline and Templates, Audit Policy, Understanding IPSec, Protocol Security, Planning, security for Wireless Network, Managing Network Traffic, Types of Problems of Internet Connectivity, Types and working of Server Services.

Linux Server installation and configuration:-Configuration Plan, Public and data directory, Host file, SWAT, Password Authentication, Telnet(09hrs)

Network Security:-Modern Network Security Threats and the basics of securing a network. Secure Administrative Access, LAN security considerations. Network Security Devices. Cryptography. Wi-Fi security considerations.(09hrs)

Raster & Vector Graphics:-Traditional Design concepts, Traditional and digital applications of color, concept and composition. Making Selections, Understanding Appearances, Working with Groups and Layers, Advanced Drawing and Path Editing, Working with Color, Object Transformation and Positioning, Use of Brushes, Use of Masks, Use of Symbols, Application of Filters, and Live Effects, Advanced Text Editing, Designing for the Web, Creation of Blends, Working with Images, Performing Specialized Tasks Saving and printing, Working with Other programs.

Introduction to Flash:-About Flash and General over view - Stage and Work area of Flash, using guides, grid & rulers. Using frames and key frames, working with time line.Using layers - to create a layer, to create a layer folder, to show or hide a layer or folder, to view the contents of the layer as outlines, to change the layer height in the timeline, to change the order of the layers or folders. Using Guide layers. Drawing in Flash - to raw with a pencil tool, to paint with a brush tool, to draw with pen tool.Using colours in Flash. to use a gradient fill. Importing Artwork. Video and Audio. Different file formats in Video & Audio. Flash Compatible Audio & Video file formats. Introduction to Adobe Premier Project. Creating a Sequence. Editing in the Timeline. Refining the sequence. Transitions. Audio. Tiles. Effects. Output

Introduction to Adobe After Effects:-Special effect Techniques. Introduction to User interface. Concepts of compositions, Key framing, Looping animation, motion path. Introduction to Bound Effects, Authoring Tool & Special effects Tool, filter effects and mask to components.3D Animation transformations, use of common loop sound, simple scripting in special effect Tool. Rotoscoping, Chroma, 2D & 3D tracing, Green/Blue screen technique/shooting. Colour Correction

Introduction to 3Ds Max:-Fundamentals & concepts of Animation. 3D Animation Techniques. User Interface. Modelling. Lighting/Rending. Character Setup & Animation. Dynamics

Introduction to Front Page:-Background Pictures, Tables - Adding and Deleting Rows, Columns, and Cells Background Colors,P icture Manipulation-Transparent, Alt Representation Text Tags, Rotating, Thumbnails, Picture Gallery, Hyperlinks - To 'Outside'/External Sites, Internal Link, Bookmark, Email Addresses, Rollover Styles, Target Frames, Marquees, Forms – Search Page, Inserting a Form,

One Line Text Box, Option Button, Check Box, Text Area, Drop Down Box, Confirmation Pages, Sample Forms Page, Date and Time Stamp, Counter, Page Transitions, Changing your Password, Themes, Banners, Buttons, Headings, Hyperlinks/Bullets/ Horizontal Lines, Navigation Bars, Frames, Shared Borders, Scheduling a Web Page or Picture to Appear.

Programming Language Basics:-Introduction to computer programming language, Generationsof Programming Languages, Procedural & non- procedural programming Language, Structured & Object Oriented Programming Language, Algorithm, Flowchart. Introduction to Scripting Language, difference between programming and scripting languages, working principle of Scripting language. VbScrpt- Embedding VBScript in HTML, VBScript to Display Information, Hiding VBScript from Older Browsers, Code Documentation & Formatting, Variables, subtypes & Constants, Arrays, VBScript Operators, VBScript Procedures, Program Control & Structure, Strings & Numbers, Message & Input Boxes, Dates & Times, Explorer 5.x DOM, Event Handlers - Top-Down vs. Event-Driven Programming, Mouse Events, Keyboard Events, Validation & Error Handling. VBScript & the Web - Platform or Host dependence.

JAVA Script- Introduction to Java Script, Where does Java Script Fit in? Comparing Java Script to VBScript, Comparing Java Script to Java, The Purpose of Java Script, Prerequisites, Using Java Script in an HTML Document, Hiding Java Script from old Web Browsers. Basic Syntax Used in Java Script Commands, Variables, Functions, Flow Control Structures, Operators, String Processing, Objects, History Object, Date Object, Using Objects like Arrays, Events.

PHP (Hyper Text Pre Processor) :-Introduction to PHP, its features and advantages. Basic PHP Syntax, tags, Data types, Constants and Variables, Operators and expressions.PHP Conditional Events, Flow control and looping in PHP. Functions in PHP. Arrays and Strings in PHP. Super Global Variables in PHP. Form handling and validations.

My SQL:-The SQL Create Command. Table Creation Rules. Dropping a Table.The SQL-INSERT Command. Inserting NULL. Viewing data (SQL-SELECT).Updating Data in a table (The SQL-UPDATE command).Deleting rows of data (The SQL-DELETE command).Viewing the structure of an already existing table (SQL-DESCRIBE command): My SQL Scripting.

Web Page Design and Publishing:-Design issues, URL, Home Page, Web Browser, Network Server, IIS, Web Server, Publishing / hosting website in a network server / web server. Web Auditing, VPN Account, Remote updating. Blog Creation Define Blog, History, Blog Taxonomy, What to Blog about? How to Blog - Self hosted or free blogging service, Difference between a blog and a website.

Overview of Information Security:-Understanding Information Security - Need of the Information security, Basics of IS (CIA), History and evolution of IS, Dimensions of Information Security, Intranet/Internet, Information Security and Cyber Security relationship. Why Care About Security - Challenges to Information Security, Benefits of Information of Security, Understanding techniques to enforce IS in an organization, Identifying tools to enforce Information Security. Identifying frameworks to enforce Information Security. Overview of Information Security Threats Types of threats - DDoS, Malicious codes, Espionage, etc Identification of Threats -Probing of threats, Scanning of threats, Modus Operandi, Sources of Threats. External threats, Internal threats, Best Practices or Guidelines used to Identify Threats -Conduct regular education and awareness trainings for employees and third parties, Best Practices or Guidelines used in mitigation of threats, Deploying up to date

technology. Maintaining Systems and Procedures, Educating Users, Conducting regular education and awareness trainings for employees and third parties. Collaborate with peers and experts through different forums to understand contemporary issues and solutions.

Information Security Vulnerabilities:-Why do Information Security Vulnerabilities exists - Types of Technical Vulnerabilities, Types of Native Vulnerabilities, Understanding Security Vulnerabilities, Flaws in Software or Protocol Designs, Weaknesses in How Protocols and Software Are Implemented, Weaknesses in System and Network Configurations, Weaknesses in Web or Cloud applications, Weaknesses in Online e-transactions, Browser Security and Role of cookies and pop-ups, Security holes in Browser, Web Applications, OS, and Smart phones, Identifying role of Social sites and media in cyber security and vulnerability. Understanding Vulnerability Assessment Tools and Techniques, Techniques to Exploit Vulnerabilities. Techniques to Fix security Vulnerabilities

Risk Management:-What is Risk?, Relationship between Threat, Vulnerability, and Risk What Is the Value of an Asset? What Is a Threat Source/Agent? Examples of Some Vulnerabilities that are Not Always Obvious. What Is a Control?, What Is Risk Likelihood and consequences? What Is Impact?, Control Effectiveness. Risk Management, Purpose of Risk Management, Risk Assessment (Phases), Why Is Risk Assessment Difficult?, Types of Risk Assessment, Different Approaches to Risk Analysis, Best Practices and Guidelines in Assessing and Calculating Risks. Develop and implement policies and procedures to mitigate risks arising from ICT supply chain and outsourcing. Best Practices and Guidelines in Mitigating Risk.

3. SEWING TECHNOLOGY (सिविंग टेक्नोलॉजी)

Introduction Trade, Job Prospects, Safety precautions, First Aid

Basic Industrial Terminology Trade related Tools, their importance, usage and safety

Measuring Tools, Drafting Tools, Marking Tools, Cutting Tools, Sewing Tools, Finishing Tools

Fabric Fundamentals Brief idea about fibers, Types of Fabrics, Selection of Needle and thread according to fabric types, Broken Needle Policy Fabric Preparation for cutting Fabric Grain, Selvedge, Shrinkage, Straightening the fabric Grains Measurements, Units

Measuring Techniques

Basic Sewing Machine Parts and functions, Machine needle, Stitch formation, Sewing machine practice, Care and maintenance, Trouble-Shooting, Types of Industrial Sewing Machine

Over lock machine Parts and functions, Machine practice, Care and maintenance

Trouble Shooting Basic Garment Analysis

Seams Classification, Uses, Properties of Seams, Seam finishes Sewing Aids, Presser foot

Folds, Guides

Introducing Fullness Darts – Necessity, type & precautions during stitching, Pleats – Necessity, type & uses

Introducing Fullness Tucks – Types &use, Gathering and Shirring, Flare, Ruffles/Frills – Types (Straight & Circular) & uses.

Hand stitches Hand needles – Size & types, Sewing Thread, Types & Applications of hand stitches

Hems Types, Uses

Corner Makings Types, Uses

Casing Introduction, Use

Edge Finishing Facings, Bindings, Piping's

Necklines Different shapes of neckline

Plackets Types , Sample makings

Pockets Types, Design variations

Collars Classification, Collar terms

Sleeves Classification, Sleeve length variation, Sample making of Sleeves with and without cuff.

Trimmings Types, Applications, Fixing of Buttons, hooks etc. Making of Buttonhole

Mending Darning, Patching

Drafting & developing Pattern for Ladies suit.

Human Figures Eight Head Theory, Brief introduction about Joints and Muscles, Types of Figures Body Measurements, Importance, Types & Measuring Techniques, Precautions Measurement Charts

Patterns Importance, Pattern Information, Types of Spreading & Pattern Layout, Importance, Spreading methods/machines, Types of layout Pattern Drafting, Drafting/Pattern Terminology, Principles of Pattern drafting

Pressing Tools, Methods Importance of Pressing Trial Room, Necessity, Specification

Sketching and drafting of Sari Petticoat.

Mass Production Process Sequence of operations, Types of cutting machines, Fusing Technology, Types of Industrial Machines Used in sewing section, Finishing

Sketching and drafting of the following garments Ladies Tops/Short kurties, Ladies suit

Night wear (one piece/two piece), Sari blouses

Sketching and drafting of the following garments Dresses for newborn, Dresses for Toddler, Dresses for Kids

Pattern Making, Fabric Estimation, Cutting, Sewing, Pressing & Folding of the following garments with design variations

Kurta & Pyazama, Casual Shirts & Trousers

Laundry Stains Classification, Removing techniques

Quality Control Definition, need & planning, Types of Inspection, Stages of Inspection
Role of Quality Controller

4. INSTRUMENT MACHENIC (इन्स्ट्रुमेंट मैकेनिक)

Organization of the Institute, Departments various trades functions. Types of work, responsibility to be undertaken, incentives and future planning of profession. Safely precautions to be observed in the trade both during 'theoretical Periods' and 'Practical hours/workshop hours' Elementary First Aid. Safety and hazards. Sign boards and types. Hazardous and non-hazardous. Environmental pollution related to the trade- caused, consequences, mitigation and control.

Basic hand tools, types, classification use & metal cutting fundamentals. Filing- Flat, square and Parallel to an accuracy of 0.5mm. Measurement & measuring instruments, Marking tools, Fasteners & Fastening devices.

Precision Measuring :- Instruments, gauge blocks, sine bar, dial indicators, vernier calipers, micrometers, bevel protractor, thickness gauges. Element & types of crew threads used in instruments, Calculation of drill size for tapping. Types of tubes used for instrumentation. Tube cutter, Flaring tools, swedging tools, equipment's & fixture required for pipe bending, straightening, thread cutting, method of installation.

Electrical components- conductor, semiconductor & insulators. Standard wire gauge (SWG). Introduction of electricity- static electricity. Current, voltage, P.D, E.M.F, resistance. Electrical circuit - D.C & A.C circuit differences. Importance of grounding. Uses of multimeter. Resistor, Resistivity and colour code, Types of resistors used in instrumentation. Definition and purpose of soldering and desoldering. Soft soldering. Types of soldering irons. Solder & flux. Care & precaution of soldering. De-soldering tools and method of use. Ohm's law & Kirchhoff s laws. Series & parallel circuits. Primary & secondary cells and batteries. {Liquid & dry). Maintenance free batteries construction-charging, efficiency-use, advantage. Switches and types. Magnet and magnetism, magnetic properties. Magnetic campus and its uses. Explanation of Electro-magnetism, Advantages, disadvantages- application-types E.M. relays.

Types- uses of Solenoids. Circuit breakers and their working. Principles of alternating current, A.C & DC electricity, types of wave forms, time period and frequency, peak to peak values, RMS values, Average values. Inductor and Inductance, types of inductors, Factors affecting the value of inductance, self- inductance (L),Mutual inductance (M), Inductors in series and parallel, Q factor of the coil. Capacitance, types of capacitor, unit of capacitance, factors affecting the value of capacitors, charge, energy stored in capacitors. Capacitors in series and parallel. Capacitors in DC circuit, RC time constant.

A.C.-impedance, Inductive reactance, capacitive reactance. AC current through - R, L, C circuits. Resonance in RLC circuit. Importance - of series and parallel resonance,

properties. Impedance, Admittance, Q- factor. Introduction of AC and DC generators working principles, construction. Operation, field magnets, armature windings, commutator and brushes, EMF equation. Faraday's Law, Lenz's Law, Fleming's left Hand and right-hand rules. DC motors working principles, construction, operation, types. Different speed controlling techniques of DC motors. AC motors, induction motors, three phase motors, stepper motors. Transformer, types, transformation ratio. Open circuit test and short circuit test, regulation Auto transformer. Current measurement. Instrument transformer. Potential transformer and current transformer.

Basics of electrical measuring instruments- Types - absolute and secondary instruments. Types of secondary instruments, Essential of electrical measuring instruments- deflecting torque, controlling torque, damping torque etc, Types of controlling torques- spring control, gravity control. Types of damping - air friction damping, fluid friction damping, eddy current damping DC instruments - 'D1 Arsonval meter, PMMC meter- working principle, method of working, moving coil operation. Construction-damping, magnetic shielding, bearings. Terminology -parallax error, (FSD) full scale deflection reading, measurement value, metersensitivity, accuracy. Meter resistance, maximum power, capability etc. Ideal and practical characteristics of ammeter, voltmeter. Meter range extension - Converting galvanometer into ammeter, voltmeter. Range extension of voltmeter, ammeter. Shunt resistance and series resistance value calculation. Meter resistance, meter FSD identification techniques.

Ohm meters- measuring electrical resistance. Basic construction of Ohm meter, working method of ohmmeter. Types of Ohm meter - series and shunt type of ohm meters. Megger/ insulation tester, earth tester - construction working advantages and disadvantages of various types of ohm meter. AC instruments - types of AC measuring instruments -MI, electro dynamometer type, Working principle, construction, advantages and disadvantages of MI instruments and electro dynamometer instruments. Various applications. Electro dynamometer applications - as voltmeter, ammeter, power measuring instrument, energy measuring instrument, power factor meter etc. AC voltage and current measurement using PMMC meter (rectifier type).

Induction type meters - working principle construction and operation of induction type instruments. Construction mand Applications - single phase and three phase energy meter, watt meter. Walt hour meter, Ampere Hour meter, power factor meter etc. Special instruments: voltage tester, continuity tester, rotation test, phase sequence indicator, synchronizing, the synchroscope, _ frequency meter. Thermocouple type ammeters. Semiconductor, Covalent bond, Doping, Intrinsic and extrinsic semiconductor. PN junction diode, Forward and Reverse characteristics. Specification of diodes (data

sheets). Applications of diode. Special semiconductor diode-Zener diode, tunnel diode, Photo diode. Transistors. Defining transistors, NPN& PNP transistor, Symbol, operation, Biasing of Transistor & mode of Application. Transistor CB, CC, CE Amplification, current gain, voltage gain, and power gain. Introduction to FET, MOSFET. Rectifiers: half wave rectifier, full wave (bridge & center tapped) rectifier. Voltage multipliers. Filters: Introduction, purpose and use of ripple filter. Types of filters. Capacitance filter, inductance filters, RC filters, LC filters, voltage dividers and bypass filters.Voltage regulators. Introduction & purpose Zener regulators, shunt regulators, series regulators, IC regulators, variable regulators.

Power Supply units. Introduction, purpose & use. UPS and SMPS, inverters and converters and their mapplications. Thyristor devices: basic description and applications of SCR, TRIAC, DIAC. General characteristics of an amplifier, Concept of amplification.

Types of Amplifiers. Effect of temperature. DC load line and AC load line. PCB basic construction, applications. Lay outing circuit on PCB. Oscillator's oscillations, oscillation frequency, basic working principle and working of Talk circuit, Crystal controlled oscillators, Phase shift oscillators, RC phase shift oscillators, Colpitt, Clapp, Hartley, and IC oscillators. Operational Amplifier. Differential amplifier, ideal op- amp. Op-amp with feedback, advantages of feedback. Inverting and Non inverting and inverting amplifier, Op- amp as summer, differential amplifier. V to I converter and I to V converter, Instrumentation amplifier Basics of op- amp applications - integrator, differentiator, Introduction of timers (555) and its applications.

Number systems; binary, octal, decimal and hexadecimal number system. Conversion of number systems. Boolean algebra, binary addition, subtraction, multiplication and division.1's and 2's compliment, BCD code, ASCII code, gray code. Logic Circuits.

Basic gates-AND, OR and NOT gates. De-Morgan \s Theorem. Universal gates - NAND and NOR gates. Special gates - Ex-OR, Ex –NOR gates and Buffer and its applications. Basic digital ICs, function, digital application, logic symbols. Adders - Half adder, full adder Subtractor - Half subtractor, full subtractor. Flip flops - RS flip flop, clocked RS flip flop, JK flip flop, Basics of Counters and registers. Multiplexer and de-multiplexer. Encoder and decoder. BCD display, BCD to decimal decoder. BCD to 7 segment display circuits.

Digital meters: displays: LED,7 segment display, LCD, CRT, electro- luminescent displays, electro-phoretic image display, liquid vapor display, dot matrix display. A/D and D/A converters, Introduction, weighted register D / A converter, binary(R-2R)

ladder D/A converter, specification for D/A converter, Ramp or counter type A/D converter, GPIB (general purpose interface bus) IEEE - 488, RS 232.

Digital meters: frequency meter, phase measuring meter, and time measuring instruments. Digital capacitance meter.

CRO:introduction and applications of CRO, functional block diagram of CRO, CRT power supply.Various types of probes. Applications of various types of CROs like dual beamCRO, Dual trace CRO, storage oscilloscope.

Introduction to Computer, Block diagram of PC, software familiarization of Multimedia System consisting of CD ROMS, DVD ROMS, Sound Cards. Computer Hardware, Computer systems, computer hardware, CPU, CPU operations, ROMs and RAMs, I/P and O/P and peripheral equipments,terminals, printers, MODEMS, Data interface, ADC and DAC. Introduction to microprocessor microcomputers, Memories Intel 8085. Architecture Instruction set of 8085,

Microprocessor.

1. Data transfer group.
2. Arithmetic group.
3. Logic group.

Basic Programming of 8085 such as adding, subtraction of two 8-bit numbers, etc. Block diagram and pin' diagram 8255 and its operation. Microprocessor applications.

Scope and necessity of instrumentation. Fundamentals of measurement systems-functional block diagram of measurement system. Calibration and calibration standards– basic standards, secondary standards, working standards. Fundamental units -The metric system, Base & supplementary units, Derived Units, Multiplying factors and standards of length, mass, time & frequency. Temperature & electrical units. Instrument characteristics Static characteristics– accuracy, precision, sensitivity, resolution dead zone, repeatability, reproduceibility, drift, Dead band, backlash, hysteresis. Dynamic characteristics– speed response, fidelity, lag. Error, deviation, true value, data.

Types of errors- systematic, random & illegitimate error. Certainty/uncertainty, validity Of result. Measuring system Response. Introduction, amplitude responses, Phase response, Delay, rise time & slew rate. Damping & its importance. Statistical analysis – arithmetic mean, deviation from the mean average deviation, standard deviation. Stress & Strain Measurement. Introduction to Strain gauges, types of strain gauge sand differences. Applications of strain gauges, load cells. LVDT, RVDT, advantages and limitations. Measurement of motion, velocity/vibro meter sand acceleration. Difference between tachometer and speedometers.

Types of tachometers-Eddy current type, AC and DC tachometer. Strobo scope and its applications. Seismic instrument. Principle of Pressure in Liquids & Gases. Properties of matter Principles of liquid pressure, units of pressure Liquids pressure and volume, density and specific gravity. Factors affecting liquid pres- sure. Pressure relation with volume, temperature and flow. Units of pressure and unit conversions.

Types of pressure: absolute, gauge, atmospheric and vacuum pressure sand their relationships. Barometers, manometers types and applications.

Types of pressure sensing elements- bourdon tube, diaphragms, capsules, and bellows. Each on types, shapes, material used for various applications, ranges advantages and limitations. Pressures witches type sand applications. Electrical pressure transducers. Method of conversion, primary and secondary pressure transducers. Potentio metric pr. Transducers, Capacitive pr. transducers, reluctance-servo pressure transducers, strain gauge pressure transducers, piezo electric pressure transducer. Differentials pressure transducers.

Low Pressure Measurement. Vacuum, gauges, thermal conductivity gauges, pirani gauges, thermocouple gauges, slack diaphragm. Ionization gauge, McLeod gauge, capacitance manometers. Method of pressure instrument calibration. Dead weight tester and comparators/manifolds. Pressure Instrument Installation and Servicing. Elements of pressure transmitters, Installation components, pressure taps, Isolation valve, instrument piping, connections and fittings blow down valve, instrument valve, pulsation damper, diaphragm seal, pressure transmitter, Installation, procedure, locating and mounting, piping, electrical wiring placing into service, guidelines for periodic maintenance, troubles shooting and repair, instrument shop safety.

Properties of Fluid Flow. Basic properties of fluids, fluids in motion, getting fluids to flow, units of flow rate and quantity flow, factors affecting flow rate, Reynolds number, relation between flow rate and pressure, area, quantity. Types of flow meters – head type, variable area type, quantitative flow meters. Mass flow meters.

Head type of flow meters: working principle, types- venturi tube, orifice plates and its shapes. Pitot tube, flow nozzles, constructions, tapings, advantages, limitations, applications, materials used for various flows. Types of secondary devices used to measure for flow rates. Open channel flow meters- principle of open channel flow, weirs, notches and flumes. Various shapes and their applications, maintenance, Variable area type flow meter- Rota meter, constructions, working principle, applications. Various shapes of float, type of materials used for body and float. Factors affecting rotameter performance, measuring gas and liquid flow. Positive Displacement. Meters.

Advantages and disadvantages of positive displacement meters, piston meter, oscillating piston meter, rotating vane meter, notating disk meter, lobed impeller and oval flow meter, calibrating positive displacement meters. Target flow meters, turbine flow meter, magnetic flow meters, vertex flow meter. Construction, working principle, advantages and disadvantage, applications. Carioles mass flow meter, thermal flow meters and summary basics of ultrasonic flow meters. The Doppler hit method. The beam deflection method, frequency difference method.

Metering the flow of solid particles. Measuring Volumetric and mass flow rate of solids, volumetric solids flow meter, mass flow meter for solids, belt type solid meters belt type solid meters belt speed sensing and signal processing, slurries, constant weight feeders. Principles of level measurement. Types of level measurements-solid and liquid, volume and mass, mechanical and electrical type. Surface sensing gauges, storage tank gauges, sight glasses, magnetic gauges, buoyancy, displacement gauges. Factors need to consider for open and closed channel level measurements level switches, mercury level switches in high pressure tank, level detectors, magnetic reed switches. Pressure head instruments. Hydrostatic pressure, specific gravity, pressurized fluids, pressure head instrumentation, air bellows, U-tube manometers, air purge systems, liquid purge systems, force balance diaphragm system. Electrical method conductivity and capacitance method for. measuring the liquid level, capacitance probes, zeroand span adjustments, sonic level detectors, point level detection. Solid level measurement Using weight to determine level, sonic solid level measurement with microwaves, using capacitance probes to measure solid level, diaphragm switches, nuclear gauges, microwave solid level detectors.

Temperature measurement. Temperature, heat, specific heat, changing physical state Fahrenheit and Celsius temperature scales Rankin and Kelvin scales, calibration of temperature scales primary and secondary standards. Industrial application of temperature measuring instruments with compensating link & precautions to be taken. Bimetallic and fluid filled temperature instruments. Bimetallic thermometers, liquid-in-glass thermometers, filled system thermometers, thermometer bulbs, capillary & bourdon tube, temperature transmitters for filled system, advantages & disadvantages of filled systems. Electrical temperature instrument. Resistance thermometer, how it works, RTD bridge circuits, lead wire error, RTD elements. protecting wells for RTD, advantages and disadvantages of RTDs, thermistors, thermocouples, Ex-tension wires, compensating for changes in reference junction temperature, construction of thermocouple junction, types of thermocouple, advantages and disadvantages of thermocouples. Pyrometry. Molecular activity and electromagnetic radiation, defining pyrometry, effects of emittance, effects of temperature, wavelength and radiated

energy, pyrometers and wavelengths, using of optical and radiation pyrometer, Measurement of humidity. Thermal imagers. Recorders. Introduction to recorders, Construction, working principle, various parts installation and use of pneumatic and electronic recorders. Strip-chart, circular chart. Final control elements in process loops. Final control elements, in process loops. Final control elements actuators, load set Point compensation, feedback loops, control variables, effects of disturbances on performance, parts of final control sub-system, control signal, electric control signals, fluidic control signals, Pneumatic and Hydraulic Actuators. Pneumatic principles, effects of changing pressure, pressure /volume/ temperature relationship, effects of changing temp. Pneumatic actuators, diaphragm actuator, spring and springless actuators, direct and reverse acting actuator, piston actuator, positioner, Electrical actuators and their advantages.

Control valves. Control valves functions and components, types‘ of control valves, based on valve flow characteristics- liner, equal percentage, quick opening valves, globe valves, cage valves, butterfly valves, ball valves, sliding gate valves, diaphragm valves, split body valves, capacitive, inductive type valve, proximity switch, IR switch, micro switch, limit switch, other control valves, control valve mechanical considerations, selecting control valves, valve positioner.

Control elements applications. Feed water control system works, sequential. Valve control, control and block valves, applying relays in final control elements, relay logic in operation, automatic valve control, controllers and activators, turbine control System, throttle and governor valves and activators. Introduction of internal parts of different types of control valves.

Introduction to controllers. Basic block diagram of control systems. Advantages Process variable and set point, analog controllers, digital controllers, control angles and limits, control loop measuring Pv, amplifying signals final control elements, current proportioning. Hunting & its effect on the product. Types of controller and their operation. Types of controller, range limit of controllers. & ON/OFF controllers, direct and reverse acting controllers proportional controllers, automatic /manual split control, pneumatic control. Adaptive, limiting and batch control, ratio control system, feed forward, feedback control systems and cascade control system. Comparison between pneumatic and electronic control systems. Basic knowledge on communication protocol.

Controller models and tuning. Controller tuning, setting, controller modes, proportional mode, off-set, integral mode, reset mode, derivative mode(rate), single, mode controller, two mode controller, three mode controllers, tuning the control loop, step-change-response method.

Introduction to programmable controllers. History of programmable controllers, general characteristics of programmable controllers, some limitation of PLCs, method of developing PLC programming.

Input/output devices. Definition of input /output devices, I/O interface, input modules, output modules, input devices encoders, output devices, the opto-isolators, safety.

Processing and programming functions. The processor unit, the memory, memory organization, ladder diagrams, data logger, most used programming symbols, start, stop, station example, other programming symbol timers and counters, data manipulation instructions, alternate PLC symbols.

Digital control systems: need of smart devices, HART transmitters futures, advantages, applications. Working method of HART devices, HART protocol. HART communicators and PC based HART device configuration. Stepsin calibration ofHART devices. Communication.

Networking: types of networks used in digital instrument systems. LAN, WAN, Ethernet. Point to point and multi networking. Ring, delta, star connections. Redundant Net. TCP/IP addresses and descriptions. Types of Cable categories (CAT), and their descriptions. Various types of Cable connectors. Advantages and disadvantages of co-axial cable and fiber optic cables. Various tools used in networking- wire cutter, crimp tool, memory blade holder, memory blade cartridge, cable strip tool with blade cassettes. Terminators and extra connectors, taps, calibration tool etc. fundamentals: modulation and demodulation, signal to noise ratio, digital communication basics-PWM, PCM, FSK. Fundamentals of SCADA and DCS. History of DCS development. Basic architecture, description advantages and disadvantages, applications.

Terminology- RTU (remote transmitting unit, central monitoring station, types of communications, field instruments and types.

Field bus: futures, advantages, architecture, basic block diagram, working. Work station, Human Machine Interface (HMI). Controller (with basic types), filed bus interfacing modules, gateway, network manager, I/O modules, field bus devices (I/0), remote transmission panel (RTP), Ethernet. Electronic device description language (EDDL) and device description (DD). Field bus power supply and its function. Introduction of digital and multi drop communication protocol Vendors.

Futures- library, call up, various visualized futures, Reports (alarms, events), history, trading etc.

Basic Hydraulics: Principles of Hydraulics. Fluid power and hydraulics, force, weight and mass, pressure, work, power, energy, incompressibility and non-diffusion, hydrostatic pressure, Pascal's law, transmission of fluid power, fluid flow in pipes, Bernoulli's principle, the effect of heat on liquids. A typical hydraulic power system. Hydraulic Fluids. Functions of Hydraulic fluids,physical properties, viscosity, viscosity index, viscosity and pressure, power point, fluid selection, component protections, chemical properties, system contamination, water, dissolve air, foaming, corrosion and rusting, types of hydraulic fluids. Directional control valves. Directional control valve classification, review of two way valves, 'globe, gauge, plug, needle, ball, automatic two way valves, check valves, pilot operated check valves, spool valves, three ways pool valves, controlling hydraulic motors, NO and NC valves, holding valves, four and five way valves, rotary spool valves, schematic symbols, flow ratings, accessories. Pneumatic principles, mass, pressure, work and energy, compressibility, law of pneumatics, transmission of pneumatic fluid power, pneumatic leverage, air properties, airflow in pipelines, viscosity of air pressure, Bernoulli's law, components of pneumatic power system. Primary air treatment. Air treatment, preliminary filtering, relative. Humidity, effects of moisture, water removal, dew point, moisture separators, oil scrubbers, air dryers, (deliquescent and absorption type) air receivers. Secondary air treatment. Methods of treatment, Contaminate separation, contaminate filtration and filter classification and rating, types of media surface filters, depth filters, absorption filters, Lubricating the air. Piping houses and fittings. Requirement of piping, airflow, piping dimensions and safety factors piping connections, compressed air piping applications, metallic tubing, tubing bending and tube fitting, tube installation, nonmetallic tube houses, hose fittings and coupling, hose installation.

Analytical instruments. Exposure to basic analytical instruments. Types of electrodes used for PH measurements. Relation of PH and mV.PH indicator and controllers. Conductivity meters. Dissolved oxygen meter.

5. DRAUGHTSMAN CIVIL (ड्राफ्टसमैन सिविल)

Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Introduction of PPEs. Introduction to 5S concept& its application. Response to emergencies e.g.; power failure, fire alarm, etc. Familiarisation & information about rules and regulations of the Institute and Trade. Overview of the subjects to be taught for each year. List of the Instruments, equipments and materials to be used during training. Importance of B.I.S. Introduction of Code for practice of Architectural and Building Drawings (IS: 962- 1989, SP-46:2003). Layout of drawing. Lines, Lettering, Dimensioning. Knowledge of different types of scale. Principle of R.F.

Materials:- Stones :–characteristics, types & uses. Bricks –. Manufacturing, characteristics of good bricks, types, uses and hollow bricks. Lime– characteristics, types, manufacturing & its uses. Pozzolanic :- characteristics, types & uses. Cement :– Manufacturing, characteristics, types, uses and test of good cement. Different types of projection views: Orthographic, Isometric, Oblique and Perspective.

Building materials:- Sand:-characteristics, types &uses. Clay Products :– types earthenwarestoneware, porcelain, terracotta, glazing. Mortar & Concrete:– Types, uses, preparation, proportion, admixtures and applications.

Building materials:-Timber:- Types, Structure, disease & defects, characterstic, seasoning, preservation and uitility. Alternaative material to Timber Plywood, Block board, Particle board, Fireproof reinforced plastic(FRP), Medium density fireboard (MDF) etc. Tar, bitumen, asphalt:- Properties, application and uses.

Protective materials:-Paints:- characteristic, types, uses.Varnishes:– characteristics and uses. Metal:– characteristic, types, uses. Plastics:– characteristic, types, uses.

Building Construction:-Sequence of construction of a building. Name of different parts of building. Stone masonry:- Terms, use and classification. Principle of construction, composite masonry. Strength of walls. Strength of masonry. Brick masonry – principles of construction of bonds. Tools and equipments used

Building Construction:- Foundation:- Purpose of foundation**.** Causes of failure of foundation Bearing capacity of soils**.** Dead and live loads**.** Examination of ground**.** Types of foundation**.** Drawing of footing foundation setting out of building on ground excavation. Simple machine foundation

Building Construction:- Types of shoring and scaffolding in details. Types of Underpinning and Timbering in detail**.**

Treatments of building structures:-DPC Sources and effects of dampness**.** Method of prevention of dampness in building**.** Damp proofing materials – properties, function and types. Anti-termite treatment–objectives, uses and applications. Weathering course – objectives and materials required. Fire proofing – effect and rules. Arches: - Technical terms-. Types ,centring**.** Lintel :-types, wooden, brick, stone, steel & RCC. Chajjahs–characteristics, Centring & Shuttering

Surveying:- Introduction, History and principles of chain survey. Instrument employed. Use, care, maintenance and common terms. Classification, accuracy, types. Main divisions (plane & geodetic).

Chaining. Speed in field and office work. Knowledge of Mouza Map. Compass survey:-Instrument and its setting up Bearing and each included angle of close traverse. Local attraction. Magnetic declination and its true bearing. Precaution in using prismatic compass.

Plane table survey:- Instrument used in plane table survey**.** Care and maintenance of plane table

Levelling:- Auto level , dumpy Level, Tilting Level – introduction, definition**.** Principle of Leveling. Levelling staffs, its graduation & types. Minimum equipment required Types,component / part and function. Temporary and permanent adjustment, procedure in setting up. Level& horizontal surface Datum Benchmark,

Focussing& parallax:- Deduction of levels / Reduced Level. Types of leveling, Application to chain and Levelling Instrument to Building construction. Contouring :-Definition, Characteristics, Methods. Direct and Indirect methods**.** Interpolation of Contour, Contour gradient , Uses of Contour plan and Map. Knowledge on road project.

Theodolite survey:- Introduction. Types of theodolite. Uses, Methods of Plotting. Transit vernier theodolite. Terms of transit theodolite. Fundamental line of theodolite. Adjustment of theodolite. Checks, Adjustment of errors. Open and closed traverse and their application to Engineering Problems. Vernier scale- types. Measurement of horizontal angle. Measurement of vertical angle. Adjustment of a close traverse. Problems in transit theodolite-departure, latitude, northing and easting. Carpentry joints :- terms, classification of joints, Uses, types of fixtures , fastenings. Doors –Parts, Location, standard sizes, types. Windows-types. Ventilators-purpose-types.

Electrical Wiring:- Safety precaution and elementary first aid. Artificial respiration and treatment of electrical shock**.** Elementary electricity. General ideas of supply system. Wireman's tools kit. Wiring materials. Electrical fittings. System of wirings. Wiring installation for domestic lightings. Floors – Ground upper floor-Types. Floor & Flooring- materials used types. Stairs:-Terms. Requirements, Planning and designing of stair and details of construction. Basic concept of lift and Escalator

Roofs & Roof coverings: –Purposes, Elements, Types, Fla, pitched. Truss-king post, queen post, mansard, bel-fast, steel, composite. Shell-types-north-light & double curved. Dome. Components parts. Roof & coverings – objectives, types & uses.

Building:-Principle of planning**,** Objectives & importance. Function& responsibility. Orientation. Local building Bye-Laws as per ISI code. Lay out plan & key plan. Submitted in composition of drawing. Provisions for safety. Requirement of green belt and land.

Computer aided drafting:-Operating system ,Hardware& software. Introduction of CAD. Its Graphical User Interface. Method of Installation. Basic commands of CAD. Knowledge of Tool icons and set of Toolbars. Knowledge of shortcut keyboard commands.

Building Planning:- Economy & orientation. Provision for lighting and ventilation. Provision for drainage and sanitation. Types of building. Planning & designing of residential , public and commercial building.

Prefabricated Structure:- Preparation. Method of construction, assembling. Advantages & disadvantages.

3D modeling concept in CAD:- 3D coordinate systems to aid in the construction of 3D objects**.** Knowledge of shortcut keyboard commands. Parks &play ground-Types of recreation, landscaping. Etc**.** Concepts of design of earthquake resisting buildings- requirements resistance , safety, flexible building elements, special requirements, base isolation techniques.

Reinforced cement concrete structure:- Introduction to RCC uses. Materials – proportions Form work. Bar bending details as per IS Code. Reinforced brick work.

Materials used for RCC:- Construction. Selection of materials – coarse aggregate, fine aggregate, cement water and reinforcement. Characteristics. Method of mixing concrete-machine mixing and hand mixing. Slump test. Structure – columns, beams, slabs - one-way slab & two-way slab. Innovative construction. Safety against earthquake. Grade of cement, steel- behaviour and test. Bar-bending schedule. Retaining wall. R.C.C. Framed structure.

Steel structures:- Conmen forms of steel sections. Structural fasteners, Joints. Tension & compression member. Classification, fabrication. Construction details.

House drainage of building:- Introduction. Terms used in PHE. Systems of sanitation. System of house drainage. plumbing, sanitary fittings, etc. Types of sewer appurtenance. Systems of plumbing. Manholes & Septic tank. Water treatment plant**.** Swerage treatment plant

Roads:-Introduction. History of highway development. General principles of alignment. Classification and construction of different types of roads, Component parts. Road curves, gradient. Curves-types, designation of curves. Setting out simple curve by successive bisection from long chords. simple curve by offsets from long chords. Road drainage system.

Bridges &Culvert:-Introduction to bridges. Component parts of bridge. Classification of culverts. IRC loading. Selection of type and location. Factors governing the ideal site. Alignment of bridge. Foundation-selection- caisson. Coffer dam- types. Types of super structure. Substructure-piers, abutments, wing walls. Classification of bridge. Tunnels- rules used for the sizes of different members.

Railways :-Permanent way**.** Rail gauges, Functions, Requirements, Types, Sections, Length of rail. Welding of rail, wear of rail. Coning of wheels, hogged rail, bending of rail, creep of rail. Causes and prevention of creep. Sleeper and ballast- function, types, requirement, materials, rail. Fixtures, Fastenings and plate laying in rail. Joints-types, fish plate, fish bolt-spikes, chairs and keys-bearing plate, block elastic, base plate. Anchors and anti-creepers. Construction of permanent ways. Railway station and yard.

Irrigation Engineering:- Terms used in irrigation. Hydrology like duty, delta, base period, intensity of irrigation. Hydrograph, peak flow, run off, catchment area, CCA, corps like, rabi, kharif etc. Storage, diversion head work -characteristics and types. Reservoir –types of reservoirs, i.e., single purpose and

multi- purpose, area, capacity and curves of reservoir. Dams, weir & barrages- types purposes. Hydro electric project like Forebay, Penstock, Turbines, Power house, etc. Canals- classification and distribution system, canal structures. Types of cross drainage works like Aquaduct, Super passage, Syphon, Level crossing, inlet and outlet, etc.

Estimating and Costing :- Introduction. Purpose and common techniques. Drawing of construction. Measurement techniques. Estimate-necessity, importance, types- approximate and detailed estimate-main and sub estimates, revised, supplementary, maintenance/repair estimate -taking off quantities- method**.** Rate analysis of typical items and their specifications. Labour and materials. Govt. Schedule of rate. Estimating of irregular boundaries by trapezoidal and Simpsons formula.

Total Station:-Introduction. Components parts, accessories used. characteristics, features. Advantages and disadvantages. principle of EMD. Working and need. Setting and measurement. Electronic, display & Data reading. Rectangular and polar co- ordinate system. Terminology of open and closed traverse.

GPS(Global Positioning System):-Introduction of GPS system. Co-ordinate and time system. Satellite and conversional geodetic system. GPS. Signal, code, and biases**.** Role of TRANSIT in GPS development. GPS segment organisation. GPS survey methods. Basic geodetic co-ordinate. Ground support equipment, signals. Tracking devises& system. Time measurement and GPS timing. Definition and application of Remote sensing, Photo grammetry, Arial photography, satellite images. Pattern recognition and digital signal.

6. MACHINIST GRINDER (म□ीनिश्ट ग्राईन्डर)

Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.

Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies e.g.; power failure, fire, and system failure. Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962. Description of hand tools, Safety precautions, care and maintenance and material from which they are made. Ferrous and nonferrous metal and their identification by different methods. Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc. Theory of Semi precision measuring instruments. General measuring tools (used in grinding shop) their description, use care and maintenance. Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants. Brief description of drilling machine use and care. Knowledge of tool fixing and job holding device on drilling machine. Knowledge of different types of files according to cut and shape. Methods of filing operation. Knowledge of surface finish accuracy by filing. Brief description of a Centre lathe, its use. Knowledge of transmission of speed from motor to spindle of a lathe. Knowledge of aligning a job on lathe. Lathe tools nomenclature. Knowledge of controlling cutting speed, feed and depth of cut. Lathe tools and their uses. Selection of tools for different operation in lathe. Taper and its types and problems. Taper turning methods and calculations. i.e. Form tool, TT attachment, Compound rest etc. Method of screw cutting and simple calculation. Knowledge of spindle speed mechanism related to lead screw of lathe. Application and use of pedestal grinder. General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser. Precision measuring instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses. Knowledge of digital measuring instruments and its uses. Pneumatic gauges – its accessories and control device and use for checking dimensions. Different types of abrasive, manufacture of grinding wheels, their grades. Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and loaded wheels. Knowledge how to square up a work piece using an angle plate. Checking of squareness. Multiple clamping of parts to achieve concentricity &uniformity in size. Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551- 1966. Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond. Grinding wheel speed, surface speed per minute conversion of peripheral speed to r.p.m. Depth of cut and range at usefulness. Depth micrometer and vernier caliper. Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical surface grinder etc. Method of grinding tapers. Introduction Training- Revision of previous works. Common types of grinding machines. Plain cylindrical external and internal cylindrical grinder and universal grinder. Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses. Test for alignment and checking, balancing of wheel, dressing different types of wheel, dressers their description and uses. Holding devices such as Magnetic chuck, chucks and face plates collets their description and uses. Method of holding jobs on magnetic chuck, face plate and chucks. External grinding operational steps in external grinding of a job and precautions to be taken. Holding devices such as jig and fixture angle plates 'V' blocks etc. their description and uses. Internal grinding operational steps in internal grinding of a job precautions to be taken. Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerances as per ISI: 919- 1963. Basic size and its deviation, position of tolerance zones with respect of zero line. Fits different types clearance, interference and transition. Interchangeable system. Letter symbols for holes and shaft and fundamental deviation hole basis and shaft basis system. Heat generated in grinding dry and wet grinding use of coolant, their composition and selection. Characteristic of coolant. Grinding a

square job grinding angular surface taker grinding by stane land taper and angle protractor. Grinding defects vibration, chattering, glazing and loading their causes and remedies.Tool and cutter grinding machine-parts and accessories, description use, care and maintenance, pedestal grinder and bench grinder-their description and uses. Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface. Tools and cutter grinder their description, working principles, operations care and maintenance. Special types of grinding machines and centreless grinders. Their description, working principles, operations, care and maintenance. Diamond Wheel and Applications of diamond wheel in grinding. Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table. Total preventive Maintenance. Cylindrical grinding machine, its parts, use care and maintenance surface grinding machine-its parts use care and maintenance Universal cylindrical grinding machines parts description use, care and maintenance. Internal grinding machine and its parts their description, use care and maintenance. Milling cutters and its nomenclature. Grinding of bushes and cylinders steps and precautions to be taken. Dial test indicators marking block, height gauge and surface plate their description. Principle of vernier caliper, protractors, micrometers (O/S, I/S and depth) and other instruments having vernier graduations. Combination sets-their use care and maintenance. Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about ISO- 9000. Importance of Quality.Wheel marking system selection of wheels. Specification and types (shapes & size) of grinding wheels, diamond wheels and their uses. Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding wheels by different methods. Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. Heat generated in grinding dry and wet grinding, use of coolants their composition and selection, limit, fit and tolerances as per ISI: 919-1963. Basic size and its deviation position of tolerance zone with respect to zero lines. Fits different types clearance, interference and transition Interchangeable system Letter symbols for holes and shafts and fundamental deviation hole basis and shaft basis systems. Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable) and slip their description use care and maintenance. Inside micrometer depth gauge, special types of micrometers, universal dial test indicator their construction and function. Special type of grinding machine centreless, thread crankshaft etc. their description, use care and maintenance. Essential mechanism of grinding machines, wheel is guards to IS: 1991-1962 machine guards etc. Process of cleaning and oiling at grinding machines (care and Maintenance) types of steady rests their description and use. Principle types of grinding fluids importance of uniform temperature, selection and use at grinding fluids, method of supplying grinding fluids. Types of holding devices methods of holding work, type of centres - holding work between centres types of chucks and holding process inchucks. Holding work on face plate, pneumatic chuck and magnetic chuck. Precautions to taken before grinding, peripheral of surface speed of grinding wheels, importance of constant wheel speeds, calculations at S.F.P.M. Calculation at R.P.M. and S.F.P.M. of grinding wheels calculation of work speed for cylindrical grinding speed and feeds for cylindrical grinding speed and feeds for internal grinding. Traverse and over run of traverse, width of wheel and depth of cut in different types of grinding achiness. Grinding allowance and time estimation. Rough and finish grinding process. Surface grinding methods of surface grinding by using periphery of grinding wheel and ring edge of grinding wheel. Types of surface grinding machines. Work finish, wheel selection holding of work. Process of grinding angular surfaces. Grinding slots and grooves. Grinding "V" blocks. Recommended wheel speeds for surface grinding machines. Hones and Honing, types of honing stones there description and use. Amount and rate of stock removal. Adjustment for elementary honing conditions, honing tolerances. Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of headstock and tail stock. Method of plain cylindrical surface grinding step-grinding and shoulder and face grinding. Method of grinding external and angle (simple) taper and steep. Taper double compound taper. Use of universal head for angular grinding. Measuring and checking of taper and angles. Use of

taper plug and ring gauges. Taper and angle checking by using protractors, micrometer and rollers. Use of sine bar and gauge block- taper checking by sine bar gauge block D.T.I. micrometer and rollers. Other out of round surfaces. Holding work with fixed steady rest, in process gauges and pneumatic gauges. Centreless grinding process of holding job, and types of operations. Effect of setting work above and below wheel centre. Jig and fixture holding work by fixture and vice non-electric and magnetic chuck. Use of three jaw and two jaw steady rest. Internal centreless grinding methods of holding jobs and processes of grinding. Selection of wheels. Internal grinding work movement and wheel movement. Rotation and reciprocation of job and wheel spindle, Internal grinding allowance, selection of wheels for internal grinding allowance, selection of wheels for internal grinding. Thread grinding method of holding jobs methods of grinding threads and thread calculation. Thread grinding method of holding jobs method of grinding threads and thread calculation. Various types of thread grinding wheels and their selection. Types of dressers and process of process of dressing selection of coolants and their use. Laps and lapping material, types of laps lapping abrasives rotary diamond lap lapping lubricants lapping pressures wet and dry lapping. Hand lapping and machine lapping. Lapping flat surface lapping cylindrical surface polishing wheels polishing operations abrasive buffing wheels. Grinding defects and their corrections, inaccurate work out of round, out of parallel taper on and irregular marks spiral scratches, discolored burnt surface etc. Waviness marks of surface, chatters-short close evenly spaced long and regularly spaced, marks in phase with vibration of floor, random marks, random waves etc. Glazing of wheel and loading ofwheel. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. Importance of Technical English terms used in industry -(in simple definition only)Technical forms, process charts, activity logs, in requiredformats of industry, estimation, cycle time, productivity reports, job cards. Introduction to CNC Technology CNC M/c. principle advantages classification, drives, controls. Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language. Introduction to CNC grinding. Personal safety, safe material handling, and safe machine operation on CNC turning centers.CNC technology basics, Comparison between CNC and conventional lathes. Concepts of positioning accuracy, repeatability. CNC lathe machine elements and their functions - bed, chuck, tailstock, turret, ball screws, guide ways, LM guides, coolant system, hydraulic system, chip conveyor, steady rest, console, spindle motor and drive, axes motors, tail stock, encoders, control switches. Feedback, CNC interpolation, open and close loop control systems. Machining operations and the tool paths in them – stock removal in turning and facing, grooving, face grooving, threading, drilling.

7. REFRIGERATION AND AIR CONDITIONER TECHNICIAN

Introduction to trade and related industries. General safety precautions and first aids, firefighting equipment and electrical safety. History of Refrigeration and Air conditioning. Function, use and specifications of refrigeration tools, instruments and equipment. Grooming of technicians.

Fitting

Different types of Fitting hand tools, power tools, - their use. Function, construction, Specification & their application. Machineries and equipment used in fittings like drilling machines, grinding machines – types, specifications and care and maintenance. Fitting Precision measuring instruments – Function, construction, Specification & their application. Sheet Metal Function, construction, working, use, and application, specification of Sheet metal tools, instruments and equipment. Care and maintenance of tools. Types of sheet metal joints (cold and hot) and their use. Rivet & riveting- their types and use. Solder and its composition.

Electrical

Electrical terms such as AC and DC supply, Voltage, Current, Resistance, Power, Energy, Frequency etc. Safety precautions to be observed while working on electricity. Conductors and Insulators, Materials used as conductors. Series and parallel circuit, open circuit, short circuit, etc. Measuring Instruments such as voltmeter, ammeter, ohm meter, watt meter, energy meter and frequency meter. Earthing and its importance. Earth resistance. Insulation and continuity test. Inductors and capacitors. Effects of inductor and capacitors in an AC circuit. Inductive reactance, capacitive reactance, Impedance and power factor. Lagging and leading power factors. Single phase and Three phase supply system. Star and Delta connection and their comparison. Line voltage, Line current, Phase voltage and Phase current. Methods of improving power factor.

Electronics

Introduction to Electronics. Basic Principles of semiconductors, Principles and application of Diodes. Solder – its composition and paste. Rectification, Zener diode as voltage regulator – transistors parameters- CB, CE, CC, configuration, amplification. SCR Photo diodes, photo transistors, multi – vibrator, CR & LR circuit. SCRs, UJTs, ICs.

Welding

Introduction to basic principles of commonly used Welding processes, oxy fuel gas welding / cutting, brazing & soldering, nozzles, base metal and filler metal. Use of flux. Welding tools and equipment type specification and use. Safety method in welding. Method of gas welding, gas used and flames adjustment and pressure setting of O2 and DA. Difference between soldering and Brazing in terms of

temperatures, filler materials, joint strengths and application. Use of Oxy Acetylene, Oxy LPG, Air LPG and two stage regulators for brazing/soldering. Description of back fire arrester.

Basic Refrigeration

Basic principle of refrigeration, working, use, specifications of refrigeration tools, instruments and equipment. Fundamentals of Refrigeration, units and measurements, Pressure & its Measurements. Thermodynamics law. Science related to refrigeration, work, power, energy, force, Heat and Temperature, Different temperature scales, Thermometers, Units of heat, sensible heat, latent heat, super heating and sub cooling, saturation temperature, pressure, types, units. Types of Refrigeration systems, including Vapour absorption refrigeration cycle (VARC), water – combination. Study the construction and working of vapor compression cycle, low side & high side of vapour compression system. Applications of vapour compression cycle. Coefficient of Performance (COP), Ton of Refrigeration. Construction and working of V.C Cycle, fundamental operations, sub cooling and super heating. Study of Ph, Ts, Pv diagram. Refrigerator (Direct cool) Function, construction, working of single door direct cool refrigerator, specifications, trouble shooting, care and maintenance. Requirement of Vacuum and level of vacuum. Refrigerator (Direct cool) Study the construction & working of direct cool Refrigerator. Study the electrical components of refrigerator. Study the mechanical components of refrigerator and their types. Study the heat exchanger, door gaskets, Heat Insulation materials Care and maintenance of refrigerator.

Importance of flushing in evaporator and condenser, use of dry nitrogen for flushing, necessity of replacing capillary and drier. Evacuation, leak testing, gas charging method in refrigerator, Refrigerants used in Refrigerators and its properties. Desiccant drying agent.

Frost Free Refrigerator

Study the construction and working of Frost Free (2 or 3 door) Refrigerator parts particularly, the forced draft cooling, Air Duct circuit, temperature control in Freezer & cabinet of Refrigerator, air flapper / louver used in refrigerator section, automatic defrost system. Study of Electrical accessories & their functions (Timer, Heater, Bimetal, Relay, OLP, T/S etc.) Refrigerator cabinet volume calculation.

Refrigerator (Inverter Technology)

Study the construction and its working of two and three door frost free refrigerator Care and maintenance, installation method. Compressor Function, construction, working, application of compressor,(Fixed speed and variable speed compressor) like Reciprocating, rotary, scroll and inverter type. Study the construction & working of reciprocating, rotary, scroll, screw and centrifugal compressor, wobble & swash plate compressor. Compressor efficiency factors, wet compression, oil,

properties, lubrication methods. AC motors and their types. Advantages of AC motor over DC motor. Revolving field theory. Phase splitting theory. Capacitor method and inductor method used to split the single phase. Torque – starting torque and running torque. Split phase induction motors, working principle and construction. Starting winding and running winding. Starting current and running current. Method of changing the direction of rotation (DOR). Capacitor starts induction run motor, working principle and construction. Centrifugal switch and its function. Starter and its necessity.DOL starter and the safety devices incorporated in it. Description of hermetic compressor motor. Capacitor starts capacitor run motor, working principle and construction. Starting capacitor and running capacitor Shaded pole motors, working principle and construction. Torque comparison among various single-phase AC motors. Common faults, causes and remedies in motors.

Motors

Motors used in refrigeration And Air conditioning system, types, construction, working & their starting methods. Function of Starting relay, Capacitors, OLP's. Production of rotating magnetic field by three phase AC supply. Working principle of three phase induction motor. Terms such as torque, slip, rotor frequency and their relation. Construction of squirrel cage induction motor. Importance of phase sequence. Construction of slip ring induction motor Comparison between SCIM and SRIM. Three phase motor starters such as DOL starter, Star – Delta starter, Auto transformer starter and Rotor resistance starter. Common faults, causes and remedies in three phase AC motors. Working principle of inverter technology, advantages of variable speed technology over fixed speed. Working principle of control system for inverter Air Conditioners (ACs). Printed circuit board (PCB), including power PCB, filter PCB, heat sink and reactor. Wiring diagram.

Condenser

Function of condenser, types, Construction of air-cooled condenser. Effect of chocked condenser. Advantages, de scaling of air-cooled condenser. Effects of air fouling and bypass air in condenser. Types of water-cooled condenser, application, and advantages. Liquid receiver, pump down, application, types, function and working. Description of water-cooled condenser.

Drier

Function of drier, types, application and its advantage. Description of desicants. Expansion Valve Expansion valve used in domestic refrigeration and air conditioning systems. Capillaries, Automatic and Thermostatic Ex. Valves, and electronic expansion valves.

Evaporator

Working principle, Function, types of evaporators used in refrigerator, water coolers,bottle coolers, window and split A.C, Super heating in evaporators, Function of accumulator and types. Methods of defrosting.

Refrigerant

Classification of refrigerants, nomenclature of refrigerants including chemical name and formulas, hydrochlorofluorocarbons (HCFCs), hydro fluorocarbons (HFCs) and hydro fluoroolefins (HFOs), blends of HFCs and blends of HFCs/HFOs. Climatic impact of refrigerants: Stratospheric ozone depletion, global warming, mechanism of ozone depletion; the Montreal Protocol phase-out schedule of ozone depleting refrigerants (HCFCs) and high global warming refrigerants (HFCs). Brief introduction of Ozone Depleting Substances (Regulation and Control) Rules, 2000 and its amendments. Introduction of properties of refrigerants; environment related properties: Ozone Depleting Potential (ODP), GWP; ODP and GWP of various refrigerants, thermo chemical properties: flammability and toxicity of refrigerants, lower flammability limit (LFL) and upper flammability limit of A3 and A2L refrigerants. Thermo physical properties: pressure temperature of different refrigerants.

Safe handling of flammable refrigerants. Refrigerant leak detection methods evacuation and charging of refrigerant, temperature glides of refrigerant blends, procedure of charging of refrigerant blends especially the zeotropic blends, hydrocarbon blends, HFC blends (R-404A, R-407C, R-410A) and blends of HFC/HFO.

Retrofitting

Changes of components & practices while retrofitting CFC appliances with HC Refrigerants. Properties of HCs Thermal Insulation Function, types, thermodynamic properties of heat insulation materials used in refrigeration and Air Conditioning systems. Introduction of polyols and foam blowing agents (HCFC- 141b, cyclopentane, water, C02, methyl formate, HFO-1233zd (E), HFO-1336mzz (Z)). Window Air Conditioner Study of construction and working principle of window AC and its components; electrical controls and wiring. Installation, troubleshooting and servicing. Energy Efficiency Ratio (EER) - Energy-efficiency labeling on ACs. Installation of Window AC Advantages of proper installation of window AC with emphasis on proper functioning and avoidance of leakage of refrigerant. Selection of installation location considering safety, exclusive availability of power point and obstruction-free air flow from condenser. Step by step procedure for proper installation, and proper inclination of AC cabinet backward/ outward for drainage of condensate.

Split AC

Construction and working principle, types, troubleshooting & care and maintenance.

Energy Efficiency Ratio (EER) -Energy-efficiency labeling on ACs. Advantages of proper installation with emphasis on proper functioning and avoidance of leakage of refrigerant. Selection of location of indoor and outdoor units ensuring minimum distance between the units, away from flammable materials, if any, good air flow within the cooling space as well as over the condenser. Locate power supply point considering safety and exclusiveness. Step by step procedure for installation both for indoor and outdoor unit. Ensure convenient access for drainage of condensate from the cooling coil. Split AC (Wall Mounted) Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit. SPLIT A.C (floor, Ceiling /Cassette mounted Split A.C) Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit.

SPLIT A.C (Ducted)

Study of the Duct able split AC, its Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit.

MULTI SPLIT A.C

Study the construction and working, various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, trouble shooting.

INVERTER SPLIT A.C.

Study of construction and working principle of inverter AC and its components, electrical circuit and controls, installation, servicing, trouble shooting, fault detection, leak testing and gas charging. Concept of Indian Seasonal Energy Efficiency Ratio ISEER). Energy Efficiency leveling on inverter AC.

CAR AIR CONDITIONING

Study various components, electrical circuits and wiring diagram, testing components, fault detection, leak testing, Study of good service practice, evacuation, gas charging, Installation, trouble shooting, Magnetic clutch operation, free movement of flywheel (nonfunctioning of clutch), care and maintenance.

COMMERCIAL COMPRESSOR (Fixed & Variable)

Function, types, Construction & working, applications of compressors used in commercial refrigeration. Volumetric efficiency, Capacity control, factor influencing volumetric efficiency. Compressor lubricant oil, types, properties, types of lubrication methods such as splash, forced feed.

Study the Construction and working principle of different commercial compressor (Open and Sealed type) (Reciprocating, centrifugal, screw, scroll compressor).

WATER COOLED CONDENSER

Study the water-cooled Condenser, its type and capacity, construction and working, de scaling, application. Evaporative condenser- Types and their function, construction and application. Liquid receiver, function. Drier, types and application.

COOLING TOWER

Cooling tower, types, Construction, capacity, advantage & disadvantages of different types of cooling tower. Efficiency, approach and Cooling tower range.

WATER TREATMENT

Necessary, Causes of water contamination control of scale deposit, corrosion and algae, Water softening and De-scaling method, pump and fan used. Regenerate and backwash.

EXPANSION VALVE

Types and function, construction, working principle, & their advantage &disadvantages. Thermostatic Expansion Valves (TXV), Automatic Expansion Valves (AXV), Float valves, fixed and modulating orifice controls & electronic Expansion Valves, LMC (level master control). Selection of Expansion valves and capillaries for various Refrigeration and Air Conditioning applications. (09 hrs.)

EVAPORATOR

Function, types, Plate & Tube forced air DX evaporators. Types of Defrost system. Water/ Brine chillers. Types of brine used as secondary refrigerant. Accumulator, its function. Liquid-suction-liquid Heat- exchanger, their function, construction, application & advantages. Study of Accumulator and Oil separator.

WATER COOLER & WATER DISPENSER

Study the refrigeration cycle of water cooler and dispenser, types, construction & working, Capacity & applications. Study the electrical and mechanical components of storage type water cooler and Bubble type water dispenser. Insulation material used in water cooler and dispenser; refrigerant used in the system. UV and RO type water coolers and dispensers.

VISIBLE COOLER ANDBOTTLE COOLER- Visible cooler & bottle coolers. Description, construction & working, with HFC-134a and hydrocarbons, safety especially for flammable

refrigerants, maintenance, testing of mechanical and electrical components including sealed electrical components fitted in appliances using flammable refrigerants.

DEEP FREEZER / DISPLAY CABINET-

Description, Construction, working, specifications, function, care and maintenance, faults and remedies.

ICE CUBE MACHINE-

Description, Construction, working, reverse cycle functioning & Circuit diagram, installation method.

SOFTY MACHINE -Description, Construction and function.

ICE CANDY PLANT- Function, construction, working principle, Circuit diagram, capacity& types of compressor used. Brine composition to maintain required temperature. Operation, maintenance, retrofit.

ICE PLANT-

Details about components of Ice plant their functioning, working principle, Circuit diagram, capacity & types of compressor used, agitator functioning, temperature maintaining. Properties and handling of ammonia and other flammable low-GWP refrigerants.

WALK IN COOLER & REACH IN CABINET

Details about components, their functioning, working principle, Circuit diagram, capacity & types. Care and maintenance.

COLD STORAGE

Study of cold storage plant, parts, Construction, applications, controls & electrical diagram used in cold storage plant. Food preservation spoiling agents- controlling of spoiling agents, preservation by refrigeration system, maintaining temperature in different places. Types of cold storage and its details. Properties of commonly used refrigerants like ammonia and its safe handling. Cold storage-type construction, capacity and specification. Use of vibration eliminator and shock absorber, Study the lay out and electric wiring of the storage plant. Mobile refrigeration in transport vehicles. Method of pressure testing, evacuation & charging to the system and testing efficiency. Cold storage plant operation, its common trouble & remedies. Deep freezing, freezing tunnel, blast freezer its function and working, its application.

HVAC (Plant) – Introduction to HVAC, Fundamentals of Central Air Conditioning / HVAC plant, requirements of comfort A.C, study of psychometric terms, DBT, WBT, RH, enthalpy, dew point,

and specific humidity. Types of Central air conditioning (Direct and indirect system) Construction, working, components, faults, care and maintenance. Description of blowers & fans, function and types, static and velocity pressure measurements.

DUCT

Function, types, materials, duct designing, duct insulation, properties of insulating materials 'K' factors, Acoustic insulation, air distribution methods, air flow, AHU, FCU, fan, blower. AIR FILTERS Function of air filters, types, construction, maintenance, effect of chocked Air filter, Hepa filters.

PACKAGE AC (with Air Cooled Condenser)

Study the Package AC (with Air Cooled Condensers), its Construction and working principle, types, trouble shooting.

PACKAGE A.C WITH WATER COOLED CONDENSER- Study Package AC, types, construction and working principle, trouble shooting, and various applications. Duct system, AHU.Care and maintenance, installation method.

SPLIT PACKAGE- Construction and working principle, types, Study various electrical and mechanical components, trouble shooting.

CENTRALISED/INDUSTRIAL AIRCONDITIONING-Construction and working principle, types, maintenance of Industrial Air-conditioning plant. Humidification and dehumidification methods. AHU, description of FCU. Temperature and pressure controls used in AC plant, its construction, working, safety devices, cooling towers, piping lines. (09 hrs.)

DIRECT EXPANSION SYSTEM- Study Direct expansion system. Operation & Preventive Maintenance Schedule of central AC plant. Maintain log book for daily operation. VRF / VRV system – description and function of different parts. Details of piping have and controls system, Common reason for error code, types of ODU and IDU.

INDIRECT/CHILLER SYSTEM

Study central station AHU and FCU, Air washers used in chilled water system, understanding lay out, modulating valves for temperature control. Expansion valves & other related control – description and function. Study of Humidification & De-humidification. Humidifiers & De- humidifier's. Humidity control. Use of hygrometer. Construction and study of commercial A.C plant, package chillers, screw chillers, reciprocating chillers. Controls used in AC system, Electromechanical, pneumatic and electronic. Detail study of heat load calculation for commercial and industrial buildings. MOBILE AC (Bus, train) Study the refrigeration cycle in automobile AC, its Construction, working of bus AC, Magnetic clutch operation, freewheeling (de engaging clutch). Refrigerants used HCFC-22, HFC-

134a, HFOs, blends of HFCs and HFOs. Construction & working of train AC and its operation. Trouble shooting in train A.C. Planning for Preventive maintenance and scheduling of maintenance activities in large AC and Refrigeration plant.

8. MECHANIC TRACTOR (मेकैनिक ट्रेक्टर)

Admission & introduction to the trade: Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available- Hostel, Recreation, Medical and Library working hours and timetable.

Occupational Safety & Health:- Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving &road-testing vehicles.

Energy conservation- Definition, Energy Conservation Opportunities (ECOs)-Minor ECOs and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips.

Hand & Power Tools: - Marking scheme, Marking material-chalk, Prussian blue. Cleaning tools-Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, crosscut. Hammer-ball peen, lump, mallet. Screw drivers- blade screw drive Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open-end spanner. Sockets & accessories, Pliers Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car Jet washers Pipe flaring &cutting tool, pullers-Gear and bearing.

Systems of measurement- Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

Fasteners- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of Gaskets, Selection of materials for gaskets and packing, oil seals.

Cutting tools :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.

Limits, Fits &Tolerances:- Definition of limits, fits & tolerances with examples used in auto components.

Drilling machine - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.

Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors.

Hand Reamers - Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.

Sheet metal - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings.

Basic electricity- Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings. Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.

Description of Chemical effects- Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo- electric energy, Thermisters, Thermo couples, Electrochemical energy, Photovoltaic energy, Piezo- electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates usingswitches.

Introduction to welding and Heat Treatment Welding processes - Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques Heat Treatment Process- Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.

Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT, Liquid penetrant and Magnetic particle testing method - Portable Yoke method.

Introduction to Hydraulics & Pneumatics: - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear Pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).

Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), &

Automobile Association.

Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands.
Tractor Industry in India–leading manufacturers, development in Tractor industry, trends, new product. Study of tractors, dozers & their major assemblies, and different make (indigenous). Constructional differences between tractor and dozers and their merits. Different type of Tractor starting method and stopping.

Engine Basics: Classification of engines, **Principle & working of 2&4- stroke diesel engine (Compression ignition Engine (C.I),** Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection. Brief on common rail diesel injection engine. **Engine output, compression pressure,** Compression ratio.

Engine Components - Working principle & construction of cylinder heads, types of combustion chambers. Function of Engine Valves, different types, materials, Type of valve operating mechanism. Importance of Valve seats & inserts, importance of Valve movement, Valve stem, oil seals, Valve-timing diagram and concept of Variable valve timing.

Description of Cylinder block, Cylinder block construction, types of cylinder blocks & cylinder liners. Description & functions of different types of pistons, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy.

Description & function of connecting rod- importance of big end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins. Recommended clearances for the cylinder liners & rings. Bearing failure & its causes- care & maintenance. Description of crankshaft & Camshafts. Types of their drives. Description of Overhead camshaft, importance of Cam lobes. Crankcase ventilation (PCV). Camshaft, Crank-shaft balancing, Firing order of the engine. Description and function of the fly wheel and vibration damper. Timing mark.

Cooling systems:-Purpose, types, Heat transfer method, effect of boiling point & pressure, coolant properties, preparation and recommended change of interval, use of anti-freezer.

Cooling system components- water pump, function of thermostat, pressure cap, Recovery system & Thermo- switch. Function & types of Radiator.

Lubrication system: - purposes & characteristics of oil, type of lubricants, grade as per SAE, & their application, oil additives, type of lubrication system. Lubrication system components- different type of Oil pump, Oil filters & oil cooler. Probable reasons for low / high oil pressure, high oil consumption and their remedies.

Intake & exhaust systems - Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.

Intake system components- Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material.

Exhaust system components- Description and function of Exhaust manifold, Exhaust pipe, Mufflers- Reactive, absorptive, Combination, Electronic mufflers, Catalytic converters, Backpressure, Diesel particulate filter, Exhaust Gas Recirculation (EGR).

Carburetor operation-Carburation, Carburetor system components, Carburetor systems, Metering jets, Accelerating, Carburetor barrels Diesel Fuel Systems- Diesel fuel characteristics, concept of Quiet diesel technology & Clean diesel technology, Fuel feed system used in Tractor's description and layout. Diesel fuel system components, Description and function of Diesel fuel injection system, types of fuel injection pumps, type of drive, injectors-types and function. Governor and their types. Distributor-type injection pump, Glow plugs, Cummins & Detroit Diesel injection. Diesel electronic control- Diesel electronic control systems (DEC), Common rail diesel injection System. Method of bleeding fuel supply system.

Clutch:-types, construction and function. Components of clutch -driver & driven plates, torsion spring, cushion springs, operating fingers, clutch shaft, Slave cylinder & oil seal. Clutch release bearing & linkages.

Manual transmissions- Function, description, types and their application. Gearbox layout. Components of tractor gear box. Principle of epicyclical gear box. Necessity of torque convertor, need of 4 x 4 wheel drive / Front wheel drive, Low & high gear ratio, universal joint and propeller shaft.

Final Drive & Drive Shafts Differential carriers double reduction gearing, differential lock, crown wheel and pinion adjustments, function and types of power take off (PTO) mechanism. Types of front & rear axles. Common trouble and their remedies, care and maintenance.

Steering & Suspension Systems- Function and types of steering system. Description, construction and function of mechanical steering system steering wheel, steering gear box, tie-rod, arms link, ball and socket joints etc. their movement and adjustment. Description and mechanism of foot steerage pedal as incorporated in tractors. Description, working and principle of hydraulic steering system. Different parts such as pump, distributor valves, pipe line and hoses etc Development of mechanical framing. Use of Power tiller, Tractor & Bulldozer, Chassis frame of tractor.

Wheels & Tyres- Description, construction and function of Wheel. Rim sizes. Types & sizes of tyres. Solid, pneumatic & Radial. Ply rating. Tyre materials, Hysteresis & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Importance of in-Flatting tyres to correct pressure. Repair and maintenance of tyres and tubes. Storage of tyres. Descriptions Tire wear Patterns and causes Nitrogen vs atmospheric air in tyres.

Braking Systems - Braking fundamentals Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake fade.

Braking systems - Brake type used on tractor -principles, Air brakes,

Braking system components- Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Applying brakes, Brake force, Brake light switch.

Drum brakes & components - Drum brake system, Drum brake operation, Brake linings & shoes, Backing plate, Wheel cylinders Disc brakes & components-Disc brake system, Disc brake operation,

Disc brake rotors, Disc brake pads, Disc brake calipers, Proportioning valves, Proportioning valve operation, Brake friction materials.
Description, working principle & use of power tiller(two wheel tractor) power unit. Method of power transmission to wheel from engine. Main clutch assembling working procedure steering Clutch/ brakes mechanism method of power transmission to implement (Rotation), irrigation pump, thresher. Hitching of M.B. Plough, trailer disc harrow.

Tractor equipment:- Description, function of harrows, cultivators, seed drills & tractor trailer. Hitching of equipment. Danger in overloading & incorrect field operation. Average life of Agriculture implements. Description and function of tractor accessories such as Draw bar, top link & Belly Pulley. Setting of draw bar to correct height. Use of Hydraulic lift. Maintenance of tractor accessories.

Tractor Electrical Maintenance: Lighting arrangement in tractors (As applicable). Description of charging circuit. Operation of alternator, regulator unit ignition warning lamp troubles and remedy in charging system. Fault finding in electrical system. Description of starter motor circuit, common troubles and remedy in starter circuit. Description of lighting circuit. Charging & discharging of lead acid battery.

9. SURVEYOR (सर्वेयर)

Importance of safety and general precautions related to the trade. All necessary guidance to be provided to the newcomers to become familiar with the working of ITI system. Importance of survey or trade Job after completion of training.

Introduction of First aid. Job responsibility of the trade:-Overview the subject to be taught. List of the instrument equipments to be used during training**.** Layout of drawing sheet**.** Dimensions of drawing sheet. Details layout of lettering, lines & dimensioning system. Introduction of surveying, types of surveying, use, application principal. Knowledge of different types of scales, determine of R.F & uses of scales. Different types of projection views orthographic, sectional, isometric view. Use & application of conventional signs & symbols. Uses of Chain/ tape, testing of a chain & correction. Ranging (direct & indirect), Principle of chain survey, application. Terms used in chain survey, Offset, types of offsets, limit of offset, field book, types of field book, entry of field book method of chaining in slopping ground. Field procedure of chain survey errors in chain survey, plotting procedure. Calculation of area (regular & irregular figure) Knowledge of site plan. Basic terms used in compass survey. Instrument & it setting up. Conversion of bearing web to R.B. Calculation of included angle from bearing local attraction, magnetic declination and true bearing, closing error. Adjustment of closing error, precaution in using prismatic compass. Introduction to Auto CAD. Use AutoCAD command. Plane table survey, principle, merits & demerits. Instrument used in plane table survey setting up the plane table.(centering, levelling, orientation) Methods of plane table survey (radiation, intersection, resection, traversing). Error in plane table survey.

Introduction to Theodolite:- Types of Theodolite, parts of Theodolite, Terms used in Theodolite survey. Temporary adjustment of Theodolite, Angle measurement process. Reading of angles, field book entry of measured angles. Permanent adjustment of Theodolite. Traversing using theodolite (closed & open), traverse computation, determination of consecutive coordinates, independent co-ordinate, checking & balancing of traverse, preparation of gales traverse table, computation of area using co-ordinates, calculation of omitted measurement.

Introduction to levelling. Types of levelling instrument:- Technical terms used in Leveling. Temporary & permanent adjustment. Different types of leveling Entry of level book. (Reduced level calculation method) Curvature & refraction effect sensitivity of bubble tube. Common error and their elimination. Degree of accuracy. Introduction of tachometry & terms use advantages and disadvantages. Tachometric constants & its determination. Determination of horizontal & vertical distances by various methods. Use Auto CAD command drawings.

Contouring, contour interval selection of contour interval, characteristics of contour, uses of contour contouring by various method. Interpolation of contour by various methods, drawing of contours, computation of volume establishment of gradient by abney level. Curves, Purpose, Types of curves – simple, compound, reverse, transition, vertical. Elements of simple curve, computation of elements of simple curve. Various methods for setting out simple, compound, reverse, transition & vertical curve.

Familiarization with modern survey instruments:-

Parts of Total station, temporary adjustment of T.S, working procedure of T.S. Familiarisation with cadastral map, term used in cadastral survey, preliminary knowledge for prepare a site plan. Calculation of area by digital planimeter. Types of surveys for location of a road. Points to be considered during reconnaissance survey. Classification of roads and terms used in road engineering, alignment of roads relative importance of length of road, height of embankment depth of

cutting & filling, road gradients super elevation etc. Details knowledge for preparation of topographical map. Details knowledge for preparation of cadastral map. Details knowledge for preparation of a road project.

Use auto cad command survey software for survey drawing. Importance of cartographic projection. Uses of various types of cartographic projection for mapping. Introduction of GIS& GPS. Elements of GPS/DGPS. Observation principles. Sources of error & handling of error in GPS. Various type of GPS application. Concept & use of survey software. Introduction to hydrographic survey, practice various method s of water depth measurement process, floe velocity measurement & determination of cross-sectional area of a river. Handling of eco sounder, current meter. Basic terms used in transmission line survey, justification criteria for constructing new line, marking process of tentative alignment, selection process of a good alignment. Process of detail survey & final location survey. Use of sag template, Various type of tower, construction of tower foundation. Basic terms used in railway line project survey, justification criteria for constructing new line, marking process of tentative alignment, selection process of a good alignment. Process of detail survey & final location survey. Specification & uses of various types of building materials, types of foundation, knowledge of R.C.C. works, & other construction related items. Procedure of prepare a detail estimate.

10. MECHANIC DIESEL (मैकेनिक डीजल)

Importance& scope of Mechanic Diesel Trade Training. General discipline in the Institute
Elementary First Aid, Occupational Safety & Health, Knowledge of Personal Safety &Safety precautions in handling Diesel machine, Concept about House Keeping & 5S method. Energy conservation process, Safety disposal of Used engine oil, Electrical safety tips. Safe handling of Fuel Spillage, Knowledge of Fire Safety &Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment.

Hand & Power Tools:- Marking scheme,

marking material-chalk, Prussian blue.

Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber, Punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade Screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C- clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers
Combination pliers, multi grip, long nose, flat- nose, Nippers or pincer pliers, **Side cutters, Tin snips, Circlip pliers, external circlips pliers.**

Air impact wrench, air ratchet, wrenches Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers-Gear and bearing.

Systems of measurement:- Description, Least Count calculation, care & use of - Micrometers-Outside, and depth micrometer, Micrometer adjustments, Description, Least Count calculation, care & use of Vernier Calliper. Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

Different types of metal joint (Permanent, Temporary), methods of Bolting, Riveting, Soldering, Brazing, Seaming etc.

Fasteners Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of Gaskets, Selection of materials for gaskets and packing,
oil seals. Types of Gaskets paper, multilayered metallic, liquid, rubber, copper and printed. Thread Sealants-Various types like, locking, sealing, temperature resistance, anti locking, lubricating etc.
Cutting tools Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
Limits, Fits & Tolerances Definition of limits, fits &tolerances with examples used in auto components
Drilling machine Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.

Taps and Dies Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors.
Hand Reamers Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
Sheet metal State the various common metal Sheets used in Sheet Metal shop Sheet metal operations, Shearing, bending, Drawing, Squeezing Sheet metal joints, Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire- gauges. The blow lamp its

uses and pipe fittings.

Basic electricity Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter, Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings, Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel. Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo- electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

Introduction to welding and Heat Treatment Welding processes. Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding - principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques. Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques. Basic knowledge about advance welding process &equipments like MIG, TIG, Spot Welding, Plasma Cutter.

Heat Treatment Process. Introduction, Definition of heat treatment, - Definition of Annealing, Normalizing, Hardening and tempering. – Case hardening, Nitriding, Induction hardening, Flame Hardening process used in auto components with examples.

Non-destructive Testing Methods. Importance of Non- Destructive Testing In Automotive Industry, Definition of NDT, Liquid penetrant and Magnetic particle testing method – Portable Yoke method

Introduction to Hydraulics & Pneumatics- Definition of Pascal law, pressure, Force, viscosity Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves- 2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Auto Industry - History, leading manufacturers, Development in automobile industry, trends, new product. Brief about Ministry of Road transport &Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description, Uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.

Introduction to Engine-Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Main Parts of IC Engine, Direct injection and indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/ instrument on a dash board of a vehicle-Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light. Different type of starting and stopping method of Diesel Engine, Procedure for dismantling of diesel engine from a vehicle

Diesel Engine Components- Description and constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence.

Valves & Valve Actuating Mechanism- Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads, importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valve timing. Description of Camshafts & drives Description of Overhead camshaft (SOHC and DOHC), importance of Cam lobes, Timing belts &

chains, Timing belts & tensioners. Description & functions of different types of pistons, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. Compression ratio. Description & function of connecting rod, importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins. Description and function of Crank shaft, camshaft, Engine bearings- classification and location materials used & composition of bearing materials- Shell bearing and their advantages- special bearings material for diesel engine, Application bearing failure & its causes-care & maintenance. Crank-shaft balancing, firing order of the engine. Description and function of the fly wheel and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel, Description of Cylinder block, Cylinder block construction, Different type of Cylinder sleeves (liner).

Engine assembly- procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.

Need for Cooling systems Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems,

Basic cooling system components Radiator, Coolant hoses, -Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.

Need for lubrication system Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system

Splash system Pressure system, Corrosion/noise reduction in the lubrication system. Lubrication system components, Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, Different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Intake & exhaust systems Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.

Intake system components Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material.

Exhaust system components Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers-Reactive, absorptive, Combination of Catalytic converters, Flexible connections, Ceramic coatings, Back- pressure, Electronic mufflers.

Fuel Feed System in IC Engine(Petrol & Diesel) Gravity feed system, Forced feed system, main parts, Fuel Pumps- Mechanical & Electrical Feed Pumps. Knowledge about function, working & types of Carburetor.

Diesel Fuel Systems Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology &Clean diesel technology.

Diesel fuel system components Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection.

Electronic Diesel control Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.

Marine & Stationary Engine:- Types, Double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, Reduction gear drive, electromagnetic coupling, Electrical drive, generators and motors, supercharging.

Emission Control:- Vehicle emissions Standards- Euro and Bharat II, III, IV, V Sources of emission, Combustion, Combustio hamber design.

Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, controlling air- fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic, Reduction (SCR), EGR VS SCR

Basic Knowledge about DC Generator & AC Generator

Constructional details of Alternator, Description of charging circuit operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and **remedy** in starter circuit.

Troubleshooting- Causes and remedy for Engine Not starting Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise

11.MATHS (गणित)

Fractions-Classification of Unit System. Fundamental and Derived Units F.P.S., C.G.S, M.K.S and SI Units. Measurement Units and Conversion. Factors, HCF, LCM and Problems Fractions-Addition, Subtraction, Multiplication and Division. Decimal Fractions- Addition, Subtraction, Multiplication and Division. Solving Problems by using calculator

Square Root: Ratio and Proportions, Percentage- Square and Square Root. Simple problems using calculator. Application of Pythagoras Theorem and related problems. Ratio and Proportions. Direct and Indirect proportion, Percentage, Changing percentage to decimal

Material Science- Types of metals. Physical and Mechanical Properties of metals. Types of ferrous and non-ferrous metals. Introduction of iron and cast iron. Difference between iron and steel, alloy steel and carbon steel. Properties and uses of rubber, timber and insulating materials

Mass, Weight, Volume, and Density- Mass, volume, density, weight & specific gravity**.** Related problems for mass, volume, density, weight & specific gravity

Speed and Velocity, Work Power and Energy- Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation. Related problems on speed and velocity. Potential energy, Kinetic Energy and related problems with related problems. Work, power, energy. HP. IHP, BHP and efficiency

Heat & Temperature and Pressure- Concept of heat and temperature, effects of heat, difference between heat and temperature. Scales of temperature, Celsius, Fahenhiet, Kelvin and Conversion between scales of temperature. Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation. Co-efficient of linear expansion and related problems with assignments. Problem of Heat loss and heat gain with assignments. Thermal conductivity and insulators. Boiling point and melting point of different metals and Non metals. Concept of pressure and its units in different system

Basic Electricity- Introduction and uses of electricity, molecule, atom, how electricity is produced electric current AC, DC and their comparison, voltage, resistance and their units. Conductor, Insulator, types of connections- Series and Parallel, Ohm's Law, relation between VIR & related problems. Electrical power, energy and their units, calculation with assignments. Magnetic induction, self and mutual inductance and EMF generation. Electrical Power, HP, Energy and units of electrical energy

Mensuration- Area and perimeter of square, rectangle and parallelogram. Area an Perimeter of Triangle. Area and Perimeter of Circle, Semi-circle, circular ring, sector of circle, hexagon and ellipse. Surface area and Volume of solids-cube, cuboids, cylinder, sphere and hollow cylinder. Finding lateral surface area, total surface area and capacity in liters of hexagonal, conical and cylindrical shaped vessels

Levers and Simple Machines- Simple machines, Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relation between efficiency, velocity ratio and mechanical advanta Lever and its types.

Trigonometry- Measurement of Angle, Trigonometrical Ratios, Trigonometric Table Trigonometry-Application in calculating height and distance (Simple Applications)

Friction- Advantages and disadvantages, Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction. Friction – Lubrication. Co- efficient of friction, application and effects of friction in workshop practice.

Centre of Gravity- Centre of gravity and its practical application

Area of cut – out regular surfaces and area of irregular surfaces- Area of cut – out regular surfaces – circle, segment and sector of circle. Related problems of area of cut – out regular surfaces – circle, segment and sector of circle. Area of irregular surfaces and application related to shop problems

Algebra- Addition, Subtraction, Multiplication & Divisions, Algebra – Theory of indices, Algebraic formula, related problems.

Elasticity- Elastic, plastic materials, stress, strain and their units and young's modulus. Ultimate stress and working stress.

Heat Treatment- Heat treatment and advantages. Different heat treatment process – Hardening, Tempering, Annealing, Normalising, Case Hardening

Profit and Loss- Simple problems on profit & loss. Simple and compound interest

Estimation and Costing- Simple estimation of the requirement of material etc., as applicable to the trade Problems on estimation and costing

12.SHEET METAL WORKER (भीटमेटल वर्कर)

General discipline in the institute Elementary of First aid Importance of the sheet metal work in the Industry. General safety precautions Safety precaution in sheetmetal work. Metals and Non-Metals and their Characteristics, Types, Sizes and uses of Sheet Metals as per BIS. Use of reference table. Raw material information: CRCA, HRCA & MS Material Terms & definitions in sheet metal work.Marking and laying out tools and accessories Measuring Tools : steel Rule, calipers, try square, L square , Micrometer, Vernier caliper, Vernier height gauge, Combination set, screw pitch gauge, radius gauge, SWG, Bevel Protractor etc. Marking Tools: Scratch AWL, divider, Trammel point, punches etc. Cutting tools: Snips, shears, hacksaw, chisel, cutting plier, files, drills, tap & die sets etc.

Hand tools: mallets, hammer, sheet metal hammers, groovers, riveting tools, screw drivers, wrench and spanners etc. Holding tools & accessories: vices, C clamps, stakes, stakes holder, hollow mandrel, wooden former, Jigs & fixtures, soldering bits etc.

Sheet Metal Folded Joints: Description of Sheet Metal Seam, Grooved seam, Locked Grooved seam, Paned down seam, Knocked up seam inside and outside, capstrip seam, pitsburg seam etc. Folding and joining allowances, edge stiffing, wiring allowances and false wiring, types of notches in sheet metal. Definitions of pattern, Development, stretched out pattern, Master pattern (gross pattern) and templates Development of by parallel line method, radial line method.

Development of surfaces: Triangulation method and geometrical construction methods. Solid and Hollow Punches. Description of hand punches as per BIS. Sizes of solid and hollow Punches and their uses. Rivets and its parts, Selection of Rivet heads.Types of Rivet and their uses. Standard sizes of Rivets and Riveting Tools. Calculation for Riveting allowances (pitch and Lap).

Fastening of Sheet Metal: Self taping screws, Clips and Connectors; Their uses, Types and Allowance of 'S' Clips, Government Clips, Drive Clips, Mailing Clips etc.Solder, Different types of solder and their composition. Types and uses of fluxes, their effect on different metal. Process of soft soldering, hard soldering (brazing).Heating appliances (Hand Forge, Blow Lamp, L.P.G.) Development & laying out pattern of elbow pipe, T pipe and off set pipe in equal diameter. Development of T pipe, round equal and unequal. Introduction to tubes and pipes. Laying out pattern of 600 off- set 'T' pipe. Pattern Development of 'Y' pipe. Preparation of pickling solution. Protection-Coating, Cleaning and preparing of Sheet Metals Corrosion and anti corrosion treatment of sheet metal. Method of galvanizing, tinning, anodising, sheradising and Electroplating. Development and laying out of pattern of segmental quarter bend pipe. Need for ducting. Places where ducting is employed and the working principle of a dust cyclone, Gutter and its use. False ceiling. Safety precaution in gas & arc welding Description of Oxyacetylene plant and the equipments, accessories & tools. Types of oxy-acetylene flames& its uses. Types and description of flux. Types of welding blow pipes & its functions. Various types of pipe joints. Method of metal preparation & cleaning them base metal before welding. Gas welding defects causes & remedies. Arc welding defects causes & remedies. Importance of the trade in the development of Industrial Economy of the Country. Review of Types of sheet metal Fabrication. Methods of developments. Introduction to Aluminum fabrication, and its applications. Ferrous and Non- Ferrous metals. Use of Copper and Alloys. Laying out pattern of conical elbows. Pattern development of lobster back bend. Chemical and Physical properties of Aluminium. Use of Aluminium and its Alloys. Brief Description of hand punch machine. Hand and Power operated drilling Machines. Drill Bits, parts and effects of cutting angles. Angles for Drilling Sheet Metals, effect of speed, Feed Cutting Fluids, etc., on metals. Difference between drilled and punched holes. Description of swaging and beading machine, its parts, operating principles etc.Description of Fly Ball press. Operating

Principles of Power Press and press brakes. Method to calculate the pressure adjustment. Clearance between Die and Punch. Introduction to "C" and "H" frame presses. Properties of stainless steel and its uses.Properties and uses of tin, lead, zinc and silver. Description and Physical properties of Muntz Metal, Gun Metal, White Metal etc. Introduction to pipe/tube bending. Brief description of Hydraulic pipe bending machine. Operating Principles etc. Description of roll forming machine types and operating principles, description of slip roll forming machine and its function. Use of Die and Die Holder, Description of taps and tap wrench. Method to operate folding/brake folder for typical folding. Description and use of jigs and fixtures. Definition of Planishing and its application. Brief description of polishing machine. Various types of bobs and polishing compounds. Operating principles of spinning lathe. Description of spinning. Different process of metal joining types of weld joint &weld positions. Oxy- acetylene welding equipments & application, Types of flame & their uses. Principle of arc welding. Types of welding machines and their uses. Advantages and disadvantages of AC/DC welding machines.Arc length and its importance Welding defects. Principle of resistance welding. Types and applications. Welding symbols. Introduction to CO2 welding process. Welding equipments and accessories. Advantages and application of CO2 process.TIG welding process. Advantages. Description of equipments. Types of polarity and application. Types of Tungsten Electrodes, Filler rods, Shielding Gases. Defects, causes and remedy in TIG welding process. Latest sheet metal cutting techniques: Plasma cutting, Laser cutting, water jet cutting and punching etc. Specification of aluminium channels angles, strips, tubes beadings, packing rubber, cardboard, glasses etc. Tools and equipments used in aluminium fabrication. Assembly & Sub assembly: Gaurding assembly, Door assembly, Chassis assembly, Cabinet assembly, Power pack assembly etc. Process of painting. Spray painting. Etch primer painting, Powder coating, buffing, grinding, and sanding. Selection of different grit sizes. Types of Radiators and construction of Radiators, Mufflers, Estimation of work. Material handling: handling of light, medium and heavy materials. Use of cranes and types. Estimation and costing.

13.TURNER (टर्नर)

All necessary guidance to be provided to the newcomers to become familiar with the working of Industrial Training Institute system including stores procedures.

Soft Skills: its importance and Job area after completion of training. Importance of safety and general precautions observed in the industry/shop floor. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure.

Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application.

Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. Measurement, line standard and end standard, steel rule- different types, graduation and limitation. Hammer and chisel- materials, types and uses. Prick punch and scriber. Vice – types and uses, Files- different types of uses, cut, grade, shape, materials etc. Try square-different types, parts, material used etc. Calipers- types and uses (firm joint). Vee – block, scribing block, straight edge and its uses. Hacksaw-their types & uses. Center punch- materials, construction & material uses. Drill machine-different parts. Hacksaw blades- sizes, different Parts. Hacksaw blades-sizes, different pitch for different materials. Nomenclature of drill. Surface plate its necessity and use. Tap - different types (Taper 2nd and bottoming) care while tapping. Dies different types and uses. Calculation involved to find Out drill size (Metric and Inch). Getting to know the lathe with its main components, lever positions and various lubrication points as well. Definition of machine & machine tool and its classification. History and gradual development of lathe. Classification of lathe in Function and construction of different parts of Lathe. Types of lathe drivers, merit and demerit. Description in details-head stock-cone pulley type- all geared type- construction & function. Tumbler gear set. Reducing speed-necessary & uses. Back Gear Unit–its construction use. Lathe cutting tool-different types, shapes and different angles (clearances and rake), specification of lathe tools. Combination drill-appropriate selection of size from chart of combination drill. Drill, chuck- its uses. Lathe accessories, chuck independent, self-centering, collet, magnetic etc., its function, construction and uses. Vernier caliper-its construction, principle graduation and reading, least count etc Digital vernier caliper. Outside micrometer –different parts, principle, graduation, reading, construction. Digital micrometer. Cutting speed, feed depth of cut, calculation involved-speed feed R.P.M. etc. recommended for different materials. Different types of micrometer, out side micrometer. Vernier scale graduation and reading. Sources of error with micrometer & how to avoid them. Use of digital measuring instruments. Drills-different parts, types, size etc., different cutting angles, cutting speed for different material. Boring tool. Counter - sinking and Counter boring. Letter and number drill, core drill etc.Reamers-types and uses. Lubricant and coolant-types, necessity, system of distribution, selection of coolant for different material:Handling and care. Knurling meaning, necessity, types, grade, cutting speed for knurling. Lathe mandrel- different types and their uses. Concept of interchangeability, Limit, Fit and tolerance as per BIS: 919-unilateral and bilateral system of limit, Fits- different types, symbols for holes and shafts. Hole basis & shaft basis etc. Representation ofTolerance in drawing. Driving plate. Face plate & fixed &traveling steadies- construction and use. Transfer caliper-its construction and uses. Lathe centers-types and their uses. Lathe carrier- function types & uses. Mandrel – Different types and its use. Magnetic stand dial indicator,its used and care. Taper – different methods of expressing tapers, different standard tapers. Method of taper turning, important dimensions of taper. Taper turning by swiveling compound slide, its calculation. Bevel protector & Vernier bevel protractor-its function &

reading. Method of taper angle measurement. Sine bar-types and use. Slip gauges-types, uses and selection. Method of brazing solder, flux used for tip tools. Basic process of soldering, welding and brazing.Vernier height gauge, function, description & uses, templates- its function and construction. Screw thread-definition, purpose & it's different elements. Driving plate and lathe carrier and their usage. Fundamentals of thread cutting on lathe. Combination set-square head. Center head, protractor head-its function construction and uses. Different types of screw thread-their forms and elements. Application of each type of thread. Drive train. Chain gear formula calculation. Different methods of forming threads. Calculation involved in finding core dia., gear train (simple gearing) calculation. Calculations involving driver- driven, lead screw pitch and thread to be cut. Thread chasing dial function, construction and use. Calculation involving pitch related to ISO profile. Conventional chart for different profiles, metric, B.A., With worth, pipe etc. Calculation involving gear ratios and gearing (Simple & compound gearing). Screw thread micrometer and its use. Calculation involving gear ratios metric threads cutting on inch L/SLathe and vice-versa.Tool life, negative top rake-its application and performance with respect to positive top rake. Calculation involving tool Thickness, core dia., pitch proportion, depth of cut etc. of sq. thread. Calculation involved – depth, core dia., pitch proportion etc. of Acme thread. Calculation involved depth, core dia., pitch proportion, use of buttress thread. Buttress thread cutting (male & female) & tool grinding. Different lathe accessories, their use and care.

Lubricant-function, types, sources of lubricant. Method of lubrication. Dial test indicator use for parallelism and concentricity etc. in respect of lathe work Grinding wheel abrasive, grit, grade, bond etc. Form tools-function-types and uses, Template-purpose & use. Dial test indicator- construction & uses Calculation involving modified rake and clearance angles of lathe tool at above and below the center height. Subsequent effect of tool setting. Jig and fixture-definition, type and use. Chip breaker on tool- purpose and type.

Cutting tool material-H.C.S., HSS, Tungsten. Carbide, Ceramic etc, - Constituents and their percentage. Tool life, quality of a cutting material. Checking of taper with sin bar and roller-calculation involved.

Cutting speed, feed, turning time, depth of cut calculation, cutting speed chart (tungsten carbide tool) etc. Basic classification of tungsten carbide tips.

Accessories used on face plate–their uses. Angle plate-its construction & use. Balancing- its necessity. Surface finish symbols used on working blueprints- I.S. system lapping, honing etc.Preventive maintenance, its necessity, frequency of lubrication. Preventive maintenance schedule., TPM (Total Productive Maintenance),EHS (Environment, health, Safety) Marking table-construction and function. Angle plate- construction, eccentricity checking. Roller and revolving steadies, Necessary, construction, uses etc.

Different types of attachments used in lathe. Various procedures of thread measurement thread screw pitch gauge. Screw thread micrometer, microscope etc. Tool maker's button and its parts, construction and uses, telescopic gauge its construction and uses. Inside micrometer principle, construction graduation, reading, use etc. (Metric & Inch.)

Care for holding split bearing. Fixture and its use in turning. Calculation involving fractional threads. Odd & even threads. Multiple thread function, use, different between pitch & lead, formulate to find out start, pitch, lead. Gear ratio etc. Indexing of start - different methods tool shape for multi- start thread. Setting of a lathe calculation for required changewheel.

Calculation involving shape of tool, change wheel, core dia etc. Calculation involving shape, size pitch, core dia. Etc. Helix angle, leading angle & following angles. Thread dimensions-tool shape, gear, gear calculation, pitch, depth, lead etc.

CNC technology basics: Difference between CNC and conventional lathes. Advantages and disadvantages of CNC machines over conventional machines. Machine model, control system and specification.

Axes convention of CNC machine - Machine axes identification for CNC turn centre. Importance of feedback devices for CNC control. Concept of Co-ordinate geometry, concept of machine axis.

Programming – sequence, formats, different codes and words.Co-ordinate system points and simulations. Workpiece zero points and ISO/DIN G and M codes for CNC. Different types of programming techniques of CNC machine. Describe the stock removal cycle in CNC turning for OD / ID operation. L/H and R/H tool relation on speed. Describe CNC interpolation, open and close loop control systems. Co-ordinate systems and Points. Program execution in different modes like manual, single block and auto. Absolute and incremental programming. Canned cycles. Cutting parameters- cutting speed, feed rate, depth of cut, constant surface speed, limiting spindle speed, tool wear, tool life, relative effect of each cutting parameter on tool life. Selection of cutting parameters from a tool manufacturer's catalog for various operations. Process planning & sequencing, tool layout & selection and cutting parameters selection. Tool path study of machining operations Prepare various programs as per drawing.

Tool Nose Radius Compensation (G41/42) and its importance (TNRC). Cutting tool materials, cutting tool geometry – insert types, holder types, insert cutting edge geometry. Describe Tooling system for turning Setting work and tool offsets. Describe the tooling systems for CNC TURNING Centers. Cutting tool materials for CNC Turning and its applications ISO nomenclature for turning tool holders, boring tool holders, indexable inserts. Tool holders and inserts for radial grooving, face grooving, threading, drilling.

Prepare various part programs as per drawing & check using CNC simulator. Processes and Tool selection related to grooving, drilling, boring & threading.

Describe Tapping on CNC turning. Programming for Grooving/Threading on OD/ID in CNC Turning. Trouble shooting in CNC lathe machine Identify Factors affecting turned part quality/ productivity. Parting off operation explanation. Bar feeding system through bar feeder. Input and Output of Data.DNC system. Interlacing with PC. Use of CAM Programme. (Optional).

Setting of tools for taper threads-calculation of taper setting and thread depth. Heat treatment – meaning & procedure hardening, tempering, carbonizing etc. Different types of metal used in engineering application.

Interchangeability meaning, procedure for adoption, quality control procedure for quality production. Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs in required formats of industry, estimation, cyclet ime, productivity reports, job cards.

Terms used in part drawings and interpretation of drawings –tolerances, geometrical symbols - cylindricity, parallelism. Automatic lathe-its main parts, types diff. Tools used-circular tool etc. Related theory and calculation.

14.WIREMAN (वायरमैन)

Occupational Safety & Health Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Concept of Standard. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. Identification of Trade-Hand tools-Specifications. Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units & effects of electric current. Solders, flux and soldering technique. Resistors types of resistors & properties of resistors. Introduction of National Electrical Code 2011 Explanation, Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types of Insulators, Temp. Rise permissible Types of wires & cables standard wire gauge Specification of wires & Cables-insulation & voltage grades Low , medium & high voltage Precautions in using various types of cables / Ferrules.

Ohm's Law -Simple electrical circuits and problems. Reading of simple Electrical Layout.

Resistors - Law of Resistance. Series and parallel circuits.

Kirchhoff's Laws and applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance.

Common Electrical Accessories, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB.

Chemical effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electro-plating and Electro chemical equivalents. Explanation of Anodes and cathodes. Lead acid cell-description, methods of charging- Precautions to be taken & testing equipment, Ni-cadmium & Lithium cell, Cathodic protection. Electroplating, Anodizing. Different types of lead acid cells. Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage & current, Sealed Maintenance free Batteries, Solar battery.

Inverter, Battery Charger, UPS- Principle of working. Lead Acid cell, remedies. Nickel Alkali Cell-description charging. Power & capacity of cells. Efficiency of cells.

ALLIED TRADES: Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames & blades- their specification & grades. Care & maintenance of steel rule try square and files. Marking tools description & use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools-their care and maintenance. Types of drills description & drilling machines, proper use, care and maintenance. Description of taps & dies, types in rivets & riveted joints. Use of thread gauge. Description of marking & cutting tools such as snubs shears punches & other tools like hammers, mallets etc. used by sheet metal workers. Types of soldering irons-their proper uses. Use of different bench tools used by sheet metal worker. **Soldering** materials, fluxes and process.

Magnetism –Classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance. Para and Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid. MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro- magnetic Induction, Faraday's Law, Lenz's Law.

Electrostatics: Capacitor- Different types, functions and uses.

Alternating Current –Comparison and Advantages D.C and A.C. Related terms frequency Instantaneous value, R.M.S. value Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive and Capacitive reactance Impedance (Z), power factor (p.f). Active and Reactive power, Simple problems on A.C. circuits, single Phase and three-phase system etc. Problems on A.C. circuits. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. **Earthing**- Principle of different methods of earthing. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB). In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC guidelines.

Basic electronics- Semiconductor energy level, atomic structure 'P' type and 'N' type.

Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating.

Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter.

Type of measuring instruments – MC & MI, Construction & working principles of Ammeter, Voltmeter, Ohm-meter ,Wattmeter, Energy meter, P.F. meter, frequency meter, multi meter, clamp meter, Megger & earth tester. Introduction of Digital meters. CT & PT. Tong tester / Clip on Meter. Introduction and explanation of electrical wiring systems, cleat wiring, casing & Capping, CTS, Conduit and concealed etc., I. E. Rules. Related to wiring, National Building codes for house wiring, specification and types, rating & material. Branching of circuits with respect to loads such as lighting and power. CTS/PVC Conduit-surface and concealed/ metal conduit/ PVC casing and capping. IE rules regarding clip distance. Fixing of screws, cable bending etc. Description of different electrical fittings and accessories such as lamp holders, switches, plugs brackets, ceiling rose, cut out etc. IS 732- 1863.Wiring materials used for P.V.C. cables I.E. rules, Indian standards regarding the above wiring such as-clip distance fixing of screws, cable bending etc. Description of Rowel tools and Rowel plugs, their sizes, plugging, compound, plugs- wall jumper and their sizes and uses. Introduction to estimation procedure, P.V.C. casing and capping materials, sizes and grades etc. Conduit pipe wiring materials and accessories, types and sizes of conduit. Layout of Light points, fan points etc. Layout of heating leads etc.- their controls, main switches, distribution boards as per I.E. rules. I. E. Rules for earthing conduits using earth clips and earth wire as per IS 732-1863. Introduction of Illumination- Terms & definitions, laws of illumination, illumination factors, intensity of light –importance of light, colour available. Construction, working & applications of – Incandescent lamp, Fluorescent tube, CFL, Neon sign, Halogen, Mercury vapour and types, sodium vapour etc. Decoration lighting, Drum Switches etc. Connections of different types of motors used in industry, their normal methods of wiring, Control , starting and protection devices-their connections, layouts and earthing Code practice for earthing of Industrial Wiring. Wiring methods & types in workshop & factories. Wiring in commercial building- their special precautions as per I.E. rules. Introduction to LAN wiring.

Power drives - Introduction, types, advantages & disadvantages.

UPS- Introduction, types, Load calculation, Backup time calculation.

Computer networking - Identification of network hardware / component. CAT-6 cable, RJ-45.

DTH- Introduction of direct to home system, Music channel wiring/interconnecting couplers.

General idea of fixing meter boards & taking service connection. Sealing of I.C. cut out & meters as per I.E. Rules, General Electric Appliances using heating effect – their capacities, voltage ranges, Calculation of current. Explanation of inter connection wiring circuits in the main building and auxiliary blocks, meter boards and its locations. Study of layout symbols in the preparation of layout diagrams. Block diagram of computer, main parts inside the system unit, ports & connectors, of PC parts & peripherals associated with PC like-keyboard, Mouse, Printers, Scanners, Camera, Modem, External Storage Devices & UPS. Features of Operating System like M.S. Windows, Components of Windows- Calculator, Notepad, Paint, Windows Explorer.

INTERNET: Websites, Browsing, Downloading Creating and Using E-mail ID's Using it for Communications.

LED, Diode, types of transistor, UJT, SCR, regulator ICs and Zener diode uses and its application. IC-voltage regulator pin configurations and applications. **Common Electrical Accessories**, their specifications-Explanation of switches, lamp holders, plugs and sockets etc. Development of domestic circuits using switches, fuse, MCB, sockets, lamp, fan, calling bell/buzzer, Two way switch, I.C.T.P, I.C.D.P, MCCB, ELCB, RCCB etc. Importance of Neutral, effect of opening of neutral wire.

Soldering- Solders, flux and soldering techniques. Types of soldering irons-their proper use. Introduction to D.C Generators and working principle, parts of D.C. Generator. Classification of Generators- Self excited and separately excited- their application in practical field. Types and characteristics of D.C. Generators – Series, Shunt and compound, their applications. Explanation of Armature reaction, interlopes, commutation and EMF equation of DC generators. Parallel operation of Generators. Introduction to D.C. Motor- Working principle, types of motors Explanation of terms used Torque, speed, Back E.M.F. etc. Characteristics, Speed control of DC motors. Necessity of starter-Types of starters, 2 point 3 point and 4 point starters, Protective devices used. Methods of speed control, advantages, disadvantages & Industrial applications. Trouble shooting and fault rectification. Introduction to A.C. Poly phase systems- advantages, 3 phase star delta. Terms used in 3Ø systems, connection and their relations w.r.t. current and voltage. Principle of measurement of A.C. 3 ph. Power. Simple calculation of A.C. 3 phase circuit parameter - I, V, Z & P.F. etc . Parts and construction of Alternators, principle of working, types of Alternators, EMF equation. Various applications and power rating of alternators. General idea of loading and regulation of Alternator. Parallel operation of Alternators, synchronising methods. Introduction to A.C single phase motors and types. Capacitors start/run- start and run. FHP motors and their uses. Various application of A.C single phase motors.

Three phase Induction motor:- Construction, Principle of operation of Three phase induction motor. Squirrel cage induction motor and slip ring induction motor. Rotor slip, rotor frequency and rotor torque. Factors affecting torque. Effect of variation in applied voltage. Starting methods. Speed control methods. Importance of phase sequence in three phase induction motor. Single phasing preventer. Starters - DOL starter, Star – delta starter and Auto transformer starter. Description of starter delta starter (manual, semi and Auto). Formative arrangement of a motor resistance starter for slip ring induction motor. Motor control circuit and starting devices. Power and control wiring circuits of AC motors.

TRANSFORMERS – Power Transformer – Its construction, working, performance, parallel operation of transformer, their connections. Cooling of transformer, S.C. & O.C. tests. Regulation and efficiency, Specifications, problems on e.m.f. Equation, transformation ratio. Characteristics of ideal transformer. Construction of core, winding shielding, auxiliary parts breather, conservator. Buchholz's relay, other protective devices. Transformer oil testing and Tap

changing off load and on load. Transformer bushings and termination. Auto transformer- Its construction, working, performance & uses.

GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER Generation of Electricity and their types. General idea about overhead transmission, distribution (LV, MV & HV) and their types of accessories used. General arrangement and maintenance of outdoor type of substation. Explanation of overhead bus bar, side by bar. Bus trunking and rising mains. I.E. rules regarding panel erection, bus bar, spacing bus bar chamber, danger boards. Connection of high voltage metering equipment used with bus bar. Types of Distribution, Explanation of line protecting devices and their general principle. Brief description of connection of places of use.

SUBSTATION EQUIPMENTS. Switchgear-CBs – ACB, VCB, SF6, OCB etc. protection schemes, CT/PT-Protective relays, lightning arrestors, Explanation of different types of switches and switches gears multi Range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc.

TYPES OF SUBSTATIONS - INDOOR, OUTDOOR & POLE MOUNTING

Substation construction: Outdoor and Indoor substation. E.H.T. substation H.T. substation. Medium & low voltage substation(Pole mounting type)

U.G. CABLE. Construction of cable, Types , Application & methods of jointing UG cable & testing General idea of laying method and jointing precautions to be observed and different accessories used for medium voltage termination. Need of Synchronizing, various methods, precautions to be observed while Synchronizing. Control Panel elements, types and specifications. Layout and installation of panel board, Panel board wiring methods, colour coding of cables for its easy identification. Grouping and numbering of cables by using ferrules. Importance and advantages of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine tests. Common faults, causes and remedies in domestic and industrial wiring installation, Methods of Locating faults. Concept and Principle of plan, estimation and cost. Preparation of complete house wiring layout, industrial wiring, commercial wiring for office Lodge, Hospital, Bank, Hotels etc. I.E. rules for Multi-storied buildings.

15.FITTER (फिटर)

All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application.

Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment.

Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table. Measuring standards (English, Metric Units), angular measurements.

Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files-specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements. Marking off and layout tools, dividers, scribing block, - description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Uses, care & maintenance of cold chisels-materials, types, cutting angles. Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. Power Saw, band saw, Circular saw machines used for metal cutting.

Micrometer- outside and inside– principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer.

Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper.Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.

Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.

Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine-description, parts and uses.

Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses. Sheet and wire gauge.

Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges.

Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method of soldering, selection and application-joints. Hard solder- Introduction, types and method of brazing.

Various rivets shape and form of heads, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, the spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.

Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators.

Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints- Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and setting up parameters for ARC welding machines- selection of welding electrodes. Care to be taken in keeping electrode.

Oxygen acetylene cutting- machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.

Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses.

Counter sink, counter bore and spot facing-tools and nomenclature,Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.

Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A.& B.S.P.) and metric /BIS(coarse and fine) material, parts (shank body, flute, cutting edge).

Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor).

Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.

Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.

Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.

Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.

Interchange ability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits- basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system.

Method of expressing tolerance as per BIS Fits: Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.

Pig Iron: types of pig Iron, properties and uses.

Cast Iron: types, properties and uses Wrought iron: - properties and uses.

Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.

Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate.

Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.

Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators- measurement of quality in the cylinder bores.

Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centres, works with catch plate, dog, simple description of a facing and roughing tool and their applications.

Lathe cutting tools- Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.

Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.

General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper.

Screw thread definition – uses and application. Square, worm, buttress, acme (nonstandard-screw threads),Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.

Maintenance Total productive, maintenance, Autonomous, maintenance, Routine maintenance, Maintenance schedule, Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies. Installation, maintenance and overhaul of machinery and engineering equipment

Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torqueing. Dowel pins: material, construction, types, accuracy and uses.

Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses.

Power tools :its constructional features, uses & maintenance.

Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers.

Special files: types (pillar, Dread naught, Barrow, warding) description & their uses.

Templates and gauges-Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge).

Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance.

Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.

Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tastings urfaces quality – dimensional tolerances of surface finish.

Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting-its aim and the methods of performance.

Metallurgical and metal working processes such as Heat treatment, various heat treatment methods - normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart.

Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).Tapers on keys and cotters permissible by various standards.

The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing.

Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization.

Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.

Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings.

Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, Teflon polyamide(nylon).

The importance of keeping the work free from rust and corrosion.

Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads-Std. Pipe threads Die and Tap, pipe vices.

Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.

Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and household taps and pipe work. Inspection & Quality control-Basic SPC-Visual Inspection.

Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses.

Aluminum and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminum etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing properties of bronze and brass.

Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts.

Vee belts and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions- coupling types-flange coupling,-Hooks coupling- universal coupling and their different uses. Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.

Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set.

Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method.

Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.

Fluid power, Pneumatics, Hydraulics, and their comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law.

Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems. Pneumatic actuators: - Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders.

Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2- way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control valve Pneumatic valves: Roller valve, Shuttle valve, Two- pressure valve Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls.

Symbols of hydraulic components, Hydraulic oils function, properties, and types, Contamination in oils and its control. Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems. Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses.

Hydraulic cylinders –Types, Hydraulic motors –Types, Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves, Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves, Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function Flow control valves: Types, Speed control methods – meter-in and meter-out Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils.

Importance of Technical English terms used in industry(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.

Method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds- paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Washers-Types and calculation of washer sizes. The making of joints and fitting packing. Chains, wire ropes and clutches for power transmission. Their types and brief description.

Lubrication and lubricants- purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings.

Foundation bolt: types (Lewis cotter bolt) description of each erection tools, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.