Government of India (Bharat Sarkar)
Ministry of Railways (Rail Mantralaya)
(Railway Board)

RBE No. 183/2019

No. E(MPP)2019/3/46 **New Delhi, Dated 28.10.2019**

The General Managers,
All Indian Railways/PUs,
Metro Railway/Kolkata
Railway Electrification/Allahabad
DG/RDSO/Lucknow
CAO/DMW/Patiala
CAO/COFMOW/New Delhi
ED/CAMTECH/Gwalior

DG/NAIR/Vadodara
The Directors,
IRITM/Lucknow
IRIEEN/Nasik
IRIMEE/Jamalpur
IRICEN/Pune
IRISET/Secunderabad

Sub: Revised Training Modules of Non-Gazetted Staff of Civil Engineering Department.

Ref: Chairman/Railway Board's letter No. E(MPP)/2016/3/20 dated 28.11.2018 and Board's letter dated 06.12.2018

Vide Board (CRB) letter No. E(MPP)/2016/3/20 dated 28.11.2018, DG/NAIR had been authorized as the Head of the Academic Council of all CTIs to develop Training Modules of all categories of Non-Gazetted staff. Accordingly, training modules of Civil Engineering Department was finalized and sent to this office.

2. Ministry of Railways (Railway Board) has reviewed the above Training Modules proposed and submitted by DG/NAIR. Board (ME & MS) has approved the revised training modules.

3. The revised modules prepared have been scanned and uploaded under **E(MPP) Training Circulars** and can be viewed or downloaded from **railnet** at http://www.indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,530,1068 .

4. Kindly acknowledge receipt.

O/C

(Alka Arora Misra)
Executive Director/MPP
Railway Board.

No.E(MPP)2019/3/46 New Delhi, dated: 28-10-2019

Copy to:

1) The General Secretary, NFIR, 3 Chelmsford Road, New Delhi for information with 35 spares
2) The General Secretary, AIRF, 4 State Entry Road, New Delhi for information with 35 spares.
3) The Secretary General, FROA, R.No.256-A, Rail Bhavan, New Delhi for information with 5 spares.
4) The Secretary General, IRPOF, R.No.268, Rail Bhavan, New Delhi for information with 5 spares.
5) All Members, Department Council & Secretary Staff side National Council 13-C, Ferozeshah Road, New Delhi with 90 spares.
6) The Secretary General, AIRPF Association, Room No.256-D, Rail Bhavan, New Delhi with 5 spares.
7) General Secretary, All India SC & ST Railway Employees Association, 171/B-3, Basant Lane Railway Colony, New Delhi (15 copies).

For Secretary/Railways

No.E(MPP)2018/6/1. New Delhi, dated: 28-10-2019

Copy to:

i) PS & ED(PG) to MR, MSR(A) & MSR(K)
ii) PSO/Sr.PPS to CRB, FC, ML, ME, MM, MS, MT, DG(RHS) & DG(RPF)
iii) Sr.PPS/PPS/PS to AM(Budget), AM(CE), AM(C&IS), AM(Comml.), AM(Elect), AM(Fin), AM(Mech.), AM(Plg.), AM(Project), AM(PU), AM(Sig.), AM(Staff), AM(RS), AM(T&C), AM(Tele), AM(Traffic), AM(Works), Adv.L(RS), Adv(Vig.), Adv.Fin(Exp), Adv(IR), Adv(Safety), LA, OSD(MIS).
iv) ED(Plg.), ED(Accts.), EDF(BC), EDCE(B&S), EDCE(G), EDCE(Plg.), ED(CHG), ED(CC), ED(C&IS), ED(E&R), EDEE(Dev), EDEE(G), EDE, ED(RRB), EDE(N), EDE(Res), EDF, EDF€, EDF(S), EDF(B), EDF(RM), EDF(X)I, EDF(X)II, ED(H), EDLM, ED(MIS), EDE(GC), ED(T&MPP), EDME(Chg.), EDME(Fr.), EDME(Tr.), EDME(TOT), EDME(Dev.), EDME(W), ED(PC)I, ED(PC)II, ED(PP), ED(Project), ED(Project)/DMRC, EDRE, ED(Safety), JS, JS(C), JS€, JS(P), IG./RPF(Hqs), IG/RS, ED(S9g.), ED(Stat&Econ.), EDRS(C), EDRS(G), EDRS(P), EDRS(S), EDRS(W), ED(TD), EDTT(M), EDT(MC), EDT(P), ED(T&C), EDCE(P), ED(PM), ED(PG), EDTC-I, EDTC(FM), EDTT(F), EDTT(FM), EDTT(S), EDV(A), EDVE, EDV(T), ED(W).
v) Chief Commissioner of Railway Safety, Lucknow.
vi) E(Trg.), E(NG)I, E(NG)II, E(G), F(E)I, F(E)II, F(E)III, E(SCT)I, E(SCT)II branches of Railway Board.













Ministry of Railways

Training Modules
for
Non-Gazetted
Staff of
Civil Engineering
Department

P. Way
Track Machines
Bridges & Drawings
Works

Indian Railways Institute of Civil Engineering, Pune

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ज्ञान ज्योति से मार्गदर्शन
To Beam As A Beacon of Knowledge

PREFACE

Training Modules for Non-Gazetted Staff of Civil Engineering Department.

Chairman, Railway Board, vide D.O. letter No. E(MPP)/2016/3/20 dated 28.11.2018, authorized DG/NAIR, as the head of the Academic Council of all CTIs to develop Training Modules for all segments of employees of Indian Railways. The issue was discussed & deliberated upon during meeting of the CTIs with DG/NAIR (through video conferencing) held on 29.01.2019.

Accordingly, various Committees were formed at IRICEN to carry out detailed review / prepare Training Modules for various categories, i.e. Permanent Way, Bridges, Works and Track Machines. The Training Modules prepared by the Committees of IRICEN were then sent to all Zonal Railways for feedback and suggestions. Further, a meeting was held on 24th & 25th April, 2019 at IRICEN where EDCE/G, Railway Board, CGEs of CR, NR, SR, SCR, SER & WR and Principal / Faculty of CETA Kanpur, Kharagpur, Tambaram, Kacheguda & IRTMTC/Allahabad were present and in this meeting, the training modules prepared by Committees of IRICEN were deliberated upon in detail, and, based on the discussions & suggestions received from the participants and Zonal Railways, necessary changes were made in the Training Modules.

The Training Modules were thereafter submitted to Railway Board for obtaining comments from concerned Directorates. Training Modules pertaining to USFD & Welding were sent to RDSO also, as training and syllabus for these activities (USFD & Welding) is prescribed by RDSO. The concerned Directorates of Railway Board and RDSO, after examining these Training Modules, sent their comments / suggestions and these comments/suggestions were also incorporated in the Training Modules.

The Training Modules were finalized, compiled and submitted to DG/NAIR on 10.06.2019. DG/NAIR approved the Training Modules and vide letter No.NAIR/SPCE/ Misc/2019 dated 05.07.2019 submitted the updated Training Modules for Non-Gazetted Staff of Engineering Department for approval of Railway Board.

Railway Board, vide letter No. E (MPP) 2019/3/46 dated 28/10/2019 (RBE No. 182/2019) has accorded approval to the Training Modules and these are printed in this booklet. IRICEN Faculty has worked hard in line with its motto – ***"To Beam As a Beacon of Knowledge"***.

(Ajay Goyal)
Director

Pune
November 2019

TRAINING PROGRAMS FOR ENGINEERING DEPARTMENT

P. Way

Training Module	Category	Type of Training	Training Program Details			Frequency/ Remarks
			Phase	Place of Training	Duration	
T-1	SSE/P.Way or JE/P.Way	Induction (For new recruits posted in Railway)	Ph.-I	Training in Institute	4 Months	Once, on joining Railway service/ Promotion through LDCE from P.Way category
				Training in field	2 Months	
			Ph.-II	Training in Institute	2 Months	
				Training in field	2 Months	
			Ph.-III	Training in field	6 Weeks	
			Posting Exam	Training Institute	2 Weeks	
			Total duration		**1 Year**	
T-2	SSE/P. Way	Promotion	Training in Institute		17 Days (3 weeks)	Once, on promotion from JE
T-3	SSE/P. Way or JE/ P.Way	Refresher	Training in Institute		17 Days (3 weeks)	Once in five years
T-4	Mate	Promotion	Training in Institute		18 Days	Once, on promotion from Keyman to mate Or from Track maintainer to Keyman
	Keyman	Basic				
T-5	Mate/Keyman	Refresher	Training in Institute		6 Days	Once in five years
T-6	Gate keeper	Induction	Training in Institute		12 Days	From new recruits
T-7	Gate keeper	Induction	Training in Institute		6 Days	For Gatekeeper picked up from Track maintainer category
T-8	Gate keeper	Refresher	Training in Institute		6 Days	Once in five years
T-9	Track maintainer	Induction	Training in Institute		30 Days	Once, on joining Railway service
T-10	Track maintainer	Refresher	Training in Institute		6 Days	Once in five years
T-11	SSE/USFD & JE/ USFD	Initial	Training at RDSO		20 Days	Once, selected for USFD testing
T-12	SSE/USFD & JE/ USFD	Refresher	Training at RDSO		5 Days	First refresher after three years. Thereafter once in every 5 years
T-13	Welder (AT)	Initial	Training at TPP/LKO		2 weeks	Once, on selection as welder
T-14	Welder (AT)	Refresher	Training at TPP/LKO		1 weeks	First refresher after 6 months for regular competency certificate. Thereafter, every 2 years.
T-15	Welding supervisor (SSE/JE) (P.Way)	Initial	Training at TPP/LKO		1 weeks	Once, in service. Mandatory for execution of welding in field

TRAINING PROGRAMS FOR ENGINEERING DEPARTMENT

TRACK MACHINES

Training Module	Category	Type of Training	Training Program Details			Frequency/ Remarks
			Phase	Place of Training	Duration	
TM-1	JE/Track Machines & SSE/Track Machines	Induction (For new recruits posted in Railway)	Ph.-I	Training in Institute at IRTMTC.	6 Months	Once, on joining Railway Service
			Ph.-II	Training in field including 2 weeks trg at ZRTI	6 Months*	
			Total duration		**1 Year**	
TM-2	JE/Track Machines	Promotion (promoted from technician)	Training in Institute at IRTMTC.		8 Weeks	Once, on promotion to JE
			Training in Institute at ZRTI.		2 Weeks*	
			Total duration		**10 Weeks**	
TM-3	SSE/Track Machines	Promotion (from JE/Track Machines)	Training in Institute at IRTMTC.		2 Weeks	Once, on promotion to SSE
			Training in Institute at ZRTI.		2 Weeks*	
			Total duration		**4 Weeks**	
TM-4	JE/SSE Track Machines	Refresher course	Training in Institute at IRTMTC.		2 Weeks	Once in three years when due
TM-5	Technician/Track Machines	Initial (new recruits)	Training in Institute at IRTMTC.		13 Weeks	Once, on joining Railway Service
			Training in field		13 Weeks	
			Total duration		**6 months**	
TM-6	Technician/Track Machines	Promotion (LDCE Promotion from Track Machine category)	Training in Institute at IRTMTC.		6 Weeks	Once, on promotion to Technician
TM-7	Technician/Track Machines	Refresher course	Training in Institute at IRTMTC.		2 Weeks	Once in five years

* Transportation course as per ZRTI duration.

TRAINING PROGRAMS FOR ENGINEERING DEPARTMENT

BRIDGES & DRAWINGS

Training Module	Category	Type of Training	Training Program Details			Frequency/ Remarks
			Phase	Place of Training	Duration	
B-1	JE/Bridges & SSE/Bridges	Induction (For new recruits posted in Railway)	Ph.-I	Technical Training in Institute	8 weeks	Once, on joining Railway Service
			Ph.-II	Training at Workshop, RDSO & welding trg at TPJ	10 weeks	
			Ph.-III	Training in field (Open Line)	10 weeks	
			Ph.-IV	Technical Training in Institute	7 weeks	
			Ph.- V	Training in field (constr. Unit)	10 weeks	
			Ph.- VI	General Training in Institute (ZRTI)	4 weeks	
			Ph.- VII	Posting Exam	3 weeks	
			Total duration		**1 Year**	
B-2	JE/Bridges & SSE/Bridges	Refresher		Training in Institute	18 Days (3 weeks)	Once in five years
B-3	JE/SSE Drawing	Induction (For new recruits posted in Railway)	Ph.-I	Common Training for all SSE/JE Drawing	8 weeks	Once, on joining Railway Service
			Ph.-II	General Training at ZRTI	4 weeks	
			Ph.-IIA	Field Training at place of posting	13 weeks	
			Ph.-III	Exam	1 weeks	
			Total duration		**26 weeks (6 Months)**	
B-4	JE/SSE Drawing (working as Design Assistant)	Induction (For new recruits posted in Railway)	Ph.-I	Common Training for all SSE/JE Drawing	8 weeks	Once, on joining Railway Service
			Ph.-II	General Training at ZRTI	4 weeks	
				Exam for Ph.I & Ph. II	1 weeks	
			Ph.-III	Technical Training –Part I	5 weeks	
			Ph.-IV	Field Training (OL/Constr.)	20 weeks	
			Ph.- V	Technical Training – Part II	7 weeks	
			Ph.- VI	Training at RDSO	5 weeks	
			Ph.- VII	Special Topics, Presentation & Exams	2 weeks	
			Total duration		**52 weeks (1 Year)**	

TRAINING PROGRAMS FOR ENGINEERING DEPARTMENT

WORKS

Training Module	Category	Type of Training	Training Program Details			Frequency/ Remarks
			Phase	Place of Training	Duration	
W-1	JE/Works	Induction (For new recruits posted in Railway)	Ph.-I	Training in Institute	3 Months	Once, on joining Railway Service
				Training in field	2 Months	
			Ph.-II	Training in Institute	3 Months	
				Training in field	2 Months	
			Ph.-III	Training in field (with posting)	6 Weeks	
			Posting Exam	Training Institute	2 Weeks	
			Total duration		**1 Year**	
W-2	JE/Works	Promotion (LDCE Promotion from Works category)	Training programme as per S. No. 1 above i.e. as followed for new recruits		1 Year	Once, on promotion to JE
W-3	JE/Works & SSE/ Works	Refresher	Training in Institute		12 Days (2 weeks)	Once in five years

Note:
Following P. Way, Works & Bridges (artisan staff) shall undertake training at nearest ITI of State government or by any other government/semi-government agency to be nominated by PCE.

Category	Artisans
P.Way	Black Smith, Arc Welder (reconditioning of points and crossings)
Works	Carpenter, Fitter, Mason, Painter, Black Smith
Bridges	Erector, Riveter, Welder, Black Smith, Painter, Compressor Driver

Abbreviation Used	
T	Track Modules
TM	Track Machine Modules
B	Bridge Modules
W	Works Modules
Ph	Phase
LDCE	Limited departmental competitive Exam
JE	Junior Engineer
SSE	Senior Section Engineer
PDS	Periods

P. WAY

INDUCTION COURSE (SSE/JE/P.WAY) (T-1)

DURATION OF COURSE: 12 MONTHS

SN.	Type of Training	Place of Training	Duration	Remarks
1	Induction PH-1	Training institute	4 month	Detailed training programme as per Annexure T-1 (a)
2	Induction PH-1	Training in field	2 month	Training will be given exposure of working in open line and construction organization for a duration of one month each to make him conversant with following - **Open line – duration One month** Following objective to be achieved by trainee: He should be thoroughly conversant with inspection and filling of Prorforma like; 1. LWR,SEJ 2. Points & Crossing 3. Curve 4. Level Crossing 5. Welding site 6. Reporting & Filling of RF/WF Proforma. 7. Work with track units 8. Special work site and leaning of keeping various records and quality control. **Construction org – duration one month** 1. Bridge work site 2. Track linking / Renewal site 3. Laying of turnout/curve 4. Work site protection near running lines. 5. Formation/Cess Repair site
3	Induction PH-2	Training institute	2 month	Detailed training programme as per Annexure T-1 (b)
4	Induction PH-2	Training in field	2 month	Trainee will be given exposure of working in open line for two month to make him conversant with following - **Open line –Two month** All maintenance activity like; 1. Short/long duration works 2. TMS data / inspection entries 3. Pre/post/during attention at track machine working site. 4. USFD testing 5. Attention to various track component 6. Hot/cold/monsoon Patrolling. 7. Trolly/lorry/material train working
5	Induction PH-3	Training in field	6 weeks	“On the Job training” i.e. attachment with SSE/P.Way Open Line/Construction Department where he is likely to be Posted.
6	Posting Exam	Training Institute	2 weeks	Detailed training programme as per Annexure T-1 (c)

INDUCTION COURSE (SSE/JE/P.WAY) (T-1a)

DURATION OF COURSE: 4 MONTHS

Annexure T-1 (a)

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7	**TUNNELS**	**8**
7.1	Various components, track structure including guard rail, inspection.	4
7.2	Technical Film/Video clip/Photographs on tunnel construction/ inspection.	4
	PART IV- WELDED RAILS	
1	**WELDING OF RAILS**	**28**
1.1	Necessity of welding rail joints, ill effects of joints.	2
1.2	SKV, Wider gap Welding, compressed air preheating, 3 piece mould AT welding technique, New development in AT-weld.	4
1.3	Precautions to be observed during AT weld for good quality. Competency & training requirement of welder & supervisor. Selection of rails for welding.	2
1.4	Tolerances for finished A.T. welds & FB Welds.	2
1.5	Model room showing different types of welding, welding equipment, tools	4
1.6	Flash Butt welding, Testing of FBW welds, Mobile flash-butt welding Planning & executing of TWR with MOBILE FBW PLANT including tender schedule, specifications & conditions.	4
1.7	Technical Film/Video clip/Photographs on AT welding, FBW Welding	2
1.8	Field visit to welding site	8
2	**SHORT WELDED RAILS (SWR)**	**8**
2.1	Definition, Track Structure for SWR.	2
2.2	Conditions of laying, Maintenance of SWR.	2
2.3	Tutorial on- Gap survey & adjustment of gap	4
3	**LONG WELDED RAILS (LWR)**	**48**
3.1	Definitions theory, concept of LWR. Historical development	4
3.2	Various types of Rail thermometers.	1
3.3	Permitted locations for laying, Track Structure, Laying of LWR.	4
3.4	Different types of SEJ	2
3.5	De-stressing: Criteria for destressing, method of destressing without tensor/ with rail tensors.	6
3.6	Tutorial on De-stressing using rail tensor.	2
3.7	Repairs of Rail fracture.	2
3.8	Repairs of buckling.	2
3.9	Regular track maintenance operations on LWR	4
3.10	Special track maintenance on LWR	3
3.11	Cold & hot weather patrolling.	3
3.12	Inspection of LWR and remedial actions for correction of gaps at SEJ, Hysteresis loop.	4
3.13	Competency level to carry out various works in LWR track, Dos & Don'ts.	3
3.14	Technical Film/Video clip/Photographs on LWR track including de-stressing, fracture repair, buckling, etc.	2
3.15	Tutorial on provisions of LWR manual.	6
4	**USFD**	**34**
4.1	Different types of Rail flaws/ defects.	2
4.2	Model Room: Showing fracture pieces of rails	2
4.3	Rail Fracture- Codification of Rail Defects	4
4.4	Preservation of fractured pieces for testing.	2
4.5	USFD: Ultrasonic flaw detection, fundamentals of ultrasonic waves, defect detection, need based concept of USFD, frequency of testing, brief description of various types of USFD machines and probes used, calibration and sensitivity checking, limitations of USFD, USFD Flaw /defect, marking of defects. Action to be taken for different Rail/Weld USFD flaws. SPURT Car, Recent developments,	10
4.6	Model room: Showing types of USFD testing equipment.	4
4.7	Technical Film/Video clip/Photographs showing USFD testing, flaw pattern, etc.	2
4.8	Hands on USFD Testing.	8
	PART V - INSPECTION AND MAINTENANCE OF P.WAY	
1	**INSPECTION AND DUTIES**	**13**
1.1	Duties of track maintainer	1
1.2	Duties of Key man.	1
1.3	Duties of Mate.	1

TOPIC	TOPIC DETAILS	PDS
1.4	Duties of JE/P. Way.	2
1.5	Duties of SSE/P.Way.	2
1.6	Inspection schedule of JE/P.Way/SSE/P.WAY (sectional)	2
1.7	Inspection schedule of SSE/P.WAY (Incharge)	2
1.8	Items to be inspected during Push trolley, motor trolley, on foot & footplate inspection	2
2	**MAINTENANCE OF TRACK**	**53**
2.1	Annual programme for regular Track maintenance	2
2.2	Maintenance planning	1
2.3	Through packing	1
2.4	Overhauling	1
2.5	Record of Gang work, Gang chart/diary, Keyman's diary, Mate's diary, Record of work of Artisans and other workmen.	4
2.6	Half yearly reports on conditions of permanent way, PWI's Section Register, P. Way plans and diagrams	2
2.7	Technical Film/Video clip/Photographs on gang working, track maintenance.	2
2.8	Deep screening of ballast	3
2.9	Lubrication of joints and lubrication of rails in straight on work spot and on curves, maintenance of rail joints, lubrication on switches, lead rails	3
2.10	Picking of slacks	2
2.11	Cleaning of drains and water ways, inspection of cutting, removal of loose boulders	1
2.12	Prevention of creep, Creep anchors, Anti-creep fastenings, Measurement of creep, Markers, Creep register; Creep a djustment, Adjusting joint sleepers.	2
2.13	Model room showing creep anchors, anti-creep fastening	2
2.14	Lifting and lowering of track	2
2.15	Sample of standard section of track	1
2.16	Special attention to maintenance of platform lines and drainage, maintenance of apron.	2
2.17	Maintenance in electrified areas: Basic knowledge of OHE, Special instructions to staff working in traction area, Felling/ Cutting/pruning of trees very close to OHE.	4
2.18	Working in track circuited areas - maintenance of track circuited sections, use of insulated trolleys, Gauges and other tools, maintenance of insulated joints, glued joints, Felling/Cutting/ pruning of trees obstructing view of signal, Coordination with signal and operating departments	2
2.19	Field visit to	
a.	Deep screening site.	
b.	Gang working/ track renewal site	16
3	**MECHANIZED MAINTENANCE**	**74**
3.1	3 tiers system of track maintenance, Working of MMUs	4
3.2	Small track machines: types, use in maintenance, spot attention with off track tampers, Troubleshooting and system of repairs & maintenance, procurement. Recent developments in light weight small track machines	5
3.3	Technical Film/Video clip/Photographs on working of STM.	2
3.4	Field visit to STM depot	8
3.5	Introduction to different types of track machines viz. Duomatic, CSM, tamping express, DTS, Unimat, BRM, FRM, BCM etc.	2
3.6	Working rules for track machines (IRTMM chapter 4, para 4.5-4.10)	1
3.7	Pre-requisites to tamping and other machine working, Pre & Post tamping attentions and attentions during tamping.	4
3.8	Working principles of tamping machine - 3 point & 4 point lining including working of ALC, DRP, CWS, CMS	10
3.9	Deep screening of ballast with BCM machine.	2
3.10	Tutorial on working out/drawing of fixing of various boards on track renewal site.	4
3.11	Technical Film/Video clip/Photographs on working of different track machines	4
3.12	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	4
3.13	Field Visit to Track machine site a. Tamping Machine b. BCM & DGS	16
3.14	Field visit for track laying on any important construction project (DFCCIL/RVNL/IRCON/RLY) to see use of latest machines for track laying.	8
4	**RECONDITIONING OF MATERIALS AND TOOLS**	**24**
4.1	Reconditioning of P. Way materials, Rails, Welding of scabbed rails	2
4.2	Repressing of fishplates, Use of shims, Beaters etc.	2
4.3	Reconditioning of worn out crossings and switches, type of electrodes used, RDSO approved vendor and welder system, Translamatic robotic welding- planning, execution including schedule, conditions& specifications.	10
4.4	Technical Film/Video clip/Photographs of reconditioning of switches &xing	2

TOPIC	TOPIC DETAILS	PDS
4.5	Field visit to re-conditioning depot / reconditioning work site	8
5	**TOOLS & EQUIPMENTS**	**8**
5.1	Measuring tools, Pway inspection kit & its demonstration	6
5.2	Regular Maintenance Tools.	2
	PART VI- SAFETY	
1	**TROLLEY/LORRY/DOLLY WORKING**	**12**
1.1	Distinction between Trolley, Lorry & motor Trolley.	1
1.2	Competency Certificate.	1
1.3	Working of Push Trolley, Lorry& motor Trolley, Its equipment. Working of Material train, Working of Rail Dolly and its protection arrangement	5
1.4	Tutorial on: Working of Push Trolley, Lorry & motor Trolley, Material train, Rail Dolly and their protection arrangement	4
1.5	Trolley Refuges	1
2	**PROTECTION, RESTRICTIONS & INDICATIONS**	**15**
2.1	Hand signals in day and night, Hand flags, Hand lamps, Banner flags, Detonators, life of detonators, testing, fog signals.	3
2.2	Model room demonstrations of hand flags, lamp, banner flags, detonators, etc.	2
2.3	Engineering, Indicators, Temporary and permanent,	4
2.4	Works of short and long duration, Protection arrangements during emergency/during traffic block/road vehicle working adjacent to track/during poor visibility and Caution order.	6
3	**PATROLLING**	**18**
3.1	Necessity of patrolling,	1
3.2	Kinds of patrolling i.e. Key men's daily patrol, Gang patrol, Monsoon security, Hot and cold weather patrolling, Watch at vulnerable points, Weather warnings, Single and double shift patrolling,	6
3.3	Patrol charts, Patrol books and equipments, selection and duties of patrolmen,	5
3.4	Night checks & Inspections	2
3.5	Tutorial on preparation of patrol chart	4
4	**CRS SANCTION & SCHEDULE OF DIMENSIONS**	**11**
4.1	Track Works requiring CRS sanction, Procedure for getting CRS sanction.	3
4.2	Various schedules of dimensions related to P. Way	4
4.3	Infringements, Register of infringements	2
4.4	Movement of ODC	2

TOPIC	TOPIC DETAILS	PDS
5	**DIVERSIONS**	**10**
5.1	Definition, Types of diversions.	2
5.2	Standard for laying diversions.	2
5.3	Tutorial on calculation of layout for diversion	2
5.4	Field Visit: Calculating length of diversions, marking of layout in field	4
6	**PERSONNEL SAFETY** – Dos & Don'ts while working near track	2
	PART VII- TECHNICAL STUDY TOUR	**32**
	PART VIII- MISCELLANEOUS	**26**
1.1	Ethics & Integrity	4
1.2	Communication Skills	2
1.3	Disaster Management including fire safety	4
1.4	Preventive vigilance	2
1.5	Reporting, valedictory, exams, Viva-voce, etc	14
	Total(4 months= 16 weeks x 6 days x 8pds = 768 periods of 45 mins each)	**768**

	SUMMARY	
1.	**CLASS ROOM LECTURE**	**401**
2.	**MODEL ROOM**	**30**
3.	**TECHNICAL FILM/VIDEO CLIP/PHOTOGRAPHS /VIDEO CLIP**	**34**
4.	**FIELD VISIT/STUDY TOUR**	**196**
5.	**TUTORIALS**	**57**
6	**HANDS ON**	**24**
7	**MISCELLANEOUS**	**26**
	GRAND TOTAL	**768**

Details of Model Room, Technical Film, Field Visits, Hands On, Tutorials

S. No.	MODEL ROOM	PERIODS
II/1.4	Visit to Model room for different types of rails.	1
II/2.2	Visit to Model room for different types of fish plates, fish bolts, clamps.	4
II/2.4	Visit to Model room showing different types of GJ, BJ, etc.	2
II/3.2	Visit to Model room showing different types of sleepers and fittings	2
II/3.4	Visit to Model room to show different types of PSC sleepers as mentioned in item II/3.3.	2
II/4.3	Model room to show different types of elastic fastenings.	4
III/1.3	Model room to show various models of turnout assembly.	1
III/6.2	Model room for showing various bridge models.	2
IV/1.5	Model room showing different types of welding, welding equipment, tools	4
IV/4.6	Model room showing types of USFD testing equipment.	4
V/2.13	Model room showing creep anchors, anti-creep fastening	2
VI/2.2	Model room demonstrations of hand flags, lamp, banner flags, detonators, etc.	2
	TECHNICAL FILM/VIDEO CLIP/PHOTOGRAPHS /VIDEO CLIP	
II/2.6	Technical Film/Video clip/Photographs - Glued Joint, block joint, etc.	6
II/2.7	Technical Film/Video clip/Photographs - Rail handling, Drilling of holes, Chamfering of holes, Unloading of Rails by EUR	2
III/2.7	Technical Film/Video clip/Photographs pertaining to the laying of turnouts.	4
III/5.10	Technical Film/Video clip/Photographs pertaining to LC gate, safe operation & precautions.	2
III/7.2	Technical Film/Video clip/Photographs on tunnel construction/ inspection.	4
IV/1.7	Technical Film/Video clip/Photographs on AT welding, FBW Welding	2
IV/3.14	Technical Film/Video clip/Photographs on LWR track including de-stressing, fracture repair, buckling, etc.	2
IV/4.7	Technical Film/Video clip/Photographs showing USFD testing, flaw pattern, etc.	2
V/2.7	Technical Film/Video clip/Photographs on gang working, track maintenance.	2
V/3.3	Technical Film/Video clip/Photographs on working of STM.	2
V/3.11	Technical Film/Video clip/Photographs on working of different track machines	4
V/4.4	Technical Film/Video clip/Photographs of reconditioning of switches &xing	2

S. No.	FIELD VISITS	PERIODS
II/2.8	Field visit to nearest yard for drilling of holes, chamfering of holes etc.	4
II/3.7	Field visit to nearest Sleeper Factory for production & testing of PSC sleepers	8
II/5.5	Field visit for measurement of ballast, sampling & testing	8
II/5.6	Field visit for assessment of ballast requirement	4
II/5.8	Field Visit to Ballast Depot for Training out ballast, DMT operation	8
III/2.5	Field visit for marking of turnout on ground.	16
III/2.6	Field Visit for Inspection & Measurement of turnout as per IRPWM Format	8
III/3.7	Field visit to yards for measurement of existing layout and its verification with theoretical calculations.	16
III/5.9	Field visit to nearest LC gate and Calculation of census.	8
III/6.6	Field visit to nearest bridge- Arch bridge, Girder bridges, PSC Bridges	16
IV/1.8	Field visit to welding site	8
V/2.19	Field visit to a. Deep screening site. Gang working/ track renewal site	16
V/3.4	Field visit to STM depot	8
V/3.13	Field Visit to Track machine site	
a.	Tamping Machine	
b.	BCM & DGS	16
V/3.14	Field visit for track laying on any important construction project (DFCCIL/RVNL/IRCON/RLY) to see use of latest machines for track laying.	8
V/4.5	Field visit to re-conditioning depot / reconditioning work site	8
VI/5.4	Field Visit: Calculating length of diversions, marking of layout infield	4
	HANDS ON	
II/4.2	Hands on- toe load measurement of ERC.	4
III/3.6	Hands on for layout calculations using Computer software.	8
IV/4.8	Hands on USFD Testing.	8
V/3.12	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	4
	TUTORIAL	
II/3.5	Tutorial on RDSO drawing no. for different types of PSC sleepers as mentioned in item II/1.3.	6
II/5.7	Tutorial on calculation of ballast quantity for a particular worksite	4

Details of Model Room, Technical Film, Field Visits, Hands On, Tutorials

S. No.	TUTORIAL	PERIODS
III/1.5	Tutorial on drawings of various Turnout & their assembly	6
III/2.4	Tutorial for preparation of sketch of various turnouts/ crossovers and special layouts.	8
III/4.5	Tutorial on different track structure/ layouts in yards	4
III/5.6	Tutorial on Census at L- xing.	1
IV/2.3	Tutorial on- Gap survey & adjustment of gap	4
IV/3.6	Tutorial on De-stressing using rail tensor.	2
IV/3.15	Tutorial on provisions of LWR manual.	6

S. No.	TUTORIAL	PERIODS
V/3.10	Tutorial on working out/drawing of fixing of various boards on track renewal site.	4
VI/1.4	Tutorial on: Working of Push Trolley, Lorry& motor Trolley, Material train, Rail Dolly and their protection arrangement	4
VI/3.5	Tutorial on preparation of patrol chart	4
VI/5.3	Tutorial on calculation of layout for diversion	2



INDUCTION PH-II COURSE (SSE / JE PWAY) (T-1 b)

DURATION OF COURSE: 2 MONTHS

Annexure T-1 (b)

TOPIC	TOPIC DETAILS	PDS
	PART IX-CURVES	
1	**HORIZONTAL CURVES**	**40**
1.1	Types of curves, Degree of curve, Relation between degree & Radius, Chord and Versine, Standard chords for measuring Versine.	2
1.2	Tutorial on- Record in SE/P.Way's curve register, checking of Versines of Turn-in and Turnout curves.	6
1.3	Super elevation / equilibrium cant, Maximum cant for normal and high speed trains, Cant deficiency and cant excess, Formula for safe speed on curves, Equilibrium speed, Calculation of cant to be provided and permissible speed, Transition length, Maximum cant gradient, Rates of running out of cant and cant deficiency, grade compensation.	6
1.4	Tutorial on Design of curve based on 1.3 above.	4
1.5	Miscellaneous - Running out cant on transitioned curves, laying of rails on curves, Mid stagger joints on sharp curves, Rail posts and Curve boards (IRPWM Para 409), Lubrication of outer Rails on curves, Check rails on sharp curves.	8
1.6	Widening of gauge on curves, Extra clearance on curves, Minimum length of straight between Reverse Curves.	4
1.7	Curves with similar and contrary flexure, Calculation of cant to be provided and permissible speed, Curve with X-over and diamonds	6
1.8	Tutorial on design of curve based on 1.7 above.	4
2	**VERTICAL CURVES**	**5**
2.1	Need for vertical curve.	1
2.2	Tutorial on working out geometry of vertical curve.	4
3	**REALIGNMENT OF CURVES**	**34**
3.1	Re-alignment of curves, String lining of curves, Need for curve adjustment,	2
3.2	Criteria for curve realignment.	2
3.3	Field visit: for measurement of curve and to decide whether curve realignment is required.	12
3.4	Calculations of slews by second summation method.	8
3.5	Steps involved in curve realignment	2
3.6	Curve realignment – working out slews using software.	4
3.7	Hands on curve realignment – working out slews (Manual method).	4
	PART X- SURVEYING	18
1.1	Concept of survey and modern surveying instruments.	2
1.2	Introduction of total station (concept, uses and equipment).	2
1.3	Curve setting by Theodolite/Total Station.	6
1.4	Hands on: use of Theodolite/Total station including setting out of curve.	4
1.5	Field visit on curve setting by Theodolite/Total station along with downloading of data.	4
	PART XI- TRACK RENEWALS	42
1.1	Scope and criteria for Complete track renewals (CTR), Through rail renewals (TRR), Through Sleeper renewals (TSR), Through fitting renewal (TFR) and through ballast renewal (TBR), Through bridge timber renewal (TBTR), Through turnout renewal (TTR), Through weld renewal (TWR).	6
1.2	Casual renewals of rails, sleepers, fastenings etc.	2
1.3	Methods of renewals: Planning for track renewal work including material planning, requirement of tools and plants, track machines, traffic blocks and speed restrictions. New Track Laying Standards, Protection of site – safety precautions during work.	4
1.4	Project report for Track Renewal works – IRPWM Para 309	2
1.5	Careful handling of materials, Speed restrictions and post relaying attention,	4
1.6	Release material handling: Picking of released materials, Classification & disposal. Handing over & taking over of assets between construction & open lines.	8
1.7	Mechanized track renewals - Relaying with PQRS/Track relaying train (TRT), Relaying of turnout with T-28.	8
1.8	Field visit to track renewal site, mechanized relaying (PQRS/TRT).	8
	PART XII- TRACK MANAGEMENT SYSTEM (TMS)	32
1.1	Introduction to IRICEN Website and assessing the various publications and knowledge bank, Introduction to various modules of IRCEP , TMS- Purpose & Advantage	
	TMS- Asset Creation including Hands-on (Rail, Joints, Welds, Sleepers and Fastenings, SEJ, LWR, P&C, Curve & LC).	8
1.2	Generation of various Report and Registers, Track Diagram.	4
1.3	Asset change module (Rail, sleeper, ballast, LC & P&C etc.	4
1.4	Fracture Entry, USFD entry & Weld/Rail fracture reports.	4
1.5	Store Module.	8
1.6	Misc Module.	4
	PART XIII- TRACK RECORDING & MONITORING	32
1.1	Track Parameters for track monitoring including Various Track Tolerances.	6
1.2	Method of Inspection: Push trolley, Motor trolley, Foot inspection, Engine & Rear van Inspection, TRRC, Oscillograph car, OMS, SPURT Car	6

TOPIC	TOPIC DETAILS	PDS
1.3	Frequency of inspection with various track recording modes (TRC, OMS, Oscillograph car),	4
1.4	Action to be taken based on various inspection including Track Recording results & based on TMS Reports.	8
1.5	Field visit for verification and defect identification of TRC data.	8
	PART XIV- ACCIDENTS & DISASTER MANAGEMENT	**46**
1.1	Duties of JE/ SSE /P. Way in disaster management.	1
1.2	Classification of accidents.	1
1.3	Responsibility of P.Way staff on sounding of hooters, action to be taken on reaching accident site: First aid, Preservation of clues, Assessment of men and materials for restoration, Recording site and track particulars, Preparation of a sketch, Preparation of joint note, Expeditious restoration.	4
1.4	Drivers reports on bad riding and action to be taken	1
1.5	Breaches & its types, Prevention & action during breach, Action with regard to Railway Affecting tanks. Engg. material in ART.	2
1.6	Rail wheel interaction- theory.	4
1.7	Rolling stock- general defects.	3
1.8	Coaching stock (ICF & LHB)	2
1.9	Goods stock	2
1.10	Loco stock	2
1.11	Engineering stock	1
1.12	Accident case studies	2
1.13	Accident manual and disaster management.	2
1.14	Accident proforma and diagram.	1
1.15	Field visits: Coaching stock (ICF & LHB)	4
1.16	Field visits: loco stock (diesel/ electric)	4
1.17	Field visits: goods stock (CASNUB bogies)	4
1.18	Tutorial on sketch preparation of accident site.	2
1.19	Filling of accident proforma by trainees during field visit, preferably coaching stock.	4
	PART XV- LAND MANAGEMENT	**9**
1.1	Land acquisition,	2
1.2	Demarcation of land boundaries and maintenance of land registers	2
1.3	Licensing/leasing, Way Leave Facility, NOC to Private Party/ Builder for building near Railway Boundary	2
1.4	Relinquishment of railway land,	1
1.5	Type of encroachments and PPE Act.	2
	PART XVI- OFFICE & STORES	
1	**STORES**	**18**
1.1	Procuring of office stationary and stores, Procuring of P. Way stores for maintenance and for special works, Classification of stores, Accountal of stores, DS- 8 note, RE-9B, Material Transacation Order, Adjustment Memo, Stock verification reports, Disposal of Scrap & surplus stores, Overhauling of stores, Numerical ledgers & inventory control.	4
1.2	Classification of stores, Stock verification, Stock sheet, Submission of Returns, Inventory control, Maintenance of DMTR and Ledgers, Submission of Store returns in time, Materials at site register, Imprest Store, T&P Store.	4
1.3	Functioning of Divisional Stores Depots and Track Depot, Requirement of materials for casual renewal and sanctioned renewals, Working out list for track materials, Proper care & upkeep of store, Environmental management/ improvement of store & depot including cleanliness, hygiene, afforestation, rain water harvesting, energy conservation etc.	4
1.4	Field Visit to Divisional Pway Store	4
1.5	Account /Audit Inspection	2
2	**PERSONNEL**	**31**
2.1	Muster, Pay sheet, VIIth Pay commission pay levels, Allowances.	1
2.2	Wage period, Bill preparation, Filling up of TA & OT Journals	1
2.3	Passes and leave Rules	3
2.4	Medical Assistance and Medical Examination Rules	1
2.5	Establishment Records in SSE/ JE P Way office	1
2.6	Trade Test; Other channels of promotions	2
2.7	Settlement:- PF, Pension, Gratuity, Leave Encashment; Filling up of Pension Booklet	2
2.8	Welfare Schemes & SBF	2
2.9	Industrial Relations:-Unions & Associations, PNM, JCM	2
2.10	Railway Services (Conduct) Rules, D&A Rules	4
2.11	Categories of staff under Hours of Employment Regulations	1
2.12	Labour Laws- overview; Display of Statutory Notices, Inspection by Labour Enforcement Officer	1
2.13	Payment of Wages Act, Minimum Wages Act, Contract Labour Act	2
2.14	Workmen's Compensation Act, Action in case of injury/death on duty, Ex- Gratia Payment.	2
2.15	RTI Act- Important provisions	2
2.16	Police jurisdiction and security of railway materials: IRWM- Chapter- XI	
2.16.1	General, Police jurisdiction, Lodging of complaints, cooperation with government railway police,	2

TOPIC	TOPIC DETAILS	PDS
2.16.2	Cognizable offences , Non-cognizable offences , Powers of arrest by railway staff, Warrants against railway staff , Action by railway staff in cases of attempted sabotage, Answering of court summons,	1
2.16.3	Prevention of trespass, Disposal of human bodies found run over, Disposal of cattle found dead on the line, Proforma for lodging FIR. miscellaneous	1
3	**RAJBHASHA**	**2**
3.1	Directives in use of Raj Bhasha in day-to-day working.	2
	PART XVII- CONTRACT MANAGEMENT	**21**
1.1	Introduction to Tender, Contract, agreement. Different Types & forms of Contract, Introduction to e-tendering & Service contracts.	4
1.2	Tender documents, process for Tender finalization, Earnest money, Security deposit, Performance guarantee.	
	Tender committee, General Condition of Contract (works contract & service contract) & Special Condition of Contract, SOR for P. Way works, Quality control measures at site,	4
1.3	Various registers to be maintained for progress, Quality, Safety of contractors persons, Safety measures at work site,	2
1.4	Accountal of new and Released material, Issue and receipt from contractors, Important points from vigilance angle,	2
1.5	Preparation of Contractor's On-Account/Running & Final Bills, Material Statements, Maintenance Period, Warranty/guarantee clauses, release of security deposit.	2
1.6	Time extensions to date of completion of contract, Variations in Contract Quantities and Subsidiary Agreement,	1
1.7	Supervision of contractual works, Common ignorance. Dos & Don'ts for contract matters	4
1.8	Duties towards payment to contractor's labour and maintenance of records as per labour laws	2
	PART XVIII- TRANSPORTATION-I (G& SR)	**16**
1.1	Various systems of working, Essentials of Absolute & Automatic block system.	4
1.2	Model room: Traffic Model room	2
1.3	Classification of stations, Simple layouts & condition for granting permission to approach, single line working on double line, Reception of train on blocked line and starting from non-signaled line, All Communication Failure(ACF), Interlocking, Recovery Time	4
1.4	Important definitions, General & Subsidiary Rules applying to Railway servants	2
1.5	Signals, General provisions, Description of fixed signals, Hand signals, Detonating signal flare signal, Defective fixed signal, Rules for passing defective signals,	4
	PART XIX- COMPUTER	**8**
1.1	Hands on : MS- Office: Word, Excel, PowerPoint, Search Engines, Email	8
	PART XX - STUDY TOUR	**16**
	PART XXI- MISCELLANEOUS	**30**
1.1	FIRSTAID: A lecture on health Awareness by Railway doctor may be organized. Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	2
1.2	Ethics & integrity.	2
1.3	Communication skills.	2
1.4	Disaster Management including fire safety.	4
1.5	Preventive vigilance.	4
1.6	Reporting/ introduction/ valedictory/ examination/ Viva-Voce, etc.	16
	Total (2 month= 2 x 25 days x 8 pds = 400 periods of 45mins each)	**400**

	SUMMARY	
1.	**CLASSROOM LECTURE**	**284**
2.	**MODEL ROOM**	**2**
3.	**TECHNICAL FILM**	**NIL**
4.	**FIELD VISIT/STUDY TOUR**	**48**
5.	**TUTORIALS**	**20**
6.	**HANDS ON**	**16**
7.	**MISCELLANEOUS**	**30**
	Grand Total	**400**

Annexure T-1 (b)

DETAILS OF MODEL ROOM, TECHNICAL FILM, FIELD VISITS, HANDS ON, TUTORIALS

S. No.	FIELD VISIT	PERIODS
IX/3.3	Field visit for measurement of curve and to decide whether curve realignment is required.	12
X/1.5	Field visit on curve setting by total station alongwith downloading of data.	4
XI/1.8	Field visit to track renewal site, mechanized relaying (PQRS/TRT).	8
XIII/1.5	Field visit for verification and defect identification of TRC data.	8
XIV/1.15	Field visits: Coaching stock (ICF & LHB)	4
XIV/1.16	Field visits: loco stock (diesel/ electric)	4
XIV/1.17	Field visits: goods stock (CASNUB bogies)	4
XVI/1.4	Field Visit to divisional Pway store	4

S. No.	HANDS ON	PERIODS
IX/3.7	Hands on: Curve realignment – working out slews.	4
X/1.4	Hands on: Use of total station including setting out structure.	4
XIX/1.1	Hands on : MS- Office: Word, Excel, Access, PowerPoint, Search Engines, Email	8
	Tutorial	
IX/1.2	Tutorial on- Record in SE/P.Way's curve register checking of alignment after derailments and for turn in and turnout curves.	6
IX/1.4	Tutorial on- Design of curve based on IX/1.3.	4
IX/1.8	Tutorial on- Design of curve based on IX/1.4.	4
IX/2.2	Tutorial on- Working out geometry of vertical curve.	4
XIV/1.18	Tutorial on- Sketch preparation of accident site.	2
	Model Room	
XVIII/1.2	Model room: Traffic Model room	2

INDUCTION PH-III POSTING EXAM MOUDEL (SSE / JE PWAY) (T-1c)

DURATION OF COURSE: 2 Weeks

Annexure T-1 (c)

TOPIC	TOPIC DETAILS	DURATION
1	Classroom discussion for revision of entire course and doubt clearance.	1 Week
2	Preparation of Exam and submission of diary/notes recorded during trainings and viva-voice and written exam	1 week
	Total	**2 weeks**
SN	**EXAM DETAIL**	**Marks**
1	Written exam for phase 1&2 (100 marks each) to be conducted at the end of each phase by the trainer i mparting the field training (2x100 marks)	200
2	Interview after filed training each phase (50 Marks) i ncluding daily diary maintained at Open line and Construction training (2 x 50 marks).	100
3	Posting Exam- 2 papers 75 marks each (2x75) Final Viva-voce, interview after complete training (50 marks)	200
	Total	**500**

PROMOTION COURSE (SSE / PWAY) (T-2)

DURATION OF COURSE: 17 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART I- TRACK COMPONENTS	
1	**RAILS & JOINTS**	**3**
1.1	Instruction for handling of rails, Precaution during EUR unloading, |Colour coding of Rails.	1
1.2	Technical film/Video Clips/Photographs- Rail handling, Unloading of Rails from EUR, Rail Grinding including profile measurement	2
2	**SLEEPERS & FASTENINGS**	**2**
2.1	Concrete sleepers: Mono-block PSC Sleepers, Special sleepers for L xings, turnout, SEJ, bridges approach, Slack gauge sleepers for curves (>4^0), special curve for sharp curve(>8^0), wider sleeper, Sleeper Density on different routes	1
2.2	Elastic Fastenings: Malleable cast iron inserts Elastic Rail Clips: Various types – ERC mark III, mark V, zero toe load, GJ clip. Toe load measurement of ERC, Criteria for ERC renewal. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	1
3	**BALLAST**	**4**
3.1	Ballast sections on different routes for straights and curves on single/double lines, On different gauges for fish plated track, SWR and LWR, Sections for branch lines, Loop and sidings.	1
3.2	Specification for track ballast, Measurement, Sampling & Testing of ballast	2
3.3	Ballast depot, Training out ballast, DMT operation	1
	PART II- TRACK STRUCTURE	
1	**TURNOUTS - INTRODUCTION**	**1**
1.1	Different types of turnouts : 1 in 8.5 , 1 in 12 & 1 in 16 Different types of switches – straight switches, Curved switches, Thick web switches, Derailing switches, Symmetrical Split. Different types of crossings - ordinary built-up and CMS crossings, Swing Nose Crossing, Gapless/Machine joint. Spring points.	1
2	**TURNOUTS - ASSEMBLY & LAYING**	**4**
2.1	Laying, Inspection& Maintenance of fan shaped turnouts, Spring setting device, Maintenance of turn in curves.	2
2.2	Speed Potential of Turnouts, Permissible Speed on Turnouts, and Strengthening of loop lines for 30kmph/ 50kmph.	1
2.3	Tutorial on drawings of various Turnout & their assembly	1
3	**CROSSOVERS**	**5**
3.1	Calculation for laying cross over, Cross over between straight parallel tracks with same & different no. of crossings.	1
3.2	Cross over between curved parallel tracks, Cross over between inclined tracks.	1
3.3	Scissors X-over, Definition and description of components and parts, Standard layouts, Methods of assembly, Main dimensions for setting out.	1
3.4	Hands on to Computer software for layout calculation	2
4	**LEVEL CROSSINGS**	**2**
4.1	Level crossings: Classification, Types, Equipments at LC, knowledge of rules of Gatemen, Competency, Medical, Refresher, Statutory provisions of Railway Act on LC. GWR, Protection diagram, Sliding boom operation, Census at L- xing.	1
4.2	Inspection of L-xing, Speed breakers, Road sign Boards, Provision of new LC, Manning, De- manning, interlocking and replacement with ROB, closure, shifting and replacement with LHS/ RUBs , Elimination of LC.	1
5	**BRIDGES & TRACK STRUCTURE ON BRIDGES**	**4**
5.1	Bridges: Classification, Types, Track Structure on girder Bridges, ballasted decks, arch bridges, provision of guard rails, re-railing ramps.	1
5.2	Laying & Maintenance of steel channel sleeper & H beam sleeper, composite sleeper, Introduction to RH girder & CC cribs.	1
5.3	Inspection& maintenance of bridge, Numerical Rating System.	2
	PART III- CURVES	
1	**CONCEPT OF CURVES**	**4**
1.1	Types of curves, Radius & Degree of curve, Relation between degree & Radius, Curve indication boards & Rail posts.	1
1.2	Super elevation / equilibrium cant, Maximum cant for normal and high speed trains, Cant deficiency and cant excess, Formula for safe speed on curves, Equilibrium speed, Calculation of cant to be provided and permissible speed, Transition length, Maximum cant gradient, Rates of running out of cant and cant deficiency, grade compensation.	1
1.3	Miscellaneous - Running out cant on transitioned curves, laying of rails on curves, Mid stagger joints on sharp curves, Lubrication on curves, check rails on sharp curves, Widening of gauge on curves, Extra clearance on curves, minimum length of straight between reverse curves.	2

T-2 contd.....

TOPIC	TOPIC DETAILS	PDS
2	**REALIGNMENT OF CURVES**	**5**
2.1	Criteria for Re-alignment of curves, String lining of curves.	1
2.2	Hands on Curve Realignment using Computer software.	4
	PART IV- WELDED RAILS	
1	**WELDING OF RAILS**	**4**
1.1	SKV, Wider gap Welding, compressed air preheating, 3 piece mould AT welding technique, New development in AT-weld.	1
1.2	Precautions during AT welding, Tolerances for finished AT welds and painting of weld collar. Competency & Training requirement of Welders/Supervisors, Selection of Rails for Welding.	1
1.3	Flash Butt welding, Testing of FBW welds, Mobile flash-butt welding planning & executing of TWR with MOBILE FBW PLANT including tender schedule, specifications & conditions.	1
1.4	Technical film/Video Clips/Photographs on AT welding, FBW Welding	1
2	**SHORT WELDED RAILS (SWR)**	**1**
2.1	Track Structure for SWR, Maintenance of SWR.	1
3	**LONG WELDED RAILS (LWR)**	**10**
3.1	Theory & concept of LWR.	1
3.2	Permitted locations for laying, Track Structure, Laying of LWR.	1
3.3	Different types of SEJ- laying, inspection & maintenance and lubrication.	1
3.4	De-stressing: Criteria for De-stressing, method of De-stressing without tensor/ with rail tensors.	1
3.5	Repairs of Rail fracture.	1
3.6	Repairs of buckling.	1
3.7	Regular track maintenance operations on LWR, Cold & hot weather patrolling	1
3.8	Special track maintenance on LWR	1
3.9	Inspection of LWR and remedial actions for correction of gaps at SEJ, Hysteresis loop.	1
3.10	Competency level to carry out various works in LWR track, Dos & Don'ts.	1
4	**USFD TESTING**	**12**
4.1	Rail/Weld Failure – Reporting, codification, preservation of Rail/weld piece for M&C testing	2
4.2	USFD: Ultrasonic flaw detection, fundamentals of ultrasonic waves, defect detection, need based concept of USFD, frequency of testing, brief description of various types of USFD machines	

TOPIC	TOPIC DETAILS	PDS
	and probes used, calibration and sensitivity checking, limitations of USFD, USFD Flaw /defect, Marking of defects. Action to be taken for different Rail/Weld USFD flaws. SPURT Car, Recent developments in USFD.	4
4.3	Technical film/Video Clips/Photographs showing USFD testing, flaw pattern, etc.	2
4.4	Hands on USFD Testing.	4
	PART V - INSPECTION AND MAINTENANCE OF P.WAY	
1	**INSPECTION AND DUTIES**	**3**
1.1	Duties of JE/ SSE /P. Way, Duties of Track maintainer, Keyman, Mate.	1
1.2	Inspection schedule of JE/P.Way/SSE/P.WAY (sectional/ Incharge)	1
1.3	Pway inspection kit and its demonstration	1
2	**MAINTENANCE OF TRACK**	**3**
2.1	Annual Programme for regular Track maintenance, Through packing, Overhauling, Picking of slacks, Lifting and Lowering of track, Deep screening of ballast, importance of track drainage. Inspection of cutting, Removal of loose boulders	1
2.2	Record of Gang work, Gang chart/diary, Keyman's diary, Mate's diary, Record of work of Artisans and other workmen, Half yearly reports on conditions of permanent way, PWI's Section Register, P. Way plans and diagrams	1
2.3	Lubrication of joints and lubrication of rails in straight on work spot and on curves, maintenance of rail joints, lubrication on switches, lead rails	1
3	**MECHANIZED MAINTENANCE**	**12**
3.1	3 tiers system of track maintenance, Working of MMUs	1
3.2	Small track machines: types, use in maintenance, spot attention with off track tampers , Troubleshooting and system of repairs & maintenance, procurement, Recent development in light weight Small Track Machines	1
3.3	Technical film/Video Clips/Photographs on working of STM.	1
3.4	Introduction to different types of track machines viz. Duomatic, CSM, tamping express, DTS, Unimat, BRM, FRM, BCM etc.	1
3.5	Pre-requisites to tamping and other machine working, Pre & Post tamping attentions and attentions during tamping.	1
3.6	Working principles of tamping machine - 3 point & 4 point lining including ALC, DRP, CWS, CMS	2
3.7	Working rules for Track Machines	1
3.8	Deep screening of ballast with BCM machine.	1

T-2 contd.....

TOPIC	TOPIC DETAILS	PDS
3.9	Technical film/Video Clips/Photographs on working of different track machines	1
3.10	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	2
4	**RECONDITIONING OF MATERIALS AND TOOLS**	**2**
4.1	Reconditioning of worn out crossings and switches, type of electrodes, RDSO approved vendors, Translamatic Robotic Welding- planning, execution including schedule, conditions& specifications.	2
5	**TRACK RECORDING & MONITORING**	**3**
5.1	Track Monitoring: Track Recording Cum Research Car (TRRC), Oscillograph car, OMS,	2
5.2	Riding quality, Track Quality Index(TQI), Track geometry, various track tolerances	1
	PART VI- TRACK MANAGEMENT SYSTEM (TMS)	**7**
1.1	Introduction to IRICEN Website and assessing the various publications and knowledge bank, Introduction to various modules of IRCEP , Introduction to TMS, Purpose, Advantage Hands On: Generation of various Report and Registers, Track Diagram.	2
1.2	Hands On: Fracture Entry, USFD entry &Rail/Weld failure reports, Miscellaneous Module.	2
1.3	Hands On: Store Module.	3
	PART VII- SAFETY	
1	**ACCIDENTS**	**2**
1.1	Accident manual, Accident proforma, Preparation of joint note.	2
2	**TROLLEY/LORRY/DOLLY WORKING**	**1**
2.1	Working of Push Trolley, Lorry & motor Trolley, Rail dolly, Competency Certificate.	
3	**PROTECTION, RESTRICTIONS & INDICATIONS**	**2**
3.1	Safety at Work site, Hand signals in day and night, Hand flags, Hand lamps, Banner flags, Detonators, life of detonators, testing of detonators, fog signals, Engineering Indicator Boards, Works of short and long duration, Protection during emergency Caution order. Protection arrangement during traffic block/road vehicle working adjacent to track/during poor visibility	2
4	**PATROLLING**	**2**
4.1	Kinds of patrolling i.e. Key men's daily patrol, Gang patrol, Monsoon Patrolling, security, Patrolling, Stationary Watchman at vulnerable points, Weather warnings, Single and double frequency patrolling,	1
4.2	Patrol charts, Patrol books and equipments, selection and duties of Patrolmen.	1
5	**CRS SANCTION & SCHEDULE OF DIMENSIONS**	**2**
5.1	Works requiring CRS sanction, Procedure for getting CRS sanction, Movement of ODC.	1
5.2	Various schedules of dimensions related to P. Way	1
6	**COORDINATION ASPECT WITH S&T AND ELECTRICAL DEPARTMENT**	**2**
6.1	Coordination Aspect with S&T Department: Working in track circuited areas - maintenance of track circuited sections, use of insulated trolleys, maintenance of insulated joints, glued joints. Felling/Cutting/pruning of trees obstructing view of signal	1
6.2	Coordination Aspect with Electrical Department: Maintenance in electrified areas: Felling/Cutting/pruning of trees very close to OHE	1
7	**PERSONNEL SAFETY- DOS & DON'TS WHILE WORKING NEAR TRACK**	**1**
	PART VIII- TRACK RENEWALS	**3**
1.1	Scope &Criteria for Complete track renewals(CTR), Through rail renewals(TRR), Through Sleeper renewals(TSR), Through fitting renewal(TFR) and Through ballast renewal(TBR), Through Bridge Timber Renewal(TBTR), Through Turnout Renewal(TTR), Through Weld Renewal(TWR)	2
1.2	Technical film/Video Clips/Photographs: Relaying with PQRS equipment, Track relaying train, Relaying of turnout with T-28.	1
	PART IX- TRANSPORTATION (G& SR)	**3**
1.1	Various systems of working, Essentials of absolute & automatic block system, important definitions, General & subsidiary rules applying to Railway servants, Working of Track machines	2
1.2	Classification of stations, Simple layouts & condition for granting permission to approach, single line working on double line, Reception of train on blocked line and starting from non-signaled line,	1
	PART X- LAND MANAGEMENT	**2**
1.1	Demarcation of land boundaries & maintenance of land registers, Licensing/leasing, way- leave facility, NOC to private buildings near railway boundary.	1
1.2	Type of encroachments and PPE Act.	1
	PART XI- OFFICE & STORES	**6**
1.1	Procuring of office stationary and stores, Procuring of P. Way stores for maintenance and for special works, Classification of stores, Accountal of stores, DS- 8 note, RE-9B, Material Transaction Order, adjustment memo, Stock verification reports, Disposal of scrap & surplus stores, Overhauling of stores,	

T-2 contd.....

TOPIC	TOPIC DETAILS	PDS
	Numerical ledgers & inventory control, Environmental management/ improvement of store & depot including cleanliness, hygiene, afforestation, rain water harvesting, energy conservation etc.	2
1.2	Classification of stores, Stock verification, Stock sheet, Submission of returns, Inventory control, Maintenance of DMTR and ledgers, Submission of store returns in time, Materials at site register, Imprest Store, T&P Store.	2
1.3	Preventive Vigilance	1
1.4	Police jurisdiction and security of railway materials: IRWM- Chapter- XI	1
2	**PERSONNEL**	**4**
2.1	Passes and leave Rule, D&A Rules	1
2.2	Establishment Records in SSE/ JE P Way office, Settlement:- PF, Pension, Gratuity, Leave Encashment; Filling up of Pension Booklet, Welfare Schemes & SBF	1
2.3	Industrial Relations:-Unions & Associations, PNM, JCM	1
2.4	Workmen's Compensation Act, Action in case of injury on duty, Ex- Gratia Payment, Hours of Employment Regulations Act, RTI Act.	1
3	**RAJBHASHA**	**1**
3.1	Directives in use of Raj-Bhasha in day-to-day working.	1
	PART XIII- CONTRACT MANAGEMENT	**3**
1.1	Introduction to, tender & contracts, Introduction to e-tendering & service contracts different Types & forms of contract, GCC & SCC, SOR for P. Way works, Earnest money, Security deposit.	1
1.2	Various registers to be maintained for progress, Quality.	1
1.3	Preparation of Contractor's On-Account/Running & Final Bills, Material Statements, Maintenance Period, Warranty/guarantee clauses, release of security deposit, Time extensions to date of completion of contract& Subsidiary Agreement	1
	PART XIV- COMPUTER & THEIR USAGE	**4**
1.1	Hands On: MS- Office: Word, Excel, PowerPoint, Email, Search Engines	4
	PART XV - MISCELLANEOUS	**8**
1.1	Ethics & integrity	1
1.2	Disaster Management including Fire Safety	1
1.3	Reporting/ Introduction/ Valedictory/ Examination/ Viva-Voce, etc.	6
	Total (17 days x 8 pds = 136 periods of 45 mins each)	**136**

	SUMMARY	
1	CLASSROOM LECTURES	96
2	TECHNICAL FILM/VIDEO CLIP/PHOTOGRAPHS	8
3	TUTORIALS	1
4	HANDS ON	23
5	MISCELLANEOUS	8
	GRAND TOTAL	136

Details of Technical Film, Hands On, Tutorials

S. No.	TECHNICAL FILM/VIDEO CLIPS/PHOTOGRAPHS	PERIODS
I/1.2	Technical film/Video Clips/Photographs- Rail handling, Unloading of Rails from EUR, Rail Grinding including profile measurement	2
IV/1.4	Technical film/Video Clips/Photographs on AT welding, FBW Welding	1
IV/4.3	Technical film/Video Clips/Photographs showing USFD testing, flaw pattern, etc.	2
V/3.3	Technical film/Video Clips/Photographs on working of STM.	1
V/3.9	Technical film/Video Clips/Photographs on working of different track machines	1
1.2	Technical film/Video Clips/Photographs: Relaying with PQRS equipment, Track relaying train, Relaying of turnout with T-28,	1

S. No.	HANDS ON	PERIODS
II/3.4	Hands on to Computer software for layout calculation	2
III/2.2	Hands on to Computer software for curve realignment calculations.	4
IV/4.4	Hands on USFD Testing.	4
V/3.10	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	2
VI/1.1	Hands On: Generation of various Report and Registers, Track Diagram.	2
VI/1.2	Hands On: Fracture Entry, USFD entry & Weld & fracture reports/Miscellaneous Module.	2
VI/1.3	Hands On: Store Module.	3
XIV/1.1	Hands On: MS- Office: Word, Excel, PowerPoint	4
	TUTORIAL	
II/2.3	Tutorial on drawings of various Turnout & their assembly	1

REFRESHER COURSE (SSE / JE PWAY)(T-3)

DURATION: 17 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART I- TRACK COMPONENTS	
1	**RAILS & JOINTS**	**3**
1.1	Instruction for handling of rails, Precaution during EUR unloading, Colour coding of Rails.	1
1.2	Technical film/Video Clips/Photographs- Rail handling, Unloading of Rails from EUR, Rail Grinding including profile measurement	2
2	**SLEEPERS & FASTENINGS**	**2**
2.1	Concrete sleepers: Mono-block PSC Sleepers, Special sleepers for L xings, turnout, SEJ, bridges approach, Slack gauge sleepers for curves (>4^0), special curve for sharp curve(>8^0), wider sleeper, Sleeper Density on different routes	1
2.2	Elastic Fastenings: Malleable cast iron inserts Elastic Rail Clips: Various types – ERC mark III, mark V, zero toe load, GJ clip. Toe load measurement of ERC, Criteria for ERC renewal. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	1
3	**BALLAST**	**4**
3.1	Ballast sections on different routes for straights and curves on single/double lines, On different gauges for fish plated track, SWR and LWR, Sections for branch lines, Loop and sidings.	1
3.2	Specification for track ballast, Measurement, Sampling & Testing of ballast	2
3.3	Ballast depot, Training out ballast, DMT operation	1
	PART II- TRACK STRUCTURE	
1	**TURNOUTS - INTRODUCTION**	**1**
1.1	Different types of turnouts : 1 in 8.5 , 1 in 12 & 1 in 16 Different types of switches – straight switches, Curved switches, Thick web switches, Derailing switches, Symmetrical Split. Different types of crossings - ordinary built-up and CMS crossings, Swing Nose Crossing, Gapless/Machine joint. Spring points.	1
2	**TURNOUTS - ASSEMBLY & LAYING**	**4**
2.1	Laying, Inspection& Maintenance of fan shaped turnouts, Spring setting device, Maintenance of turn in curves.	2
2.2	Speed Potential of Turnouts, Permissible Speed on Turnouts, and Strengthening of loop lines for 30kmph/ 50kmph.	1
2.3	Tutorial on drawings of various Turnout & their assembly	1
3	**CROSSOVERS**	**5**
3.1	Calculation for laying cross over, Cross over between straight parallel tracks with same & different no. of crossings.	1
3.2	Cross over between curved parallel tracks, Cross over between inclined tracks.	1
3.3	Scissors X-over, Definition and description of components and parts, Standard layouts, Methods of assembly, Main dimensions for setting out.	1
3.4	Hands on to Computer software for layout calculation	2
4	**LEVEL CROSSINGS**	**2**
4.1	Level crossings: Classification, Types, Equipments at LC, knowledge of rules of Gatemen, Competency, Medical, Refresher, Statutory provisions of Railway Act on LC. GWR, Protection diagram, Sliding boom operation, Census at L- xing.	1
4.2	Inspection of L-xing, Speed breakers, Road sign Boards, Provision of new LC, Manning, De- manning, interlocking and replacement with ROB, closure, shifting and replacement with LHS/ RUBs , Elimination of LC.	1
5	**BRIDGES & TRACK STRUCTURE ON BRIDGES**	**4**
5.1	Bridges: Classification, Types, Track Structure on girder Bridges, ballasted decks, arch bridges, provision of guard rails, re-railing ramps.	1
5.2	Laying & Maintenance of steel channel sleeper & H beam sleeper, composite sleeper, Introduction to RH girder & CC cribs.	1
5.3	Inspection& maintenance of bridge, Numerical Rating System.	2
	PART III- CURVES	
1	**CONCEPT OF CURVES**	**4**
1.1	Types of curves, Radius & Degree of curve, Relation between degree & Radius, Curve indication boards &Rail posts.	1
1.2	Super elevation / equilibrium cant, Maximum cant for normal and high speed trains, Cant deficiency and cant excess, Formula for safe speed on curves, Equilibrium speed, Calculation of cant to be provided and permissible speed, Transition length, Maximum cant gradient, Rates of running out of cant and cant deficiency, grade compensation.	1
1.3	Miscellaneous - Running out cant on transitioned curves, laying of rails on curves, Mid stagger joints on sharp curves, Lubrication on curves, check rails on sharp curves, Widening of gauge on curves, Extra clearance on curves, minimum length of straight between reverse curves.	2

T-3 contd.....

TOPIC	TOPIC DETAILS	PDS
2	**REALIGNMENT OF CURVES**	**5**
2.1	Criteria for Re-alignment of curves, String lining of curves.	1
2.2	Hands on Curve Realignment using Computer software.	4
	PART IV- WELDED RAILS	
1	**WELDING OF RAILS**	**4**
1.1	SKV, Wider gap Welding, compressed air preheating, 3 piece mould AT welding technique, New development in AT-weld.	1
1.2	Precautions during AT welding, Tolerances for finished AT welds and painting of weld collar. Competency & Training requirement of Welders/Supervisors, Selection of Rails for Welding.	1
1.3	Flash Butt welding, Testing of FBW welds, Mobile flash-butt welding planning & executing of TWR with MOBILE FBW PLANT including tender schedule, specifications & conditions.	1
1.4	Technical film/Video Clips/Photographs on AT welding, FBW Welding	1
2	**SHORT WELDED RAILS (SWR)**	**1**
2.1	Track Structure for SWR, Maintenance of SWR.	1
3	**LONG WELDED RAILS (LWR)**	**10**
3.1	Theory & concept of LWR.	1
3.2	Permitted locations for laying, Track Structure, Laying of LWR.	1
3.3	Different types of SEJ- laying, inspection & maintenance and lubrication.	1
3.4	De-stressing: Criteria for De-stressing, method of De-stressing without tensor/ with rail tensors.	1
3.5	Repairs of Rail fracture.	1
3.6	Repairs of buckling.	1
3.7	Regular track maintenance operations on LWR, Cold & hot weather patrolling	1
3.8	Special track maintenance on LWR	1
3.9	Inspection of LWR and remedial actions for correction of gaps at SEJ, Hysteresis loop.	1
3.10	Competency level to carry out various works in LWR track, Dos & Don'ts.	1
4	**USFD Testing**	**12**
4.1	Rail/Weld Failure – Reporting, codification, preservation of Rail/weld piece for M&C testing	2
4.2	USFD: Ultrasonic flaw detection, fundamentals of ultrasonic waves, defect detection, need based concept of USFD, frequency of testing, brief description of various types of USFD machines and probes used, calibration and sensitivity checking, limitations of USFD, USFD Flaw /defect, Marking of defects. Action to be taken for different Rail/Weld USFD flaws. SPURT Car, Recent developments in USFD.	4
4.3	Technical film/Video Clips/Photographs showing USFD testing, flaw pattern, etc.	2
4.4	Hands on USFD Testing.	4
	PART V - INSPECTION AND MAINTENANCE OF P.WAY	
1	**INSPECTION AND DUTIES**	**3**
1.1	Duties of JE/ SSE /P. Way, Duties of Track maintainer, Keyman, Mate.	1
1.2	Inspection schedule of JE/P.Way/SSE/P.WAY (sectional/ Incharge)	1
1.3	Pway inspection kit and its demonstration	1
2	**MAINTENANCE OF TRACK**	**3**
2.1	Annual Programme for regular Track maintenance, Through packing, Overhauling, Picking of slacks, Lifting and Lowering of track, Deep screening of ballast, importance of track drainage. Inspection of cutting, Removal of loose boulders	1
2.2	Record of Gang work, Gang chart/diary, Keyman's diary, Mate's diary, Record of work of Artisans and other workmen, Half yearly reports on conditions of permanent way, PWI's Section Register, P. Way plans and diagrams	1
2.3	Lubrication of joints and lubrication of rails in straight on work spot and on curves, maintenance of rail joints, lubrication on switches, lead rails	1
3	**MECHANIZED MAINTENANCE**	**12**
3.1	3 tiers system of track maintenance, Working of MMUs	1
3.2	Small track machines: types, use in maintenance, spot attention with off track tampers , Troubleshooting and system of repairs & maintenance, procurement, Recent development in light weight Small Track Machines	1
3.3	Technical film/Video Clips/Photographs on working of STM.	1
3.4	Introduction to different types of track machines viz. Duomatic, CSM, tamping express, DTS, Unimat, BRM, FRM, BCM etc.	1
3.5	Pre-requisites to tamping and other machine working, Pre & Post tamping attentions and attentions during tamping.	1
3.6	Working principles of tamping machine - 3 point & 4 point lining including working of ALC, DRP, CWS, CMS	2
3.7	Working rules for Track Machines (IRTMM Ch-IV para 4.5 to 4.10)	1
3.8	Deep screening of ballast with BCM machine.	1

T-3 contd.....

TOPIC	TOPIC DETAILS	PDS
3.9	Technical film/Video Clips/Photographs on working of different track machines	1
3.10	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	2
4	**RECONDITIONING OF MATERIALS AND TOOLS**	**2**
4.1	Reconditioning of worn out crossings and switches, type of electrodes, RDSO approved vendors, Translamatic Robotic Welding- planning, execution including schedule, conditions& specifications.	2
5	**TRACK RECORDING & MONITORING**	**3**
5.1	Track Monitoring: Track Recording Cum Research Car (TRRC), Oscillograph car, OMS,	2
5.2	Riding quality, Track Quality Index(TQI), Track geometry, various track tolerances	1
	PART VI- TRACK MANAGEMENT SYSTEM (TMS)	**7**
1.1	Introduction to IRICEN Website and assessing the various publications and knowledge bank, Introduction to various modules of IRCEP , Introduction to TMS, Purpose, Advantage Hands On: Generation of various Report and Registers, Track Diagram.	2
1.2	Hands On: Fracture Entry, USFD entry &Rail/Weld failure reports, Miscellaneous Module.	2
1.3	Hands On: Store Module.	3
	PART VII- SAFETY	
1	**ACCIDENTS**	**2**
1.1	Accident manual, Accident proforma, Preparation of joint note.	2
2	**TROLLEY/LORRY/DOLLY WORKING**	**1**
2.1	Working of Push Trolley, Lorry & motor Trolley, Rail dolly, Competency Certificate.	
3	**PROTECTION, RESTRICTIONS & INDICATIONS**	**2**
3.1	Safety at Work site, Hand signals in day and night, Hand flags, Hand lamps, Banner flags, Detonators, life of detonators, testing of detonators, fog signals, Engineering Indicator Boards, Works of short and long duration, Protection during emergency Caution order. Protection arrangement during traffic block/road vehicle working adjacent to track/during poor visibility	2
4	**PATROLLING**	**2**
4.1	Kinds of patrolling i.e. Key men's daily patrol, Gang patrol, Monsoon Patrolling, security, Patrolling, Stationary Watchman at vulnerable points, Weather warnings, Single and double frequency patrolling,	1
4.2	Patrol charts, Patrol books and equipments, selection and duties of Patrolmen.	1
5	**CRS SANCTION & SCHEDULE OF DIMENSIONS**	**2**
5.1	Works requiring CRS sanction, Procedure for getting CRS s anction, Movement of ODC.	1
5.2	Various schedules of dimensions related to P. Way	1
6	**COORDINATION ASPECT WITH S&T AND ELECTRICAL DEPARTMENT**	**2**
6.1	Coordination Aspect with S&T Department: Working in track circuited areas - maintenance of track circuited sections, use of insulated trolleys, maintenance of insulated joints, glued joints. Felling/Cutting/pruning of trees obstructing view of signal	1
6.2	Coordination Aspect with Electrical Department: Maintenance in electrified areas: Felling/Cutting/pruning of trees very close to OHE	1
7	Personnel Safety- Dos & Don'ts while working near track	1
	PART VIII- TRACK RENEWALS	**3**
1.1	Scope &Criteria for Complete track renewals(CTR), Through rail renewals(TRR), Through Sleeper renewals(TSR), Through fitting renewal(TFR) and Through ballast renewal(TBR), Through Bridge Timber Renewal(TBTR), Through Turnout Renewal(TTR), Through Weld Renewal(TWR)	2
1.2	Technical film/Video Clips/Photographs: Relaying with PQRS equipment, Track relaying train, Relaying of turnout with T-28.	1
	PART IX- TRANSPORTATION (G& SR)	**3**
1.1	Various systems of working, Essentials of absolute & automatic block system, important definitions, General & subsidiary rules applying to Railway servants, Working of Track machines	2
1.2	Classification of stations, Simple layouts & condition for granting permission to approach, single line working on double line, Reception of train on blocked line and starting from non-signaled line,	1
	PART X- LAND MANAGEMENT	**2**
1.1	Demarcation of land boundaries & maintenance of land registers, Licensing/leasing, way- leave facility, NOC to private buildings near railway boundary.	1
1.2	Type of encroachments and PPE Act.	1
	PART XI- OFFICE & STORES	**6**
1.1	Procuring of office stationary and stores, Procuring of P. Way	

T-3 contd.....

TOPIC	TOPIC DETAILS	PDS
	stores for maintenance and for special works, Classification of stores, Accountal of stores, DS- 8 note, RE-9B, Material Transaction Order, adjustment memo, Stock verification reports, Disposal of scrap & surplus stores, Overhauling of stores, Numerical ledgers & inventory control, Environmental management/ improvement of store & depot including cleanliness, hygiene, afforestation, rain water harvesting, energy conservation etc.	2
1.2	Classification of stores, Stock verification, Stock sheet, Submission of returns, Inventory control, Maintenance of DMTR and ledgers, Submission of store returns in time, Materials at site register, Imprest Store, T&P Store.	2
1.3	Preventive Vigilance	2
2	**PERSONNEL**	**4**
2.1	Passes and leave Rule, D&A Rules	1
2.2	Establishment Records in SSE/ JE P Way office, Settlement:- PF, Pension, Gratuity, Leave Encashment; Filling up of Pension Booklet, Welfare Schemes & SBF	1
2.3	Industrial Relations:-Unions & Associations, PNM, JCM	1
2.4	Workmen's Compensation Act, Action in case of injury on duty, Ex-Gratia Payment, Hours of Employment Regulations Act, RTI Act.	1
3	**RAJBHASHA**	**1**
3.1	Directives in use of Raj-Bhasha in day-to-day working.	1
	PART XIII- CONTRACT MANAGEMENT	3
1.1	Introduction to, tender & contracts, Introduction to e-tendering & service contracts different Types & forms of contract, GCC & SCC, SOR for P. Way works, Earnest money, Security deposit.	1
1.2	Various registers to be maintained for progress, Quality.	1
1.3	Preparation of Contractor's On-Account/Running & Final Bills, Material Statements, Maintenance Period, Warranty/guarantee clauses, release of security deposit, Time extensions to date of completion of contract& Subsidiary Agreement	1
	PART XIV- COMPUTER & THEIR USAGE	**4**
1.1	Hands On: MS- Office: Word, Excel, PowerPoint, Email, Search Engines	4
	PART XV - MISCELLANEOUS	**8**
1.1	Ethics & integrity	1
1.2	Disaster Management including Fire Safety	1
1.3	Reporting/ introduction/ valedictory/ examination/ viva-voce, etc	6
	Total (17 days = 17 x 8 pds = 136 periods of 45mins each)	**136**

	SUMMARY	
1	CLASSROOM LECTURES	96
2	TECHNICAL FILM/VIDEO CLIP/PHOTOGRAPHS	8
3	TUTORIALS	1
4	HANDS ON	23
5	MISCELLANEOUS	8
	GRAND TOTAL	136

Details of Technical Film, Hands On, Tutorials

S. No.	TECHNICAL FILM/VIDEO CLIPS/PHOTOGRAPHS	PERIODS
I/1.2	Technical film/Video Clips/Photographs- Rail handling, Unloading of Rails from EUR, Rail Grinding including profile measurement	2
IV/1.4	Technical film/Video Clips/Photographs on AT welding, FBW Welding	1
IV/4.3	Technical film/Video Clips/Photographs showing USFD testing, flaw pattern, etc.	2
V/3.3	Technical film/Video Clips/Photographson working of STM.	1
V/3.9	Technical film/Video Clips/Photographs on working of different track machines	1
VII/1.2	Technical film/Video Clips/Photographs: Relaying with PQRS equipment, Track relaying train, Relaying of turnout with T-28,	1

S. No.	HANDS ON	PERIODS
II/3.4	Hands on to Computer software for layout calculation	2
III/2.2	Hands on to Computer software for curve realignment calculations.	4
IV/4.4	Hands on USFD Testing.	4
V/3.10	Hands on- field marking of slew, lifting and Vm/H value marking on sleepers.	2
VI/1.1	Hands On: Generation of various Report and Registers, Track Diagram.	2
VI/1.2	Hands On: Fracture Entry, USFD entry & Weld & fracture reports/Miscellaneous Module.	2
VI/1.3	Hands On: Store Module.	3
XIV/1.1	Hands On: MS- Office: Word, Excel, PowerPoint	4
	TUTORIAL	
II/2.3	Tutorial on drawings of various Turnout & their assembly	1

PROMOTION COURSE (KEYMAN / MATE) (T-4)

DURATION: 18 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART-I INTRODUCTION	**3**
1.1	Railway's Organizational Structure, Role of Keyman/ Mate, Classification of Routes.	1
1.2	Duties & responsibilities of Keyman/ Mate (IRPWM Ch-1, part D).	2
	PART-II PERSONAL/WORKMEN SAFETY	**15**
1.1	Precaution during work on running lines.	1
1.2	Precaution during routine maintenance activity, handling/ transporting materials.	1
1.3	Precaution during Track machine working.	2
1.4	Precaution during working on sharp curves/ curves with poor visibility.	1
1.5	Precautions in Track Circuited Areas, Electrified Areas.	1
1.6	Precaution during working at accident spots, congested l ocations like bridge, tunnel.	1
1.7	Precautions during cold weather patrolling & night working. Precaution while working during heavy rain.	1
1.8	Safety during working in ghat sections Personal safety- Dos & Don'ts	1
1.9	Hands on: Exchange of hand signals. Fixing detonators	2
1.10	Field visit for demonstration of Protection of track in case of danger/ emergency.	2
1.11	Hands on: Repairs and Maintenance of Trolley/Man Refuge	2
	PART-III RAILS, SLEEPERS, FASTENINGS & BALLAST	**13**
1.1	Types of rails, Fish plates, Fishbolts, Instruction for handling of Rails, Unloading of Rail panels from EUR	1
1.2	PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	1
1.3	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	1
1.4	Glued joints, Block Joint, SEJs, Points& Crossing.	1
1.5	Model room showing different types of rails, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	1
1.6	Field visit for showing items mentioned at 1.5 above.	4
1.7	Ballast: Ballast profile at different location.	1
1.8	Hands on Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	2
1.9	Formation: Cross section of formation on bank and cutting, Side and catch water drains.	1
	PART-IV LUBRICATION OF RAIL JOINTS	**9**
1.1	Lubrication of Rail Joints (IRPWM Para 241)	1
1.2	Hands on: Lubrication of Rail Joints	4
1.3	Greasing of ERCs, Sealing of liners Painting of Rails and Welds	1
1.4	Lubrication of gauge face of outer rail on Curves, Turnouts, SEJ etc. Rail Flange Lubricators	1
1.5	Hands on: Lubrication of ERC, Curves, Turnouts, SEJ.	2
	PART-V POINTS & CROSSINGS	**11**
1.1	Turnouts: Definition and description of components. Different types of turnouts : 1 in 8 .5 , 1 in 12, 1 in 16, Symmetrical Split Turn-in Curves Different types of switches – Straight Switches, Curved switches, Thick web switches, Derailing switches Different types of crossings - Ordinary built-up and CMS crossings, Swing Nose Crossing. Fouling Marks, Dead Ends, Sand Hump	4
1.2	Joint Maintenance of interlocked points with signal staff	1
1.3	Field visit: Identification of various Components of turnout assembly, checking the condition of tongue rail, housing of tongue rail, throw of switches, measurement of wear at crossings & check rail clearances. Fouling Marks, Dead Ends, Sand Hump. Inspection & Measurement of Turnouts.	6
	PART-VI CURVES	**8**
1.1	Types of Curves, Radius/Degree of Curve, Cant/Super elevation, Versine, Transition Curve. Check rail on sharp curves. Curve Indication Boards, Rail Posts	2
1.2	Attention to Curve: Versine survey and rectification.	2
1.3	Hands on:	
	Measurement of curve as per IRPWM format, slew marking / pegging on track for Realignment of curve.	4
	PART-VII TRACK MAINTENANCE ACTIVITIES	**31**
1.1	Through Packing (IRPWM Para 224), Systematic Overhauling of Track (IRPWM Para227) Slack Picking (IRPWM Para 229),	2

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TOPIC	TOPIC DETAILS	PDS
1.2	Hands on: Manual through packing.	4
1.3	Hands on: Systematic Overhauling	
1.4	Mobile Maintenance Units (IRPWM Para 228)	1
1.5	Introduction to Small Track Machines. Safe operation of Small Track Machines available on Indian Railways on running track.	2
1.6	Basic knowledge regarding consumables being used in Small Track Machines.	1
1.7	Hands on Repair & Maintenance of Small Track machines, troubleshooting of Small Track machines.	2
1.8	Hands on training for operation of small Track Machines including weld trimmer, grinder, rail cutting, hole drilling, chamfering, toe load measurement etc.	2
1.9	Attention to SEJ, Glued Joints, insulated block joints, Fixing of Distance pieces on PF lines.	1
1.10	Observance of Sleepers under passage of Traffic(IRPWM Para 230) Observance of train for seized bearings/ hot axles, hanging parts of rolling stock.	1
1.11	Hands on: Measurement of Gauge, Cross level, Check-Rail Clearance, Versine, Cant.	2
1.12	Welding of Rails.	2
1.13	Technical films/ video clips/ photographs- On Welding (ATW & MBFW) of Rails	1
1.14	Technical films/ video clips/ photographs on use of weld trimmers &Grinders, Rail cutting machine, Rail drilling Machine, Chamfering machine, Impact Winch for bolt tightening, Toe load measurements.	2
1.15	Annual program for regular track maintenance: Pre monsoon, during monsoon and post monsoon attention to Track, Record of Gang work, Gang Chart, Gang Diary, Keyman's Diary, Mate's Diary.	2
1.16	Mechanized maintenance: Brief introduction to different types of track machines	1
1.17	Pre & Post tamping attention to track, Attention during Machine tamping.	1
1.18	Hands on: Pre & Post tamping activities, attention during Machine tamping	2
1.19	Creep – Causes of Creep & prevention, Anti creep devices, measurement & attention of Creep.	1
1.20	Technical films/ video clips/ photographs of various types of Tamping Machine on Railway, Unloading of Rails from EUR, Unloading of Ballast from BOBYN.	1
	PART VIII LONG AND SHORT WELDED RAILS (LWR/SWR)	**11**
1.1	Introduction to LWR/SWR track.	1
1.2	Rail temperature- types of Rail Thermometers, measurement of te mperature, permitted temperature limits for carrying out various maintenance operations.	2
1.3	Different types of SEJ – Inspection & Maintenance	1
1.4	De-stressing of LWR.	1
1.5	Competency to carry out various maintenance and repair works in LWR.	1
1.6	Do's and Don'ts for LWR and SWR track.	2
1.7	Hot and cold weather patrolling	1
1.8	Action to be taken in case of rail/weld failures.	1
1.9	Action to be taken in case of buckling	1
	PART-IX RAIL FRACTURES AND WELD FAILURES	**4**
1.1.	Preventive measures to control Rail/ weld failures, USFD Testing, Marking of USFD Flaws, Action for protection / removal of defective welds/rails	2
1.2	Hands on: Protection of Defective Rail/Weld	2
	PART-X TRACK RENEWALS	**6**
1.1	Scope, activities involved & method for execution of Through Rail Renewal, Through Sleeper Renewal, Through Bridge Timber Renewal, Through Fittings Renewal, Through Turnout renewal.	2
1.2	Deep Screening, Lifting/Lowering of track Speed restriction prescribed for various track renewal works including long and short duration works and protection of work site	1
1.3	Working of Ballast Train / DMT working	1
1.4	Technical films/ video clips/ photographs of various types of Track Renewal Machine on Railway	1
1.5	New Track Tolerances, Pre classification of Released material	1
	PART-XI LEVEL CROSSINGS	**4**
1.1	Classification of Level Crossing, Equipment at LC.	1
1.2	Visibility at LC, speed breakers, road signboards and W/L boards at level crossings, Location of various LC Boards.	1
1.3	Action during gate failures, Height Gauge damage, Breakdown of vehicle at LC	1
1.4	Technical films/ video clips/ photographs for better understanding of Level Crossing.	1

T-4 contd.....

TOPIC	TOPIC DETAILS	PDS
	PART-XII PATROLLING OF TRACK	**4**
1.1	Types of patrolling, Duties of Patrolman, Equipment of Patrolman, Reporting of unusual. Understanding of patrol chart and diary, Action to be taken during emergency by patrolman	2
1.2	Hands on: Keyman's daily Patrolling	2
	PART-XIII RAIL DOLLY/TROLLEY/DIP LORRY WORKING	**3**
1.1	Working of Trolley, Lorry and Rail dolly.	1
1.2	Technical films/ video clips/ photographs on working of Rail Dolly/Dip Lorry.	1
1.3	Tutorial on preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order, etc.	1
	PART-XIV BASICS OF SIGNALLING AND PROTECTION OF TRACK	**4**
1.1	Various types of signals & Their Aspects	1
1.2	Station limit, block sections, different types of territory (absolute /automatic).	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1
1.4	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	1
	PART-XV BRIDGES	**2**
1.1	Definition of minor/major/ important bridges, board fixing on bridge approaches, Relevance of HFL & Danger level & flood gauge, Waterway Clearance	1
1.2	Track Maintenance on girder bridges – maintenance of steel channel sleepers (including H beam sleepers & composite sleepers) and fittings, Guardrails, Maintenance of track on approaches.	1
	PART-XVI ACCIDENTS & BREACHES	**2**
1.1	Duties of Track Maintainer/ Keyman/Mate in case of Accidents & Breaches Action to be taken at site of Accident/Breaches, Preservation of clues	1
1.2	Protection of Track and reporting to higher officials	1
	PART-XVII MISCELLANEOUS	**9**
1.1	Leadership Quality, Team Spirit and Discipline	1
1.2	Ethics and Integrity	1
1.3	Communication Skills	1
1.4	Training on disaster management including fire safety	1
1.5	Reporting, Valedictory, Examination, Viva-Voce etc.	5
	PART-XVIII ESTABLISHMENT MATTER	**3**
1.1	Leave & Pass rules.	1
1.2	Maintenance of muster sheet	1
1.3	DAR, HOER.	1
	PART-XIX FIRST AID	**2**
1.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	2
	Self-development (physical & emotional)	
	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).	
	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**144**
	NOTE: Total 18 days = 18 x 8 pds = 144 pdsof 45 mins each	

	SUMMARY	
A	CLASSROOM LECTURES	85
B	TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS	7
C	FIELD VISIT	12
D	HANDS ON	32
E	MODEL ROOM	1
F	TUTORIAL	1
G	MISCELLANEOUS	9
	GRAND TOTAL	144

Details of Model Room, Technical Film, Field Visits, Hands on, Tutorials

S. No.	TECHNICAL FILM/VIDEO CLIPS/PHOTOGRAPHS	PERIODS
VII/1.13	Technical films/ video clips/ photographs: On Welding (ATW & MBFW) of Rails	1
VII/1.14	Technical films/ video clips/ photographs on use of weld trimmers &Grinders, Rail cutting machine, Rail drilling Machine, Chamfering machine, Impact Winch for bolt tightening, Toe load measurements.	2
VII/1.20	Technical films/ video clips/ photographs of various types of Tamping Machine on Railway	1
X/1.4	Technical films/ video clips/ photographs of various types of Track Renewal Machine on Railway	1
XI/1.4	Technical films/ video clips/ photographs for better understanding of Level Crossing.	1
XIII/1.2	Technical films/ video clips/ photographs on working of Rail Dolly/Dip Lorry.	1
	FIELD VISITS	
II/1.10	Field visit for demonstration of various safety drills.	2
III/1.6	Field visit for showing items mentioned at III/1.5.	4
V/1.3	Field visit: Identification of various Components of turnout assembly, checking the condition of tongue rail, housing of tongue rail, throw of switches, measurement of wear at crossings & check rail clearances. Fouling Marks, Dead Ends, Sand Hump. Inspection & Measurement of Turnouts.	6
	HANDS ON	
II/1.9	Hands on: Exchange of hand signals. Fixing detonators	2
II/1.11	Hands on: Repairs and Maintenance of Trolley/Man Refuge	2
III/1.8	Hands on Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	2

S. No.	HANDS ON	PERIODS
IV/1.2	Hands on: Lubrication of Rail Joints	4
IV/1.5	Hands on: Lubrication of ERC, Curves, Turnouts, SEJ.	2
VI/1.3	Hands on:	
	(i) Measurement of curve as per IRPWM format, slew marking / pegging on track for Realignment of curve.	4
VII/1.2	Hands on: Manual through packing.	4
VII/1.3	Hands on: Systematic Overhauling	
VII/1.7	Hands on Repair & Maintenance of Small Track machines, troubleshooting of Small Track machines.	2
VII/1.8	Hands on training for operation of small Track Machines including weld trimmer, grinder, rail cutting, hole drilling, chamfering, etc.	2
VII/1.11	Hands on: Measurement of Gauge, Cross level, Check-Rail Clearance, Versine, Cant.	2
VII/1.18	Hands on: Pre & Post tamping activities, attention during Machine tamping	2
IX/1.2	Hands on: Protection of Defective Rail/Weld	2
XII/1.2	Hands on: Keyman's daily Patrolling	2
	MODEL ROOM	
III/1.5	Model room showing different types of rails, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	1
	TUTORIAL	
XIII/1.3	Tutorial on preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order, etc.	1

REFRESHER COURSE (KEYMAN / MATE) (T-5)

DURATION: 6 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART-I INTRODUCTION	**1**
1.1	Duties & Responsibilities of Keyman/Mate (IRPWM Ch-1, part-D).	1
	PART-II PERSONAL SAFETY	**3**
1.1	Precaution during routine maintenance activity, handling/ transporting materials. Precaution during Track machine working. Precaution during working on sharp curves/ curves with poor visibility.	1
1.2	Precautions in track circuited areas, electrified areas. Precaution during working at accident spots, congested locations like bridge, tunnel, ghat section. Precautions during cold weather patrolling & night working. Precaution while working during heavy rain.	1
1.3	Hands on: Exchange of hand signals, demonstration of protection of track in case of danger/emergency.	1
	PART-III RAILS, SLEEPERS, FASTENINGS & BALLAST	**4**
1.1	PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	1
1.2	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	1
1.3	Model Room/ Model Track for showing different types of rails, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	1
1.4	Ballast: Ballast profile at different location. Glued joints, Block Joint, SEJs, Points& Crossing.	1
	PART-IV LUBRICATION OF RAIL JOINTS	**2**
1.1	Lubrication of Rail Joints (IRPWM Para 241)	1
1.2	Greasing of ERCs, sealing of liners Painting of Rails and Welds Lubrication of gauge face of outer rail on Curves, Turnouts, SEJ etc. Rail Flange Lubricators	1
	PART-V POINTS & CROSSINGS	**4**
1.1	Turnouts: Definition and description of components. Different types of turnouts : 1 in 8 .5 , 1 in 12, 1 in 16 Different types of switches – straight switches, Curved switches, Thick web switches, Derailing switches, Symmetrical Split Turn-in Curves Different types of crossings - Ordinary built-up and CMS crossings, swing nose crossing. Fouling Marks, Dead Ends, Sand Hump	1
1.2	Joint Maintenance of interlocked points with signal staff	1
1.3	Field visit: Checking the condition of tongue rail, housing of tongue rail, throw of switches, measurement of wear at crossings & checkrail clearances. Fouling Marks, Dead Ends, Sand Hump. Inspection & Measurement of Turnouts.	2
	PART-VI CURVES	**4**
1.1	Types of Curves, Radius/Degree of Curve, Cant/Super elevation, Versine, Transition Curve. Check rail on sharp curves. Curve Indication Boards, Rail Posts	1
1.2	Attention to Curve: Versine survey and rectification.	1
1.3	Hands on:	
(i)	Measurement of curve as per IRPWM format.	
(i)	Slew marking/pegging on track for Realignment of curve(ii)	2
	PART-VII TRACK MAINTENANCE ACTIVITIES	**9**
1.1	Through Packing (IRPWM Para224), Systematic Overhauling of Track(IRPWM Para227) Slack Picking (IRPWM Para229),	1
1.2	Mobile Maintenance Units (IRPWM Para228)	1
1.3	Introduction to Small Track Machines.	
	Safe operation of Small Track Machines available on Indian Railways on running track along with Technical films/ video clips/ photographs on use of weld trimmers &Grinders, Rail cutting machine, Rail drilling Machine, Chamfering machine, Impact Winch for bolt tightening, Toe load measurements.	1
1.4	Attention to SEJ, Glued Joints, insulated block joints.	1
1.5	Observance of Sleepers under passage of Traffic(IRPWM Para 230) Observance of train for seized bearings/hot axles, hanging parts of rolling stock. Precautions during Casual renewal of rail, sleeper & fastening.	1
1.6	Hands on: Toe load measurement.	1
1.7	Annual program for regular track maintenance: Pre monsoon, during monsoon and post monsoon attention to Track, Record of Gang work, Gang Chart, Gang Diary.	1

T-5 contd.....

TOPIC	TOPIC DETAILS	PDS
1.8	Mechanized maintenance: Brief introduction to different types of track machines duly showing photograph/ video clips of various Track machines.	1
1.9	Pre & Post tamping attention to track, Attention during Machine tamping.	1
	PART VIII LONG AND SHORT WELDED RAILS (LWR/SWR)	**6**
1.1	Rail temperature: types of rail thermometer, measurement of temperature, permitted temperature limits for carrying out various maintenance operations.	1
1.2	Different types of SEJ- Inspection & Maintenance	1
1.3	De-stressing of LWR.	1
1.4	Competency to carry out various maintenance and repair works in LWR. Do's and Don'ts for LWR and SWR track.	1
1.5	Hot and cold weather patrolling	1
1.6	Action to be taken in case of rail/weld failures, buckling	1
	PART-IX RAIL FRACTURES AND WELD FAILURES	**1**
1.1.	Preventive measures to control Rail/ weld failures, USFD Testing, Marking of USFD Flaws, Action for protection / removal of defective welds/rails	1
	PART-X TRACK RENEWALS	**2**
1.1	Scope, activities involved & method for execution of Through Rail Renewal, Through Sleeper Renewal, Through Bridge Timber Renewal, Through Fittings Renewal, Through Turnout renewal.	1
1.2	Deep Screening, Lifting/Lowering of track Speed restriction prescribed for various track renewal works including long and short duration works and protection of work site New Track Tolerances Working of Ballast Train / DMT working	1
	PART-XI LEVEL CROSSINGS	**1**
1.1	Classification of Level Crossing, Equipment at LC, Visibility at LC, speed breakers, Road sign boards and W/L boards at level crossings, Location of various LC Boards. Action during gate failures, Height Gauge damage, Breakdown of vehicle at LC	1
	PART-XII PATROLLING OF TRACK	**1**
1.1	Types of patrolling, Duties of Patrolman, Equipment of Patrolman, Reporting of unusual. Understanding of patrol chart and diary, Action to be taken during emergency by patrolman	1
	PART-XIII RAIL DOLLY/TROLLEY/DIP LORRY WORKING	**1**
1.1	Working of Trolley, Lorry and Rail dolly & preparation of various memo viz. track unsafe memo, caution order, track safe memo	

TOPIC	TOPIC DETAILS	PDS
	with caution order, etc.	1
	PART-XIV BASICS OF SIGNALLING AND PROTECTION OF TRACK	**1**
1.1	Various types of signals & Their Aspects, Station limit, block sections, different types of territory (absolute/automatic). Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc. Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	1
	PART-XV BRIDGES	**1**
1.1	Definition of minor/major/ important bridges, board fixing on bridge approaches, relevance of HFL & Danger level & flood gauge, Waterway Clearance Track Maintenance on girder bridges – maintenance of steel channel sleepers (including H beam sleepers) and fittings, Guard rails, Maintenance of track on approaches.	1
	PART-XVI ACCIDENTS & BREACHES	**1**
1.1	Duties of Track Maintainer/ Keyman/Mate in case of Accidents & Breaches Action to be taken at site of Accident/Breaches, Preservation of clues Protection of Track and reporting to higher officials	1
	PART-XVII MISCELLANEOUS	**5**
1.1	Leadership Quality, Team Spirit, Discipline, Ethics and Integrity	1
1.2	Training on disaster management including fire safety	1
1.3	Reporting, Valedictory, Examination, Viva-Voce etc.	3
	PART-XVIII FIRST AID	**1**
1.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher. Self-development (physical & emotional) Jogging/ yoga exercise one hour daily in morning session (7am to 8am). Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	1
	Grand Total	**48**
	NOTE: Total 6 days = 6 x 8 pds = 48 pds of 45 mins each.	

INDUCTION COURSE (GATEKEEPER*) (T-6)
(*From New recruits) DURATION-12 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART - I INTRODUCTION	**1**
1.1	Railway's organizational structure, Role of gatekeeper Classification of Routes.	1
	PART - II PERSONAL SAFETY	**9**
1.1	Precaution during work on running lines, routinemaintenance activity, handling/ transporting materials.	1
1.2	Precaution during Track machine working, working on sharp curves/ curves with poor visibility.	
	Personal safety- Dos & Don'ts	1
1.3	Precautions in track circuited areas, electrified areas.	1
1.4	Precaution during working at accident spots, congested locations like bridge, tunnel.	1
1.5	Precautions during night working, heavy rain.	1
1.6	Hands on: for demonstration of various safety drills, including exchange of hand signals & Fixing detonators.	4
	PART - III RAILS, SLEEPERS, FASTENINGS &BALLAST:	**11**
1.1	Types of Rails, Fish plates, Fish-bolts.	1
1.2	PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	1
1.3	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	2
1.4	Glued joints, Block Joint, SEJs, Points & Crossing.	1
1.5	Model room showing different types of rail, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	1
1.6	Ballast profile at different location	1
1.7	Hands on: Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	4
	PART - IV LONG AND SHORT WELDED RAILS (LWR/SWR)	6
1.1	Introduction to LWR/SWR track.	1
1.2	Rail temperature: types of Rail Thermometers, measurement of temperature and working range.	1
1.3	Do's and Don'ts for LWR and SWR track.	1
1.4	Hot and cold weather patrolling	1
1.5	Action to be taken in case of rail/weld failures.	1
1.6	Action to be taken in case of buckling	1
	PART-V RAIL FRACTURES AND WELD FAILURES	7
1.1	Introduction to Rail/ weld failures.	1
1.2	Marking of USFD Flaws, Action for protection / removal of defective welds/rails	2
1.3	Hands on: Attending rail/ weld failures, Protection of Defective Rail/Weld	4
	PART - VI LEVEL CROSSINGS	37
1.1	Level Crossings- Classification of gates number of gatekeepers at LC, Type of LC gates (Manned/Unmanned, Traffic/Engineering, Interlocked/Non-Interlocked), Provision of height gauges at LCs in electrified territory.	2
1.2	Equipment at LC, Appointment of gate-keepers, Rosters, PME, Refresher, Competency,	1
1.3	Duties of gate man, Position and alertness during passage of trains	2
1.4	Exchange of private number, Private Number book, LC register, transfer of charge	1
1.5	Responsibility regarding trespassing, Provisions of railway act related to LC,	1
1.6	Action and report in case of Unusuals: action to be taken in case of derailed wagon, train parting, unusual noise/smoke from bearing, fire, Flat tyre, hot axle/Roller Bearing seizure, hanging brake beam, opened doors of goods train, jammed wheel, or other parts of rolling stock, OHE breakdown/ Power shutdown, Protection of track in case of emergency at LC on single/ double/ multiple lines, Protection diagram at LC	2
1.7	Inspection and maintenance of LC, LC inspection register. Level Crossing Indicators, knowledge of gate signals for Interlocked gates. Environment improvement & green initiative at LC gate.	2
1.8	Gate working rules - normal working, action during danger at level crossing, working at Non-interlocked/ interlocked gates, working when signal/ interlocking is defective at interlocked gate	4
1.9	Action when lifting barrier/ boom/ gate leaf is damaged, Working of sliding boom, LC operation during Gate Signal failure	1
1.10	Visibility at level crossing and test of visibility, trimming of trees/ bushes.	1
1.11	Traffic Census at LC Gate.	1
1.12	Repair and maintenance of road surface, check rail clearances, inspection of distance blocks, Check rails, bolts, packing under the LC sleepers etc.	1
1.13	Action during foggy weather and use of fog signals.	1

T-6 contd.....

TOPIC	TOPIC DETAILS	PDS
1.14	Various records at LC:- Duty Roster, competency certificate, refresher details, PME, LC Inspection register, Complaint register, equipment failure register, list of equipment, Private no. book, Train register, transfer of charge register etc.	1
1.15	Hands on: Interlocked gate operations.	8
1.16	Hands on: Non-interlocked gate operations.	8
	PART - VII PATROLLING OF TRACK	**3**
1.1	Types of patrolling	1
1.2	Duties of Patrolman, Equipment of Patrolman. Reporting of unusual. Understanding of patrol chart and diary.	2
	PART - VIII BASIC SIGNALLING AND PROTECTION	**11**
1.1	Various types of signals & Their Aspects	1
1.2	Station limit, block sections, different types of territory (absolute/ automatic), Understanding of track circuit of LC gate area in Automatic block territory	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1
1.4	Protection during short duration/long duration works.	1
1.5	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	1
1.6	Hands on for Fixing of Indicator Boards at Work site	4
1.7	Training on disaster management including fire safety.	2
	PART - IX ESTABLISHMENT MATTER	**3**
1.1	Leave & Pass Rules	1
1.2	DAR	1
1.3	HOER	1
	PART - X MISCELLANEOUS	**6**
1	Reporting/ Relieving, Exams, Viva -Voce, etc.	6
2	**FIRSTAID**	**2**
2.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	2
3	**SELF-DEVELOPMENT (PHYSICAL & EMOTIONAL)**	
3.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).	
3.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**96**
	NOTE: Total12 days = 12 x 8 pds = 96 pds of 45mins each	

	SUMMARY	
A	**CLASSROOM LECTURES**	**63**
B	**TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS**	**0**
C	**FIELD VISITS**	**0**
D	**HANDS ON**	**32**
E	**MODEL ROOM**	**1**
	GRAND TOTAL	**96**

INDUCTION COURSE (GATEKEEPER*) (T-7)

(*who have been picked up from Track maintainer category) DURATION-6 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART - I INTRODUCTION	**1**
1.1	Railway's organizational structure, Role of gatekeeper.	1
	PART - II PERSONAL SAFETY	**5**
1.1	Precaution during work on running lines, routine maintenance activity, handling/ transporting materials.	1
1.2	Precautions in track circuited areas, electrified areas.	1
1.3	Precautions during night working, heavy rain.	1
1.4	Hands on: for demonstration of various safety drills, including exchange of hand signals & Fixing detonators.	2
	PART - III LONG AND SHORT WELDED RAILS (LWR/SWR)	3
1.1	Introduction to LWR/SWR track.	1
1.2	Hot and cold weather patrolling	1
1.3	Action to be taken in case of rail/weld failures and buckling	1
	PART - IV LEVEL CROSSINGS	**27**
1.1	Level Crossings- Classification of gates number of gatekeepers at LC, Type of LC gates (Manned/Unmanned, Traffic/Engineering, Interlocked/Non-Interlocked), Provision of height gauges at LCs in electrified territory.	2
1.2	Equipment at LC, Appointment of gate-keepers, Rosters, PME, Refresher, Competency	1
1.3	Duties of gate man, Position and alertness during passage of trains	2
1.4	Exchange of private number, Private Number book, LC register, transfer of charge	1
1.5	Responsibility regarding trespassing, Provisions of railway act related to LC.	1
1.6	Action and report in case of Unusuals: action to be taken in case of derailed wagon, train parting, unusual noise/smoke from bearing, fire, Flat tyre, hot axle/Roller Bearing seizure, hanging brake beam, opened doors of goods train, jammed wheel, or other parts of rolling stock, OHE breakdown/ Power shutdown, Protection of track in case of emergency at LC on single/ double/ multiple lines, Protection diagram at LC	2
1.7	Inspection and maintenance of LC, LC inspection register. Level Crossing Indicators, knowledge of gate signals for Interlocked gates. Environment improvement & green initiative at LC gate.	2
1.8	Gate working rules - normal working, action during danger at level crossing, working at Non-interlocked/ interlocked gates, working when signal/ interlocking is defective at interlocked gate	2
1.9	Action when lifting barrier/ boom/ gate leaf are damaged, Working of sliding boom, LC operation during Gate Signal failure	1
1.10	Visibility at level crossing and test of visibility, trimming of trees/ bushes.	1
1.11	Traffic Census at LC Gate.	1
1.12	Repair and maintenance of road surface, check rail clearances, inspection of distance blocks, Check rails, bolts, packing under the LC sleepers etc.	1
1.13	Action during foggy weather and use of fog signals.	1
1.14	Various records at LC:- Duty Roster, competency certificate, refresher details, PME, LC Inspection register, Complaint register, equipment failure register, list of equipment, Private no. book, Train register, transfer of charge register etc.	1
1.15	Hands on: Interlocked gate operations.	4
1.16	Hands on: Non-interlocked gate operations.	4
	PART - V BASIC SIGNALLING AND PROTECTION	**6**
1.1	Various types of signals & Their Aspects	1
1.2	Station limit, block sections, different types of territory (absolute/ automatic), Understanding of track circuit of LC gate area in Automatic block territory	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1
1.4	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	1
1.5	Training on disaster management including fire safety.	2
	PART - VI MISCELLANEOUS	**6**
1	Reporting/ Relieving, Exams, Viva -Voce, etc.	4
2	FIRSTAID	2
3	Self-development (physical & emotional)	
3.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).	
3.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**48**
	NOTE: Total 6 days = 6 x 8 pds = 48 pds of 45mins each	

REFRESHER COURSE (GATEKEEPER) (T-8)
DURATION:-06 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART - I INTRODUCTION	**1**
1.1	Railway's Organizational Structure, Role of GK in Railways & Classification of Routes.	1
	PART - II PERSONAL SAFETY	**4**
1.1	Precaution during work on running lines, routinemaintenance activity, handling/ transporting materials. Precaution during Track machine working, working on sharp curves/ curves with poor visibility, Precautions in track circuited areas, electrified areas.	1
1.2	Precaution during working at accident spots, congested locations like bridge, tunnel. Precautions during night working Personal safety- Dos & Don'ts	2
1.3	Hands on: for demonstration of various safety drills, including exchange of hand signals & Fixing detonators.	1
	PART - III RAILS, SLEEPERS, FASTENINGS &BALLAST:	**2**
1.1	Types of Rails, Fish plates, Fish-bolts. PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	1
1.2	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc. Glued joints, Block Joint, SEJs, Points & Crossing.	1
	PART - IV LONG AND SHORT WELDED RAILS (LWR/SWR)	**3**
1.1	Introduction to LWR/SWR track.	1
1.2	Do's and Don'ts for LWR and SWR track, Hot and cold weather patrolling.	1
1.3	Action to be taken in case of rail/weld failures, buckling	1
	PART - V RAIL FRACTURES AND WELD FAILURES	**3**
1.1	Introduction to Rail/ weld failures. Marking of USFD Flaws, Action for protection / removal of defective welds/rails	1
1.2	Hands on: Attending rail/ weld failures, Protection of Defective Rail/Weld	2
	PART 4- VI LEVEL CROSSINGS	**21**
1.1	Level Crossings- Classification of gates number of gatekeepers at LC, Type of LC gates (Manned/Unmanned, Traffic/Engineering, Interlocked/Non-Interlocked), Provision of height gauges at LCs in electrified territory.	1
1.2	Equipment at LC,	

TOPIC	TOPIC DETAILS	PDS
	Appointment of gate-keepers, Rosters, PME, Refresher, Competency	1
1.3	Duties of gate man, Position and alertness during passage of trains, Exchange of private number, Private Number book, LC register, transfer of charge	1
1.4	Responsibility regarding trespassing, provisions of railway act related to LC	1
1.5	Action and report in case of Unusuals: action to be taken in case of derailed wagon, train parting, unusual noise/smoke from bearing, fire, Flat tyre, hot axle/Roller Bearing seizure, hanging brake beam, opened doors of goods train, jammed wheel, or other parts of rolling stock, action to be taken in case of OHE breakdown/ power shut down, Protection of track in case of emergency at LC, on single/ double/ multiple lines, protection diagram	2
1.6	Inspection and maintenance of LC, LC inspection register. Level Crossing Indicators, knowledge of gate signals for Interlocked gates. Environment improvement & green initiative at LC gate.	2
1.7	Gate working rules - normal working, action during danger at level crossing, working at Non-interlocked/interlocked gates, working when signal/ interlocking is defective at interlocked gate, Action when lifting barrier/ boom/ gate leaf is damaged, working of sliding boom, gate operation during Track Circuit failure	3
1.8	Traffic Census at LC Gate.	1
1.9	Visibility at level crossing and test of visibility, trimming of trees/ bushes, Action during foggy weather and use of fog signals.	1
1.10	Repair and maintenance of road surface, check rail clearances, inspection of distance blocks, Check rails, bolts, packing under the LC sleepers etc.	1
1.11	Various records at LC:- Duty Roster, competency certificate, refresher details, PME, LC Inspection register, Complaint register, equipment failure register, list of equipment, Private no. book, Train register, transfer of charge register etc.	1
1.12	Hands on: Interlocked gate operations.	3
1.13	Hands on: Non-interlocked gate operations.	3
	PART-VII PATROLLING OF TRACK	**1**
1.1	Types of patrolling Duties of Patrolman, Equipment of Patrolman. Reporting of unusual. Understanding of patrol chart and diary	1
	PART-VIII BASIC SIGNALLING AND PROTECTION	**5**

T-8 contd.....

TOPIC	TOPIC DETAILS	PDS
1.1	Various types of signals & Their Aspects	1
1.2	Station limit, block sections, different types of territory (absolute/ automatic), Understanding of track circuit in LC gate area in Automatic block territory.	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1
1.4	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site. Protection during short duration/long duration works.	1
1.5	Training on disaster management including fire safety.	1
	PART-IX ESTABLISHMENT MATTER	**2**
1.1	Leave & Pass Rules, HOER	1
1.2	DAR	1
	PART-X MISCELLANEOUS	**4**
1	Reporting, Valedictory, Exams, Viva-Voce, etc.	4
2	FIRSTAID	2
2.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	2
3	Self-development (physical & emotional)	
3.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).	
3.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**48**
	NOTE: Total 6 days = 6 x 8 pds = 48 pds of 45 mins each	

	SUMMARY	
A	**CLASSROOM LECTURES**	**37**
B	**TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS**	**0**
C	**FIELD VISITS**	**0**
D	**HANDS ON**	**7**
E	**MODEL ROOM**	**0**
F	**MISCELLANEOUS**	**4**
	GRAND TOTAL	**48**





INDUCTION COURSE (TRACK MAINTAINER) (T-9)
DURATION: 30 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART – I INTRODUCTION	**6**
1.1	Railway's Organizational Structure, Role of Track-maintainer in Railways.	2
1.2	Classification of Routes.	1
1.3	Duties & Responsibilities of Track-maintainer (IRPWM Para 149). Duties of Trackman as per para 2.11 of GR.	3
	PART – II PERSONAL SAFETY	**21**
1.1	Precaution during work on running lines.	1
1.2	Precaution during routinemaintenance activity, handling/ transporting materials.	1
1.3	Precaution during Track machine working.	2
1.4	Precaution during working on sharp Curves/Curves with poor visibility. Precaution during working at accident spots, congested locations like bridge, tunnel.	1
1.5	Precautions in track circuited areas, electrified areas.	2
1.6	Precaution while working during heavy rain, Safety against Snake/Insect Bite Precautions during night working.	1
1.7	Safety during working in Ghat sections. Personal safety- Dos & Don'ts	1
1.8	Hands on: Repairs to Trolley Refuges/ Man refuges	4
1.9	Hands on: Exchange of hand signals. Fixing detonators	4
1.10	Field visit for demonstration of various safety drills.	4
	PART – III RAILS, SLEEPERS, FASTENINGS & BALLAST	**23**
1.1	Types of rails, Fish plates, Fish bolts.	1
1.2	PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	2
1.3	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	2
1.4	Glued joints, Block Joint, SEJs, Points & Crossing.	2
1.5	Model room showing different types of rails, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	2
1.6	Field visit for showing items mentioned at 1.5 above.	8
1.7	Ballast profile at different location, Steps to prevent Pedestrian/ Cattle Crossing	2
1.8	Hands on Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	4
	PART – IV LUBRICATION OF RAIL JOINTS	**14**
1.1	Lubrication of Rail Joints (IRPWM Para 241)	1
1.2	Hands on: Lubrication of Rail Joints	4
1.3	Greasing of ERCs, sealing of liners.	1
1.4	Painting of Rails and Welds.	1
1.5	Lubrication of gauge face of outer rail on curves, turnouts, SEJ etc.	1
1.6	Hands on: Lubrication of ERC, Curves, Turnouts, SEJ.	6
	PART – V TRACK MAINTENANCE ACTIVITIES	**57**
1.1	Through Packing (IRPWM Para 224), Slack Picking (IRPWM Para 229),	2
1.2	Hands on: Manual through packing.	8
1.3	Systematic Overhauling of Track(IRPWM Para227)	1
1.4	Hands on: Systematic Overhauling	4
1.5	Mobile Maintenance Units (IRPWM Para228)	1
1.6	Introduction to Small Track Machines. Safe operation of Small Track Machines available on Indian Railways on running track.	2
1.7	Basic knowledge regarding consumables being used in Small Track Machines.	1
1.8	Hands on: Repair & maintenance of Small Track machines, troubleshooting of Small Track machines.	4
1.9	Hands on training for operation of small Track Machines including weld trimmer, grinder, rail cutting, hole drilling, chamfering, etc.	4
1.10	Works involved in the maintenance of Points &Crossings, Curves, Level crossings and Bridges.	2
1.11	CREEP: Creep and its effect, pulling back of creep, fixing of anchors, recoupment of missing fittings, renewal of ineffective fittings.	1
1.12	Attention to SEJ, Glued Joints, insulated block joints.	1
1.13	Observance of Sleepers under passage of Traffic(IRPWM Para 230)	1
1.14	Observance of train for seized bearings/hot axles, hanging parts of rolling stock.	
1.15	Technical films/ video clips/ photographs showing various Track Maintenance activities.	1
1.16	Hands on: Casual rail renewal	4
1.17	Hands on: Casual sleeper renewal	4
1.18	Hands on: Measurement of Gauge, Cross level, Check-Rail Clearance, Versine, Cant.	2

T-9 contd.....

TOPIC	TOPIC DETAILS	PDS
1.19	Hands on: Change of Crossing and Switches in yards.	4
1.20	Welding of Rails.	2
1.21	Hands on: Assisting in welding of rail joint.	4
1.22	Technical films/ video clips/ photographs on use of weld trimmers &Grinders, Rail cutting machine, Rail drilling Machine, Chamfering machine, Impact Winch for bolt tightening, Toe load measurements.	2
1.23	Hands on: Maintenance in Electrified territories: precautions involved during maintenance of Track-Circuited sections, Felling/ Cutting/ Pruning of trees close to OHE	2
	PART – VI LONG AND SHORT WELDED RAILS (LWR/SWR)	**24**
1.1	Introduction to LWR/SWR track.	1
1.2	Rail temperature-types of Rail Thermometers, measurement of temperature and working range.	1
1.3	Hands on: Measurement of Rail temperature	1
1.4	Competency to carry out various Maintenance and Repair works in LWR.	1
1.5	Do's and Don'ts for LWR and SWR track.	2
1.6	Hot and Cold Weather Patrolling	1
1.7	Action to be taken in case of rail/weld failures.	1
1.8	Hands on : for attending emergency repair of rail/weld fracture	4
1.9	Action to be taken in case of buckling	1
1.10	De-stressing of LWR.	2
1.11	Different types of SEJ – Inspection and Maintenance	1
1.12	Hands on: Cold / Hot Weather Patrolling, Monsoon Patrolling.	8
	PART – VII RAIL FRACTURES AND WELD FAILURES	**7**
1.1	Introduction to Rail/ weld failures.	1
1.2	Marking of USFD Flaws, Action for protection / removal of defective welds/rails	2
1.3	Hands on: Attention to various types of USFD Flaws	4
	PART – VIII TRACK RENEWALS	**21**
1.1	Scope, activities involved & method for execution of Through Rail Renewal, Through Sleeper Renewal, Through Bridge Timber Renewal, Through Fittings Renewal, Through Turnout renewal.	3
1.2	Deep Screening (IRPWM Para 238), Lifting/Lowering of track (IRPWM Para 233/234),	3
1.3	Working of Ballast Train / DMT working	2
1.4	Hands on: Ballast train/ EUR unloading.	8
1.5	Technical films/ video clips/ photographs of various types of Track machine on Railway	1
1.6	Hands on: Pre & Post tamping activities, Attention during Track-Machine tamping	4

TOPIC	TOPIC DETAILS	PDS
	PART – IX LEVEL CROSSINGS	**10**
1.1	Classification of Level Crossing, Equipment at LC.	2
1.2	Visibility at LC, Speed breakers, Road sign boards and W/L boards at level crossings, Location of various LC Boards.	1
1.3	Introduction to working of gateman, competency, Refresher & medical Examination.	1
1.4	Action during Gate failures, Height Gauge damage, Breakdown of vehicle at LC	1
1.5	Technical films/ video clips/ photographs showing operation of Level Crossing and its components.	1
1.6	Hands on: Visit to nearest level crossing	4
	PART – X PATROLLING OF TRACK (Ch-X of IRPWM)	**16**
1.1	Types of Patrolling	2
1.2	Duties of Patrolman, Equipment of patrolman. Reporting of unusual. Understanding of patrol chart and diary.	2
1.3	Action to be taken during emergency by Patrolman.	1
1.4	Duties of Stationary watchman at vulnerable location	1
1.5	Hands on: rainfall reading with rain gauge	2
1.6	Hands on: Patrolling Duty	8
	PART – XI RAIL DOLLY/TROLLEY/DIP LORRY WORKING	**15**
1.1	Working of Trolley, Lorry and Rail dolly.	2
1.2	Technical films/ video clips/ photographs on working of Rail Dolly/Dip Lorry.	1
1.3	Hands on: working of Trolley, Lorry, Rail dolly and Protection	4
1.4	Tutorial on preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order, etc.	8
	PART – XII BASICS OF SIGNALLING & PROTECTION OF TRACK	**13**
1.1	Various types of Signals& Their Aspects	2
1.2	Station limit, block sections, different types of territory (absolute/auto-matic).	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1
1.4	Protection during short duration/long duration works.	2
1.5	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	2
1.6	Hands on for Fixing of Indicator Boards at Work site	4
1.7	Training on disaster management including fire safety.	1
	PART – XIII ESTABLISHMENT MATTER	**5**
1.1	Leave & Pass Rules	1
1.2	DAR	1
1.3	HOER	1

T-9 contd.....

TOPIC	TOPIC DETAILS	PDS
1.4	Avenues of career progression in Railways	1
1.5	Introduction to Civil defense organization in Railways	1
	PART – XIV FIRSTAID	**4**
1.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	4
	PART – XV MISCELLANEOUS	**4**
1	Exam, Viva-Voce, Reporting/Relieving etc.	4
2	Self-development (physical & emotional)	
2.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).	
2.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**240**
	NOTE: 30 days= 30 x 8 pds = 240 pds of 45mins each	

	SUMMARY	
A	CLASSROOM LECTURES	95
B	TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS	6
C	FIELD VISITS	12
D	HANDS ON	113
E	MODEL ROOM	2
F	TUTORIAL	8
G	MISCELLANEOUS	4
	GRAND TOTAL	240

T-9 contd.....

Details of Model Room, Technical Film, Field Visits, Hands on, Tutorials

S. No.	TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS	PERIODS
V/ 1.15	Technical films/ video clips/ photographs showing maintenance activities.	1
V/1.22	Technical film/ video clips/ photographs on use of weld trimmers &Grinders, chamfering machine, rail cutting, rail drilling impact winch for bolt tightening, toe load measurements.	2
VIII/1.5	Technical films/ video clips/ photographs of various types of Track machine on Railway	1
IX/1.5	Technical films/ video clips/ photographs showing operation of Level Crossing and its components.	1
XI/1.2	Technical films/ video clips/ photographs on working of Rail Dolly/Dip Lorry.	1
	FIELD VISITS	
II/1.10	Field visit for demonstration of various safety drills.	4
III/ 1.6	Field visit for showing items mentioned at 1.5 above.	8
	HANDS ON	
II/1.8	Hands on: Repairs to Trolley Refuges/ Man refuges	4
II/1.9	Hands on: Exchange of hand signals. Fixing detonators	4
III/1.8	Hands on Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	4
IV/1.2	Hands on: Lubrication of Rail Joints	4
IV/ 1.6	Hands on: Lubrication of ERC, Curves, Turnouts, SEJ.	6
V/ 1.2	Hands on: Manual through packing.	8
V/1.4	Hands on: Systematic Overhauling	4
V/ 1.8	Hands on Repair & maintenance of Small Track machines, troubleshooting of Small Track machines.	4
V/ 1.9	Hands on training for operation of small Track Machines including weld trimmer, grinder, rail cutting, hole drilling, chamfering, etc.	4

S. No.	HANDS ON	PERIODS
V/1.16	Hands on: Casual rail renewal	4
V/1.17	Hands on: Casual sleeper renewal	4
V/1.18	Hands on: Measurement of Gauge, cross level, check rail clearance, Versine, cant.	2
V/1.19	Hands on: Change of crossing and switches in yards.	4
V/1.21	Hands on: Assisting in welding of rail joint.	4
V/1.23	Hands on: Maintenance in electrified territories: precautions involved during maintenance of track circuited sections, Felling/ Cutting/ Pruning of trees close to OHE	2
VI/1.3	Hands on: Measurement of Rail temperature	1
VI/1.8	Hands on : for attending emergency repair of rail/weld fracture	4
VI/1.12	Hands on: Cold / hot weather patrolling, monsoon patrolling.	8
VII/1.3	Hands on: Attending rail/ weld failures, Protection of Defective Rail/Weld	4
VIII/1.4	Hands on: Ballast train/ EUR unloading.	8
VIII/1.6	Hands on: pre & post tamping activities, attention during Machine tamping	4
IX/1.6	Hands on: Visit to nearest level crossing	4
X/1.5	Hands on: rainfall reading with rain gauge	2
X/1.6	Hands on: Patrolling Duty	8
XI/1.3	Hands on: working of trolly, lorry, rail dolly and Protection	4
XII/1.6	Hands on for Fixing of Indicator Boards at Work site	4
	MODEL ROOM	
III/ 1.5	Model room showing different types of rail, sleepers, e lastic fastenings, SEJ, Glued joint, block joint, points and crossing.	2
	TUTORIAL	
XI/1.4	Tutorial on preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order, etc.	8

REFRESHER COURSE (TRACK MAINTAINER) (T-10)
DURATION: 6 DAYS

TOPIC	TOPIC DETAILS	PDS
	PART- I INTRODUCTION	**1**
1.1	Duties & Responsibilities of Track-Maintainer (IRPWM Para 149).	1
	PART- II PERSONAL SAFETY	**6**
1.1	Precaution during work on running lines, routine maintenance activity, handling/ transporting materials.	1
1.2	Precaution during Track machine working, working on sharp curves/ curves with poor visibility, working at accident spots, congested locations like bridge, tunnel.	2
1.3	Precautions in Track-circuited areas, Electrified areas.	1
1.4	Precaution while working in Ghat sections.	1
1.5	Precaution while working during heavy rain, Precautions during night working.	1
	PART- III LUBRICATION OF RAIL JOINTS	**2**
1.1	Hands on : Lubrication of Rail Joints (IRPWM Para 241), Lubrication of gauge face of outer rail on Curves, Turnouts, SEJ etc. Hands on: Greasing of ERCs, sealing of liners, Painting of Rails and Welds.	2
	PART- IV TRACK MAINTENANCE ACTIVITIES	**9**
1.1	Hands on: Through Packing, Slack Picking, Systematic Overhauling of Track, Observance of Sleepers under passage of Traffic(IRPWM Para 230), Observance of train for seized bearings/hot axles, hanging parts of rolling stock.	2
1.2	Hands on: attention to points &Crossings	2
1.3	Introduction to Small Track Machines. Handling &Safe operation of Small Track Machines required specially during rail welding.	1
1.4	Technical Film/ Video Clip/ Photographs on use of weld trimmers &Grinders, chamfering machine, rail cutting, rail drilling impact winch for bolt tightening, toe load measurements	1
1.5	Attention to SEJ, Glued Joints, insulated block joints.	1
1.6	Technical Film on maintenance of concrete sleeper track and discussions.	2
	PART- V LONG AND SHORT WELDED RAILS (LWR/SWR)	**7**
1.1	Introduction to LWR/SWR track.	1
1.2	Rail temperature: types of rail thermometer, measurement of temperature, permitted temperature limits for carrying out various maintenance operations.	1
1.3	Do's and Don'ts for LWR and SWR track.	1
1.4	Hot and cold weather patrolling	1
1.5	Action to be taken in case of rail/weld failures & buckling	1
1.6	Different types of SEJ, De-stressing of LWR.	2
	PART- VI RAIL FRACTURES AND WELD FAILURES	**2**
1.1	Introduction to Rail/ weld failures.	1
1.2	Marking of USFD Flaws, Action for protection / removal of defective welds/rails	1
	PART- VII TRACK RENEWALS	**3**
1.1	Deep Screening (IRPWM Para 238), Lifting/Lowering of track (IRPWM Para 233/234).	2
1.2	Working of Ballast Train / DMT working	1
	PART- VIII LEVEL CROSSINGS	**3**
1.1	Classification of Level Crossing, Equipment at LC.	1
1.2	Visibility at LC, speed breakers, road sign boards and W/L boards at level crossings, Location of various LC Boards.	1
1.3	Duties of gatekeeper & action during gate failures, Height Gauge damage, Breakdown of vehicle at LC	1
	PART- IX PATROLLING OF TRACK	**4**
1.1	Types of Patrolling	1
1.2	Duties of Patrolman, Equipment of patrolman, Reporting of unusual, Understanding of patrol chart and diary.	1
1.3	Action to be taken during emergency by patrolman.	1
1.4	Duties of Stationary watchman at vulnerable location	1
	PART- X RAIL DOLLY/TROLLEY/DIP LORRY WORKING	**3**
1.1	Working of Trolley, Lorry and Rail dolly.	1
1.2	Tutorial on preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order etc.	2
	PART- XI BASICS OF SIGNALLING & PROTECTION OF TRACK	**3**
1.1	Various types of signals& Their Aspects Station limit, block sections, different types of territory (absolute/automatic).	1
1.2	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters, during short duration/long duration works etc.	1
1.3	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	1
	PART- XII FIRST 4AID	**2**
1.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	2

T-10 contd.....

TOPIC	TOPIC DETAILS	PDS
	PART- XIII MISCELLANEOUS	**3**
1	Reporting, Valedictory, Exam, Viva-Voce, etc.	3
2	Self-development (Physical & Emotional)	
2.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8 am).	
2.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).	
	Grand Total	**48**
	NOTE: Total 6 days = 6 x 8 pds = 48 periods of 45mins each	





INITIAL COURSE ULTRASONIC TESTING OF RAILS & WELDS AT RDSO (T-11)
DURATION OF COURSE: 20 DAYS

TOPIC	TOPIC DETAILS	PDS
1	Inauguration and bio data filling	3
2	Various NDT methods, their principal and application.	3
3	Acoustics, sub-sonic, sonic and ultrasonic waves and their industrial applications, ultrasonic for non- destructive testing and ultrasonic spectrum.	3
4	Ultrasonic waves, mechanical waves through an elastic body, parameter of a wave, definition and units of wave parameters, decibel, wave-length and dimension of a given flaw.	
5	Ultrasonic waves-longitudinal, transverse and surface waves.	
6	Properties of sound wave-reflection, refraction, diffraction, absorption and scattering, acoustic impedance & use of couplant.	3
7	Transmission of ultrasonic waves from one medium to another at a normal incidence and at an angle to the boundary. Mode conversion, Snell's Law, Critical angles, calculation of wedge angle for angular probe	
8	Piezo-electric transducer, piezo-electric effect, properties and design of quartz crystal, barium titanate Lithium, sulphate, Lead meta niobate, PZT.	3
9	Familiarization with different control keys of UFD machine of different firms.	3
10	Principles, application and testing of pulse echo reflection method. Phased array and EMAT Techniques. Introduction of Vehicular USFD System, Method of reporting of defects by Vehicular USFD system	3
11	Horizontal scale calibration of USFD using SC & DC Probes- classroom emo.	3
12	Hands on: Horizontal scale calibration of UFD for different ranges.	3
13	Probes used in ultrasonic testing, normal probes, angle probes, calibration and checking of probes.	3
14	Hands on: Horizontal scale calibration of UFD for shear waves.	3
15	Hands on: Characteristics checking of UFD and probes.	6
16	Need based concept of testing.	2
17	Block diagram of a flaw detector principles and working of different parts.	2
18	Hands on: Sensitivity setting of UFD for UST of rails and Welds.	3
19	Important characteristics of ultrasonic flaw detector & how to check	4
20	Hands on: Ultrasonic testing of rail on track.	6
21	Ultrasonic testing of Rails, calibration and sensitivity setting, Function of probes.	2
22	UST of AT Welded rail joints of normal gap	2
23	UST of FB welded rail joints	1
24	Hands on: UST of AT Welded rail joints of normal gap.	6
25	Criteria for defect classification of rails & welds & action to Be taken for IMR/OBS/DFWO & DFWR	3
26	Frequency of testing of Rails, AT, FB, Wide gap & Gas pressure joints.	2
27	Ultrasonic testing of SEJ, improved SEJ.	1
28	Hands on: SEJ and Improved SEJ	6
29	Rail metallurgy and rail defects.	2
30	Hands on: Limitations of USFD in practical- demo through fracture pieces	3
31	Limitations of USFD.	
32	Hands on: UST of turn out (tongue rail & stock rail)	3
33	Hands on B-Scan practical	4
34	Theory for B-Scan in USFD	3
35	Rate of propagation of defect, marking and action for Gauge Corner Cracking (GCC), functional difference in USFD M/c o1 different firms.	1
36	Detail study of all correction slips.	2
37	Hands on: Case Study with actual defects & case study when flaws could not be detected in UST but fracture took place.	2
38	Exam and Viva - voce	11
39	Valedictory	6
40	Weekly revision, mid-term test	3
41	Practical Revision	5
42	Field Visit	6
42.1	Testing of Rail	
42.2	Testing of AT & FB welds	
42.3	Testing of T/O and SEJ	
	Total	**130**

	SUMMARY	
1	**Class room (Theoretical)**	**78**
2	**Practical (Hands on)**	**46**
3	**Field visit**	**6**
	Total	**130**

REFRESHER COURSE ULTRASONIC TESTING OF RAILS & WELDS AT RDSO (T-12)
DURATION OF COURSE: 5 DAYS

TOPIC	TOPIC DETAILS	PDS
1	Inauguration and bio data filling	2
2	Rail metallurgy, rail specification and defects in rails.	2
3	Re-capitulation on different methods of NDT	1
4	Re-capitulation of basic fundamentals of ultrasonic waves.	3
5	Assessment of ultrasonic Flaw detector & probes.	3
6	Panel discussion on problems related to UST of rails & welds and equipment	4
7	Latest development in UST of rails and welds	4
8	Practical demonstration techniques/equipment (Hands on)	5
9	Case Study with actual defects (Hands on)	2
10	Exam and Viva - voce	3
11	Valedictory	1
	Total	**30**

	SUMMARY	
1	**Class room (Theoretical)**	**25**
2	**Practical (Hands on)**	**5**
	Total	**30**

WELDER INDUCTION COURSE (TW-1) (T-13)

DURATION OF COURSE: 11 DAYS

TOPIC	TOPIC DETAILS	PDS
	Part 1 : Introduction (Day-1)	**08**
1.1	Brief instruction & Biodata of Trainees	01
1.2	Different Types of rails, different UTS rails, permissible wear limit of SH & new rail. Selection of rails for welding. Precautions while selecting old rails for welding.	01
1.3	Introduction to various welding equipment, weld trimmer, weld profile grinder, pre heating equipment, abrasive rail cutting m/c, Rail tensor etc.	02
1.4	Introduction to various welding materials used for welding, welding portion, mould, single shot crucible, auto thimble, luting sand etc. Regarding ingredients of Portion & their function in reaction along with technique of Preheating	02
1.5	Hands On - Selection of rails for welding.	02
	Part – II : Procedure of Thermit Welding. (Day-2)	**24**
I.I	Technical film/video/photograph on AT welding including principle and benefit of AT welding.	02
1.2	Preparation before welding Cutting of rail end, elimination of bolt hole & heat affected zone, checking squareness of joints, vertical and lateral alignment, measurement of gap, tolerances of rail end and rail joints before welding, cleaning of rail ends, checks to be carried out of by welder before welding. In a checklist form it should be explained.	02
1.3	Hands on: Check to be carried out for apparatus & consumables by welder before welding to be explained Preparation before welding as per 1.2.	04
1.4	Preparation during welding (Day-3)	
	Selection of welding portion and three piece mould, fixing of mould and mould shoes, sealing with luting sand, auto thimble, single shot crucible, re-checking alignment, checking of gap, pre-heating of rail, pre-heating time and pressure for various pre-heating equipment i.e. Air petrol, Compress air petrol and Oxy- LPG mixed, measurement of pre- heating time and pressure, reaction time, tapping and mould waiting time, trimming with hydraulic weld trimmer.	04
1.5	Hands on: Welding equipment and materials as per 1.4	04
1.6	Activities after welding (Day-4)	
	Grinding of weld with profile grinder, cutting and grinding of riser, clearing of site, re-spacing of sleepers and packing etc. protection of weld by joggle fish plate and wooden block, checking tolerances after grinding, visual inspection.	02
1.7	Hands on : Activities as per 1.6	06

TOPIC	TOPIC DETAILS	PDS
	Part – III : Practical session (Day-5)	**16**
1.1	Practical demo of AT welding complete procedure from preparation of rail to final grinding for normal gap.	04
1.2	Practical demo of AT welding -complete procedure from preparation of rail to final grinding for	04
1.3	Hands-on - Execution of AT welding normal gap welding by trainees. (Day-6 Sat 0.5 day)	04
1.4	Hands-on - Execution of AT welding wide gap welding by trainees.	
1.5	Hands-on - Execution of At Welding for combination joint welding by trainees.(Day-7)	04
	Part - IV - Handling & storage of welding equipment & material	**04**
1.1	Packing condition , Storage & handling of Portions	02
1.2	Use of STM for welding including repairs, maintenance and up keep.	02
	Part V - Defects in weld - causes & eliminations. (Day-8)	**08**
1.1	Various welding defects, causes of defects (due to portion manufacturing defect, during execution and internal defect), precautions to be taken during welding to avoid weld defects. Maintenance of welding recorded	02
1.2	Various Tests on weld -USFD, Hardness & Load Deflection and breaking of Welds etc.	04
1.3	Dos & Don'ts of AT welding	02
	Part VI - Safety & Protection of Track. (Day-9)	**08**
1.1	Track Protection & Personal Safety, Dos and Don'ts use of safety equipment. Safe working in electrified and track circuited territory	02
1.2	Hands on - Demonstration of various safety drills including exchange of hand signals & protection of track.	04
1.3	Technical film/video/photograph on Track Protection & safety.	02
	Part VII – Certification on competency	**20**
1.1	Hands On - Execution of AT Welding by trainees & discussion. (Day-10)	08
1.2	Hands On -Lab Testing on executed weld & discussion. (Day-11)	08
1.3	Interview and checking working performance of trainees. (Day-12) Sat. ½ DAY	04
1.4	Discussion on field Problems and their Solutions.	
1.5	Feedback & issue of provisional/final/revalidation of Competency Certificate.(* Competency certificate will be issued only after successful completion of three AT weld personally by Each Trainee)	
	TOTAL	**88**

WELDER REFRESHER COURSE (TW-2) (T-14)

DURATION OF COURSE: 6 DAYS

TOPIC	TOPIC DETAILS	PDS
	Part-I: Introduction (Day-1)	**06**
I.I	Brief instruction & Bio-data of trainees.	01
1.2	Different Types of rails, different UTS rails, permissible wear limit of SH & new rail. Selection of rails for welding. Precautions while selecting old rails for welding.	01
1.3	Introduction to various welding equipment, weld trimmer,weld profile grinder, pre heating equipment, abrasive rail cutting m/c, Rail tensor etc.	01
1.4	Introduction to various welding materials used for welding, welding portion, mould, single shot crucible, auto thimble, luting sand etc.	01
1.5	Hands On - Selection of rails for welding.	02
	Part- II: Procedure of Thermit Welding.	06
1.1	Preparation before welding	
	Cutting of rail end, elimination of bolt hole & heat affected zone, checking squareness of joints, vertical and lateral alignment, measurement of gap, tolerances of rail end and rail joints before welding, cleaning of rail ends, checks to be carried out of by welder before welding. In a checklist form it should be explained.	02
1.2	Preparation during welding (Day-2)	
	Selection of welding portion and three piece mould, fixing of mould and mould shoes, sealing with luting sand, auto thimble, single shot crucible, re-checking alignment, checking of gap, pre-heating of rail, pre- heating time and pressure for various pre-heating equipment i.e. Air petrol, Compress air petrol and Oxy-LPG mixed, measurement of pre-heating time and pressure, reaction time, tapping and mould waiting time, trimming with hydraulic weld trimmer.	02
1.3	Activities after welding	
	Grinding of weld with profile grinder, cutting and grinding of riser, clearing of site, re-spacing of sleepers and packing etc. protection of weld by joggle fish plate and wooden block, checking tolerances after grinding, visually inspection.	02
	Part - III - Practical session	**12**
1.1	Hands-on - Execution of AT welding normal gap welding by trainees.	04
1.2	Hands-on - Execution of AT welding wide gap welding by trainees. (Day-3)	04
1.3	Hands-on - Execution of At Welding for Combination joint welding by trainees .	04

TOPIC	TOPIC DETAILS	PDS
	Part - IV - Handling & storage of welding equipment & material (Day-4)	**02**
1.1	Packing condition. Storage & handling of Portions	01
1.2	Use of STM for welding including repairs, maintenance and up keep.	01
	Part V - Defects in weld - causes & eliminations.	**04**
1.1	Various welding defects , causes of defects (due to portion manufacturing defect. During execution and internal defect), precautions to be taken during welding to avoid weld defects. Maintenance of welding records.	02
1.2	Various Tests on weld - USFD, Hardness & Load Deflection and breaking of Welds etc.	02
1.3	Dos & Don' ts of AT welding	01
	Part VI-Safety & Protection of Track.	**01**
1.1	Track Protection & Personal Safety, Dos and Don'ts use of safety equipment's. Safe working in electrified and track circuited territory	01
	Part VII - Certification on competency (Day-5)	14
1.1	Hands On - Execution of AT welding by trainees & discussion.	04
1.2	Hands On -Lab Testing on executed weld & discussion.	04
1.3	Interview and checking working performance of trainees. (Day-6)	02
1.4	Discussion on field Problems and their Solutions.	02
1.5	Feedback & issue of provisional/final/revalidation of Competency Certificate.(* Competency certificate will be issued only after successful completion of three AT weld personally by Each Trainee)	
	TOTAL	**44**

Note: Saturday is half day working in TPP/LKO . So on 6th day full day syllabus shall be covered in first four period.

INDUCTION COURSE (TW-3) WELDING SUPERVISOR (SSE/JE PWAY) (T-15)

DURATION OF COURSE: 6 DAYS

TOPIC	TOPIC DETAILS	PDS
	Part -I : Introduction (Day-1)	**08**
1.1	Brief instruction & Bio-data of trainees.	01
1.2	Different Types of rails, different UTS rails, permissible wear limit of SH & new rail. Selection of rails for welding. Precautions while selecting old rails for welding.	01
1.3	Introduction to various welding equipment, weld trimmer, weld profile grinder, pre heating equipment, abrasive rail cutting m/c, Rail tensor etc. cutting m/c, Rail tensor etc.	03
1.4	Introduction to various welding materials used for welding, welding portion, mould, single shot crucible, auto thimble, luting sand etc.	02
1.5	Hands On - Selection of rails for welding.	02
	Part-II: Procedure of Thermit Welding. (Day-2)	**16**
1.1	Technical film/video/photograph on AT welding including principle and benefit of AT welding.	02
1.2	Preparation before welding	
	Cutting of rail end, elimination of bolt hole & heat affected zone, checking squareness of joints , vertical and lateral alignment, measurement of gap, tolerances of rail end and rail joints before welding, cleaning of rail ends. Estimation of correct length.	03
1.3	Hands on: Preparation before welding as per 1.2.	03
1.4	Preparation during welding (Day-3)	
	Selection of welding portion and three piece mould, fixing of mould and mould shoes, sealing with luting sand, auto thimble, single shot crucible, re-checking alignment, checking of gap, pre-heating of rail, pre-heating time and pressure for various pre-heating equipment i.e. Air petrol, Compress air petrol and Oxy-LPG mixed, measurement of pre-heating time and pressure, reaction time, tapping and mould waiting time, trimming with hydraulic weld trimmer.	03
1.5	Activities after welding	
	Grinding of weld with profile grinder, cutting and grinding of riser, clearing of site, re-spacing of sleepers and packing etc. protection of weld by joggle fish plate and wooden block, checking tolerances after grinding, visual inspection. Equalisation of stress. Equalization of stress(partial distressing)	03
1.6	Hands on: Welding equipment and materials as per I .4 and 1.5	02
	Part - III - Practical session (Day-4)	**08**
1.1	Hands-on - Execution of AT welding normal gap welding by trainees.	04
1.2	Hands-on - Execution of AT welding for combination Joint and Wide gap welding by trainees	04

TOPIC	TOPIC DETAILS	PDS
	Part - IV - Handling & storage of welding equipment & material	02
1.1	Packing condition, Storage & handling of Portions	01
1.2	Use of STM for welding including repairs, maintenance and up keep	01
	Part V - Defects in weld - causes & eliminations. (Day-5)	**06**
1.1	Various welding defects, causes of defects (due to portio n manufacturing defect, during execution and internal defect), precautions to be taken during welding to avoid weld defects. Maintenance of welding records.	02
1.2	Various Tests on weld - USFD, Hardness & Load Deflection and breaking of Welds etc.	02
1.3	Dos & Don'ts of AT welding	02
	Part VI - Safety & Protection of Track. (Day-6)	**01**
1.1	Track Protection & Personal Safety, Dos and Dont's use of safety equipment's. Safe working in electrified and track circuited territory	01
	Part VII - Certification on competency	03
1.1	Hands On -Lab Testing on executed weld & discussion.	03
1.2	Discussion on field Problems and their Solutions.	
1.3	Feedback & issue of provisional Competency Certificate.	
	TOTAL	**44**

TRACK MACHINE

INDUCTION COURSE FOR SSE/JE/TM (TM-1)
DURATION: 6 MONTHS

S.No.	Type of Training	Place of Training	Duration	Remarks
1	Induction PH-I	Training institute at IRTMTC/ALD	26 weeks (6 months)	**Detailed training program as per TM-1** 1 Introduction to Railway Organisation & P.Way and Track Machines (Type of Machines, functions and Utility) on IR. 2 Electrical & Electronics 3 Hydraulics, Pneumatics & Mechanical 4 I.C. Engine & Workshop Technology 5 Track Machines & working Principle 6 Establishment, Stores, Accounts & Rajbhasha 7 Group Inter Personal Skill Development 8 Computer 9 Visit to CPOH & Track Machines Working Sites
2	Induction PH-II	Training in field / ZRTI	26 weeks (6 months)	**Training will be given at Zonal Railway** 1. Transportation training in train working rules as per ZRTI module 2. On Job training
Total			**1 YEAR**	



INDUCTION COURSE FOR SSE/JE/TM (TM-1)

DURATION: 26 WEEK (6 MONTH)

TOPIC	TOPIC DETAILS	PDS
PART-I Introduction to Railway Organisation & P.Way and Track Machines (Type of Machines, functions and Utility) on IR.		**68**
1.1	**Introduction to Railway Organization** History of Railways, Zonal Railways, Divisions, Production units. TT Organization on Indian railways, Organization at headquarters and Divisional levels, CPOH and Bridge Workshop.	4
1.2	**Railway Track** Constituents of Railway Track. Requirements of Good Railway Track, Classification of Routes. Different Gauges.	2
1.3	**Formation** Formations in Embankment and Cutting.	2
1.4	**Rails** Functions, Types & Standard Rail Section. Standard length, Rolling marks & UTS.	2
1.5	**Sleepers** Functions, Types & Sleeper Density, Requirements of PRC sleepers-their advantages and disadvantages.	2
1.6	**Fastenings** Rail to Rail fastenings and Rail to Sleeper fastenings.	2
1.7	**Ballast** Functions & Specifications and profile	2
1.8	**Points & Crossings** Functions & Important terminology. Constituents of Turnout and Types of switches and crossing, Switch Angle, Flange way clearance, Heel divergence, Throw of switch. Types of Crossings, Crossing number & Main constituents of Built-up Crossing. Standard Turnouts & permissible speed. Position of Sleepers at Points & Xing Yard Visit	12
1.9	**Welding of Rails and LWR** Evil effects of Rail joints. Different types of welding, Development of Welded rails, Welding Terminology, Theory of Welded rails, Thermal forces in LWR, Permitted locations of LWR/CWR, Different Temperature Zones, De-stressing. Yard visit	10
1.10	**Track Renewal** Classification of Track Renewals and factors governing rail renewal	2
1.11	**Maintenance of Track** General Instructions as contained in IRPWM. Provisions on Regular Track Maintenance as contained in IRPWM. Provisions on Works incidental to Regular Track Maintenance with thrust on Deep Screening. Provisions on Maintenance of Track in Track. Circuited in Areas as contained in IRPWM. Provisions on Maintenance of Track in Electrified Areas as contained in IRPWM & Precautions during Machine working.	6
1.12	**Engineering Restrictions & Indicators** Categories of Engineering Works, Engineering Fixed Signals /Indicators: Temporary and Permanent Emergency Protection of track: Single Line & Double Line, Detonators & Flare Signals.	4
1.13	**Curves** Necessity of curves: their types, TTP, CTP & Transition lengths. Radius, Degree, Versine & field measurement Super-elevation: Cant deficiency, Cant excess, Cant gradient, Equilibrium cant. Negative Super-elevation, Gauge widening. Safe Speed on Curves. Field visit.	10
1.14	**Track Tolerances** Different Track Parameters and their Service tolerances. Different Track Parameters and their service tolerances. Different Schedules, Standard Dimensions, Loading Gauge, ODC. Introduction to various track machines	8

TM-1 contd.....

TOPIC	TOPIC DETAILS	PDS
PART-II ELECTRICAL & ELECTRONICS SYSTEM		**150**
1.1	**Fundamentals of Electricity** Symbols, Basic Concept of voltage and current, Ohm's law, Power law	2
1.2	**Electrical Components** Resistor: Definition, Unit, Symbol, Power Rating, Tolerance, Types Resistor: Colour coding, Combination, Application, Faults & Troubleshooting Capacitor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting Inductor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting Electronics Model Room for demonstration, checking of Resistor, Capacitor and Inductor	10
1.3	**Auto Electrical** Battery: Definition of Cell & Battery, Types, Rating, Specific Gravity, Construction Working of Lead-acid Cell & Battery. Maintenance, Testing by Hydrometer and Load tester Alternator, Regulator, Construction, Working, Maintenance and Trouble- shooting Self starter: Construction, Working, Maintenance and Troubleshooting Relay: Definition, Construction & Operation, Types, Pin diagrams, Testing Electronics Model Room for demonstration, checking and testing of Relays Engine Circuit: Description, Function and Types Working, Safety Components, Faults & Troubleshooting Z.F. Circuit: Description, Working, Safety Components, Sensors, Faults & Troubleshooting Lighting circuits of different machines, Safety and warning circuits of different machines and Locking and unlocking Circuit	18
1.4	**Fundamentals of Electronics** Electronics Symbols and Nomenclatures Fundamentals of Electronics and Applications, Active components &Passive components	4
1.5	**Semiconductor Theory** Difference between Conductor, Semiconductor & Insulator. Properties of Semiconductor, Covalent Bonds, Energy Bands, Types of semiconductor, i.e. Intrinsic, extrinsic, (P-Type, N-Type)	2
1.6	**Semiconductor Diode** Semiconductor Diode: Construction Working, Forward bias and Reverse bias, V-I Characteristics of P.N. Junction Application of P.N. Junction Diode as Rectifier - Half wave & Full wave Rectifiers (Centre Tap and Bridge Rectifier), Polarity, Protection Device Types of Diodes, Construction, Working Symbol and Application of Zenor Diode, LED, Photo Diode, Optocoupler.	6
1.7	**Transistor** Transistor, Construction, Description of Terminals, NPN & PNP-Transistor Mode of Connections, Amplifying function, Applications as Switch and Amplifier, Testing Electronics Model Room for demonstration, checking and testing of Diodes and Transistors.	6
1.8	**Transducer** Definition, Principle, Classification, Types, Tamping Depth Transducer, Function and Calibration Lining and Measuring Transducer, Satellite Transducer, Hook Transducer. Pendulum, Height Transducer, Encoder. Electronics model room for demonstration of checking and calibration of Transducers.	8
1.9	**Operational Amplifier** Definition of Operational Amplifier, Symbol, Function of each terminal, Open loop, Close loop, +ve feed back, –ve feedback, Characteristics Application of Operational Amplifier as Buffer, Inverter, Non Inverter, Adder, Sub- tractor, Integrator etc. Operational Amplifier ICs used in different PCBs in machines and their Pin diagrams Electronics Model Room for demonstration of working of Operational Amplifiers in different applications	8
1.10	**Digital Electronics** Number system i.e. Binary, Decimal, Hexadecimal, Logic Gates and Flip-Flop Electronics model room for demonstration of working of Logic Gates Basic Idea of Microprocessor, Semiconductor memories, Multiplexer	6
1.11	**Electronic Circuits and PCBs:** Discrete Circuit & Integrated Circuit, Advantage & Disadvantage of PCBs used in different machines, Description, Name Quantity and their Functions. Data sender and data receiver PCB.	2
1.12	**Power Supply:** Need of Power supply, Types of power supply, DC to DC Converter & Regulator Functional description of Power supply PCBs EK813SV, EK 812 SV, EK816SV,EK819SV,EK851SV Calibration, Testing &Troubleshooting Electronics Model Room for demonstration, checking and calibration of PCB EK813SV	6

TOPIC	TOPIC DETAILS	PDS
1.13	**Programmer unit and Logic Plan.** Function and Description of Programmer Unit, Description of different PCBs of Programmer Unit i.e. EK 501P, EK553P Description of EK552P, EK554P, Different Parts of Logic Plan Electronics Model Room for demonstration, checking and testing of Programmer unit Reading of Logic Plan and Input & Output of Programmer with the help of Logic Plan Electronics Model Room for demonstration of Logic Plan	10
1.14	**Multi-check/Multiplexer PCB** Description of Multi-check PCB EK28V&EK 207V, Different measurements taken by Multi-check PCB. Electronics Model Room for demonstration of Multi-check PCB	4
1.15	**Tamping Unit Control Circuit VPR/DUO/CSM/3X and 3x dynamic/Unimat** Functional Description of Tamping Unit Control Circuit, Function and Calibration of Depth Selector and Depth Transducer Different Positions of Tamping Unit & their Description, Current of Proportional valve Functional Description of Tamping Unit control PCBs EK16V, EK132V Functional Description of Tamping Unit Control PCBs EK176V, EK1AP7 Calibration, Testing and Troubleshooting Electronics Model Room for demonstration, testing and calibration of Tamping unit PCB	12
1.16	**Lining Control Circuit, VPR/DUO/CSM/3X and3x dynamic/Unimat** Functional Description of Lining Control Circuit and Input Potentiometer (Slew & Versine) Functional Description of Lining PCBEK349LV, K335LV, Basic concept of 3 Point Regulator / 3 Stage Regulator Functional Description of EK2038, EK2173and Over-slew PCB EK290LV Calibration of Servo Valve, Transducers &Input Potentiometer. Calibration of Lining PCBs and Troubleshooting	10
1.17	**Front Input Circuit:** Functional Description of Front Input Circuit, Front Input Potentiometer, Slew, Versine, General Lift etc. Basic idea of ALC, GVA and Laser Lining	4
1.18	**VPR/DUO/CSM/3X and 3x dynamic /Unimat** Functional description of Front Input PCB EK345LV, EK2072LVetc. Calibration, Troubleshooting & Fault finding	2
1.19	**Leveling & Lifting Control Circuit of VPR/DUO/ CSM/3X and 3x dynamic /Unimat** Functional Description of Leveling & Lifting Control Circuit, Transducers and Input Potentiometers Functional Description of PCB EK347LV&EK346LV Functional Description of PCB EK2041LV,EK2042LV Calibration of Leveling & Lifting, PCBs and Troubleshooting.	8
1.20	**Satellite Control Circuit:** Functional Description of Satellite Control Circuit, Description of different positions of Satellite, Satellite Transducer, PCBs. Functional Description of Satellite Control PCBs EK24V & EK202V. Calibration of Satellite Control, PCB, Troubleshooting & Fault finding.	6
1.21	**Work Drive Control Circuit:** Functional Description of Work Drive Control Circuit, Encoder, PCBELT-5034 Functional Description of Work Drive PCB EK319LV& VT-3005. Calibration of Work Drive PCB, Troubleshooting & Faultfinding	6
1.22	**Hook Control circuit** Functional Description of Hook Control Circuit and Transducer Functional Description of Hook Control PCB EK120V &EK144V Calibration of Hook Control PCB, Troubleshooting & Faultfinding	6
1.23	**Panel Boxes & Cable List** Main Panel Boxes i.e. Working & Engine Panel boxes, Cable List	2
1.24	**Plasser Intelligent Control System (Pics)** Description of Plasser Intelligent Control System (Pics) Electronics Model Room for demonstration and calibration of Plasser Intelligent Control System (Pics)	2

TM-1 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - III HYDRAULICS, PNEUMATICS & MECHANICAL		**148**
1.1	**Fundamentals** Introduction, Pascal's Law, Bernoulli's Theorem, Advantages of Hydraulic system.	2
1.2	**Hydraulic Symbols** Hydraulic Symbols	2
1.3	**Hydraulic Oil** Functions and Properties.	2
1.4	**Hydraulic Tank** Functions and Parts.	2
1.5	**Hydraulic Filter** Functions, Types, Filtering material, Contaminants Control, Importance of filtration.	2
1.6	**Hydraulic Hose and Fitting** Functions, Types, Hose specification: DIN, SAE & EN standards, Hydraulic Fittings, Precautions during mounting Hydraulic Hoses and Fittings.	2
1.7	**Hydraulic Seal and 'O' Ring Hydraulic Pump** Functions, Types, Seals materials, Precautions during providing hydraulic Seals, Causes of Failure. Definition, Functions and Classification, Working and Construction of Vane pump & Gear pump. Working and Construction of Axial Piston Pump. Precautions during mounting, Troubleshooting, Aeration & Cavitation.	2 6
1.8	**Pressure Control Valve** Working and Construction of Relief Valve& Unloader valve, Troubleshooting. Working and Construction of Pressure reducing valve, Sequence valve, Trouble shooting.	 4
1.9	**Direction Control Valve** Function and Types such as Spring centered valves; Spring offset valves, Check valve. Explanation of POC valve, Logic valve. Precautions during mounting, Troubleshooting.	 6
1.10	**Proportional and Servo Valve** Function and Troubleshooting of Proportional Valve. Function and Troubleshooting of Servo Valve.	 4
1.11	**Flow Control Valve** Function, Types and Troubleshooting.	2

TOPIC	TOPIC DETAILS	PDS
1.12	**Accumulator** Functions, Types, Working of Bladder & Diaphragm Type Accumulator, Charging.	2
1.13	**Hydraulic Cylinder** Function, Types and Parts.	2
1.14	**Hydraulic Motor** Definition, Classification, Working of Vane motor and gear motor. Working of Axial Piston motor. Mounting Precautions and Troubleshooting.	 6
1.15	**Heat Exchanger** Function and Maintenance aspects.	2
1.16	**Demonstration of Hydraulic Transparent Models** Hydraulic motors, D.C. Valves, Cylinder, Accumulators, Pressure Gauge etc. Pressure control valves, Flow control valves, Check Valve, Pilot Operated Check Valve etc.	 4
1.17	**Practical Disassembly & Assembly of Hydraulic Components in Model Room** Vane pump and Vane motor. Axial Piston pump. Check valve and POC valve. D.C. valves. Proportional valve. Servo valve. Relief valve and Unloader valve. Pressure reducing valve and Cylinder.	 16
1.18	**Hydraulic Circuits** Constant pressure circuit of 3X and CSM. Constant pressure circuit of Duomatic, WST & VPR Unimat and BCM. Closed loop circuit of 3X and 3x dynamic and CSM. Closed loop circuit of BCM, SBCM, BRM.HOBCM Regenerating circuit of Tamping Machines. Intermittent circuit of Non-tampers.	 12
1.19	**Demonstration of Hydraulic Equipment Sets** Demonstration of Hydraulic circuits using Fluidsim H Software & Work exercises. Demonstration of Hydraulic circuits using Fluidsim H software & Work exercises.	 4
1.20	**Pneumatic Symbols** Pneumatics symbols and Application of air on Track machines.	2

TM-1 contd.....

TOPIC	TOPIC DETAILS	PDS
	Pneumatic Components Working and maintenance of Single stage and Multi stage Air Compressor, Cooling Coil, Safety valve, Air dryer. Working and maintenance of Water separator, Air oiler, DC Valve, KE Valve, Cylinder and Pneumatic hoses.	4
1.21	**Pneumatic Circuits** Pneumatic Working circuits. Pneumatic Brake circuits.	4
1.22	**Trouble shooting** Failure Analysis and Troubleshooting of Pneumatic assemblies.	2
	Demonstration of Pneumatic circuits using Fluidsim P Software & Work exercises.	2
1.23	**Demonstration of Pneumatic Equipment Sets** Demonstration of Pneumatic circuits using Fluidsim P Software & Work exercises.	2
1.24	**Power Transmission** Block Diagram, Types of Power Transmission, Mechanical	
	Transmission, 'V' belt, Chain, Pulley, Cardon Shaft.	2
1.25	**Gear Box and Clutch Assembly in UNO/DUO** Working, Construction and Maintenance practices of Main gear box and Clutch assembly. Working, Construction and Maintenance practices of Reversing gear box and Six speed gear box.	4
1.26	**Distributor Gear Box** Working, Construction and Maintenance practices.	2
1.27	**Driving and Running Axle** Function, Parts and Maintenance aspects, setting of crown & tail pinion.	2
1.28	**Z.F. Hydro- dynamic Gear Box** Function and Construction. Precautions during working and Maintenance aspects. Failure Analysis and Troubleshooting.	6

TOPIC	TOPIC DETAILS	PDS
1.29	**Funk Gear Box** Working, Construction and Maintenance practices.	2
1.30	**Reduction Gear Box** Working, Construction and Maintenance practices.	2
1.31	**Satellite Axle Gear Box** Working, Construction and Maintenance practices. Precautionary steps to avoid failure.	4
1.32	**Tamping Unit** Function and Parts. Precautions during working & repairing. Maintenance schedule. Dimensions of different Parts and Tolerances, setting of bearings and spacers on vibration shaft. Failure Analysis and Troubleshooting.	8
1.33	**Lifting and Lining Unit** Function, assembly and maintenance aspects.	2
1.34	**Bearings** Functions, Types, Bearing Clearance and Maintenance aspects.	2
1.35	**BCM Assemblies** Working, Construction and Maintenance practices of Excavation Chain. Working, Construction and Maintenance practices of Conveyor Belts and Screens.	4
1.36	**Lubrication** Oil and Lubricants used in different gear boxes, Tamping unit, Lifting unit, Screen -drum etc., types and their capacities.	2
1.37	**Maintenance Schedules**	

TOPIC	TOPIC DETAILS	PDS
PART - IV I.C. Engine & Workshop Technology		**160**
1.1	**General** History and Development of Engine, I.C. and E.C. Engine, Advantages and disadvantages. Classification of I.C. Engine and Main Systems of I.C. Engine.	4
1.2	**Constructional Details of Engine** Cylinder, Cylinder head, Piston and Piston rings. Connecting rod, Crank shaft, Fly wheel, Cam shaft and. Sump Inlet and Exhaust valve, Push rod, Rocker arm, Valve clearance, Valve operatingmechanism. Demonstration of Engine componentsinI. C. Engine Model Room.	8
1.3	**Basic Terminology** T.D.C., BDC, Swept volume, Clearance volume, Compression ratio, Stroke length, Cylinder bore.	2
1.4	**Working Principle of I.C. Engine** Working Principle of 4 Stroke Diesel Engine (Dieselcycle). Working Principle of 2 Stroke Diesel Engine and 2 & 4 StrokePetrol Engine(Otto cycle). Demonstration in I.C. Engine Model Room. Combustion of fuel. Actual Working cycle of 4 Stroke Diesel Engine. Deviations between Actual Working cycle and theoretical cycle. Firing orders and VT diagram. Power flow in Multi cylinder engine.	16
1.5	**Air Supply system of Diesel Engine** Requirement of Air, Types of Air cleaner. Cleaning and checking of Dry type Aircleaner. Draw backs of choking of Air Cleaner. Supercharging, Turbocharger and After cooler, Importance of Aftercooling. Demonstration in I.C. Engine Model Room	8
1.6	**Fuel Supply System of Diesel Engine** Functions and classification of Fuel supply system, Block diagram. Fuel Injection Pumps, Injectors and Filters. Mico Bosch and Cummins PT Fuel supply system. Difference between Mico Boschand Cummins PT Fuel supply system. Demonstration in I.C. Engine Model Room Cetaine Number, Octane No., Delay Periodand Knocking of fuel.	

TOPIC	TOPIC DETAILS	PDS
	Drawbacks of keeping low HSD Oil level intank, Removing of Air Lock.	12
1.7	**Lubricating System of Diesel Engine** Concept of lubrication and functions of Lubricating oil, Properties of Lubricant. Oil Additives, Viscosity rating and Lubricating circuit. Different types of Lubricating systems. Oil pump, Relief Valve, Filters, Oil Cooler, Strainer, Oil Pressure Gauge, Oil Pressure Indicating light. Blow bye, Crank case ventilation, Reasons of Low lubricating oil pressure and high Oil consumption. Demonstration in I.C. Engine Model Room.	12
1.8	**Cooling system of Diesel Engine** Necessity of Cooling, Different methods of Engine cooling, Air Cooling system. Water Cooling system. Drawbacks of over cooling and reasons for overheating. Demonstration in I.C. Engine Model Room.	8
1.9	**Maintenance Schedule Maintenance Steps** Maintenance Schedules of Cummins Engine. Maintenance Schedules of Duetz Engine. Maintenance Schedules of MWM Engine. Maintenance Steps to improve Performance. Precautions in providing Piston ring on Piston and assembling in Cylinder liner. Adjustment of Valve (Tappet) clearance. Adjustment of Injection timing and testing of Nozzles. Inspection of Crankshaft. Troubleshooting of Cummins Engine. Trouble Shooting of Duetz & MWM Engine Setting of Torque wrenches, Tightening torque of different engine assemblies, clearance of moving parts. 1 day visit to TM Workshop, PD/MGS.	28
1.10	**M&C Training** Manufacturing of Iron & Steel, Shaping of Metals & Alloys. Classification of Steel on the basis of percentage of Carbon and Micro- constituents of Iron and Steel, Carbon Steel, Alloy Steel & Cast Iron. Physical Metallurgy, Mechanical properties of Cast Iron, Steel & Non Ferrous Alloy.	

TOPIC	TOPIC DETAILS	PDS
	Heat Treatment: Hardening, Tempering Annealing, Normalizing, Case Hardening, Nitriding. Inspection and testing of Materials for property evaluation. Introduction to various standards: IRS, SAE,DIN, ISI, BS etc. and Acceptance Criteria.	12
1.11	**Smithing and Forging** Forging Materials, Heating Devices, Forging Temperatures, Smith Forging Operations. Forging Processes: Hand Forging, Power Forging etc.	4
1.12	**Welding and Related Processes** Types of Welding and Metallurgy of Weld. Gas Welding, Oxy-acetylene and Air-Acetylene Arc Welding and Resistance Welding Related Processes: Soldering, Brazing etc. Procedure for welding of tamping tool and defects in Tamping Tool welding. Welding of BCM turret gears, main links, intermediate links and cutter bar and grinding operation.	12
1.13	**Bench Work and Fitting** Various Tools, their uses and Bench work. Standards of Measurement, Classification of Measuring	2
1.14	**Measurement and Inspection** Instruments and Linear Measurement. Comparators, Measuring Machines, Angular and Taper Measurements. Demonstration in Model Room.	6
1.15	**Limits, Fits and Surface Quality** Interchangeability, Limits, Fits, Allowances, Tolerances and Surface finish.	2
1.16	**Workshop Machines** Lathe Machines, Different Lathe Machines Operations. Drilling and Boring Machines. Shaper and Planner. Slotting and Grinding Machines Milling Machine and Gear Cutting. Press, Jigs & Fixtures. Broaching and Sawing Machine. Workshop visit.	20
1.17	**Threads** Different types of threads.	2
1.18	**Quality Control** Statistical Quality Control, Control Charts and their application.	2



TM-1 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - V TRACK MACHINES & WORKING PRINCIPLES		**148**
1.1	**08-Duomatic/WST/VPR3** Main features, Technical Data, Main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System.	6
1.2	**09-32-CSM** Main features, Technical Data, Main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System.	6
1.3	**08-275-2S UNIMAT** Main features, Technical Data, Main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System.	6
1.4	**08-275-3S UNIMAT &MPT** Main features of machine, Technical Data, main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System. Difference between 2S & 3SUnimat.	6
1.5	**08-275-4S UNIMAT** Main features,Technical Data, Main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System.	6
1.6	**09-3X Tamping Express and 3X Dynamic** Main features, Technical Data, Main assemblies and components. Working Principle and Power Transmission Name of PCBs, their functions and Electrical System.	6
1.7	**BCM: RM-76 and RM-80** Main features main units and their functions. Power Transmission & Technical Data Working Principle & Precaution during work	6
1.8	**BCM: RM-80-92 U and HOBCM** Main features main units and their functions. Power Transmission & Technical Data Working Principle & Precaution during work	6
1.9	**FRM-80 and 85** Main features main units and their functions. Power Transmission & Technical Data Working Principle & Precaution during work	6
1.10	**UTV and RBMV, MDU** Main features main units and their functions. Power Transmission & Technical Data Working Principle & Precaution during work	6
1.11	**B.R.M PBR 400 & Kershaw.** Main features main units and their functions. Power transmission, Technical Data, working principle & precaution during work	4
1.12	**TLE** Main features main units and their functions. Yard Activities, Fabrication of Panels, Rake Formation, Amenities at Base Depot. Working Principle, Auxilliary Track and Mode of working.	6
1.13	**TRT** Main features main units and their functions. Yard activities, Modified BRHs & Rake Formation Working Principle & SRs after relaying.	6
1.14	**T-28** Main features main units and their functions. Power Transmission and Working Principle.	4
1.15	**DTS/DGS 3X-Dynamic Stabiliser** Main features main units and their functions, Technical Data. Power Transmission, Name of PCB's and their function.	4
1.16	**RGM-72** Main features main units and their functions, Technical Data. Power Transmission, Name of PCB's and their function.	4
1.17	**Tamping Machines, DTS** Pre-requisites, Pre-tamping Operations. Operations during tamping and Post tamping Operations.	4
1.18	**BCM, SBCM & BRM** Pre-requisites, Operations prior to deployment, Operations during Traffic Block and Post Block Operations.	2
1.19	**PQRS, TRT & T-28** Pre-requisites, Operations prior to deployment, Operations during Traffic Block and Post Block Operations.	2
1.20	**Tamping Machines** Maintenance schedules of Tamping machines.	2
1.21	**BCM & FRM** Maintenance schedules of RM-76, RM-80, FRM-80, FRM-85 & KSC-600.	2
1.22	**DTS & BRM** Maintenance schedules of DTS & BRM.	2

TOPIC	TOPIC DETAILS	PDS
1.23	**UNIMAT** Maintenance schedule of 08-275 2S & 3S- Unimat.	2
1.24	**Introduction to IRTMM and RDSO TM Reports** Ch 1: Track Machine Organisation & Duties of AEN, SSE, Operator & Technician. Ch 4 & 5: Rules for Movement & Working of track Machines and Planning, Operation & Monitoring of Track Machines, Unit cost. Brief on other Chapters of IRTMM and RDSO TM Reports.	6
1.25	**Lining** Principle of Lining, Single chord system Type of lining i.e. 4 Point & 3 Point lining. Principle of 4 Point lining & Left over error. Calculation of Vm value on Transition Curve, Direction of Toggle switch. Calculation of Vm value for Reverse Curve & non-suitability of 4 Point lining on Straight. Feeding method of Vm value at Reverse and Compound curve. 3 Point lining & Left over error. Calculation of 'V' value for each machine. Method of feeding 'V' value. Design lining, Laser lining and measuring run method. Potentiometers & their calibration.	20
1.26	**Leveling** Types of leveling system, Double chord system. General lift, ramp in & ramp out. Criteria for selection of Base line. Double chord follow up system & fixed chord system, Proportional leveling, Error reduction ratio. Method of feeding of Cant on CSM. Method of feeding of Cant on other machines. Method of Calculation of Correction value ('K' Value), Function of Pendulum- Front, Middle, Rear Pendulum & Twist correction. Method of data feeding on Tamping Machines – Manually and by Computer(ALC) Design leveling and feeding of target height.	18

TOPIC	TOPIC DETAILS	PDS
PART-VI ESTABLISHMENT, ACCOUNTS, STORES & RAJBHASHA		**54**
1.1	**Leave Rules**	
	Various types of Leaves, Eligibility etc.	2
1.2	**Pass Rules**	
	Various types of passes, Eligibility etc.	2
1.3	**P. L. Bonus & GIS**	
	Terms of Payments PLB, GIS Monthly subscription, Payment at retirement.	2
1.4	**Allowances & Overtime**	
	Various Types of Allowances & Eligibility	2
1.5	**P.F.**	
	Meaning, Rate, Withdrawal.	2
1.6	**Pension Rules**	
	Pension Rules.	2
1.7	**DCRG**	
	Amount of DCRG, Emoluments.	2
1.8	**D&A Rules**	
	Minor Penalties.	2
	Major Penalties.	2
1.9	**Service**	
	Explanation and understanding of different	
1.10	**Conduct Rules**	
	Conduct rules.	2
	Manpower Planning & Training Welfare Measures in Railways, PNM, JCM & PREM.	2
1.11	**Objectives and understanding of Various Acts**	
	Minimum Wages Act, Factory Act, Industrial Dispute Act, Contractor Labour Act& Workmen Compensation Act.	2
1.12	**HOER**	
	Classification and Duty roster.	2
1.13	**Awards**	
	Different Awards.	2
1.14	**Estimates**	
	Definition & Necessity of Estimates.	2
	Kinds of Estimates & their Vetting.	2
1.15	**Tenders**	
	Different types oftenders.	2
	Power for Invitation of tenders &NIT.	2
1.16	**Railway Budget**	
	Parliamentary Control over Railway Finance, Public Accountability, Canons of financial Propriety.	2
	Railway Budget, Budgetary Terms, Budgetary Cycle, Demand of Grants, Expenditure classification,Works	2
1.17	**Introduction to Engg. Stores & Inventory Control**	
	Stock heads of Accounts, Disposal of released and surplus materials.	2
	Indenting procedure, Issue note and Write- off statement.	2
	Stock verification and Inventory Control Technique.	2
1.18	**Medical Awareness Programme**	
	Family Welfare, AIDS, Family Management & First Aid.	2
	Stress Management & Disaster Management.	2
1.19	**Rajbhasha**	
	Constitutional Provisions, Official Language Act 1963, Official Language Rules1976.	2
	Policy Guidelines & Instructions.	2

TOPIC	TOPIC DETAILS	PDS
PART-VII GROUP INTER PERSONAL SKILL DEVELOPMENT (GIPSD)		**14**
1.1	**Communication** Communication Skills and Importance in Railway Organization.	2
1.2	**Motivation** Motivation Skills	2
1.3	**Leadership** Types of Leadership & Leadership Skills.	2
1.4	**Inter Personal Relations** Need for Inter Personal Relations in Railway Organization.	2
1.5	**Attitude Building** Importance of Positive Attitude.	2
1.6	**Team Work** Team Work and Team Building.	2
1.7	**Workouts** Exercise on Group Dynamics/other aspects related with development of managerial/work related skills.	2



TOPIC	TOPIC DETAILS	PDS
PART - VIII Computer		**48**
1.1	**Microsoft Office** MS Word MS PowerPoint MS Excell	6
1.2	**Internet & E-mail** Internet & Web-surfing. e-mail & demonstration for making e-mail ID	4
1.3	**Automatic Guide Computer (ALC)** Introduction to Automatic Guide Computer (ALC) & its Hardware. Introduction to Win ALC Software Working in Geometry mode Working in Measuring Run mode Working in Design mode	14
1.4	**CMS** Description of Computer measurement system Electronics Model Room for demonstration and calibration of CMS	10
1.5	**CWS** Description of Computer measurement system Electronics Model Room for demonstration and calibration of CWS	10
1.6	**DRP** Description of Computer measurement system Electronics Model Room for demonstration and calibration of DRP	4



PROMOTION COURSE FOR JE/TM (TM-2)

DURATION: 8 WEEK

S.No.	Type of Training	Place of Training	Duration	Remarks
1	Promotion	Training institute at IRTMTC/ALD	8 Weeks	**Detailed training program as per TM-2**
2		Training in field / ZRTI	2 Weeks	Transportation training in train working rules as per ZRTI module
	Total		**10 WEEKS**	

TOPIC	TOPIC DETAILS	PDS
PART - I INTRODUCTION TO RAILWAY ORGANISATION, P.WAY AND TRACK MACHINES		**20**
1.1	**Introduction to Railway Organization** History of Railways, Zonal Railways, Divisions, Production units, TT Organization on Indian railways.	2
1.2	**Railway Track, Rails** Constituents of Railway Track. Requirements of Good Railway Track, Classification of Routes. Different Gauges. Functions, Types & Standard Rail Section, Standard length, Rolling marks.	2
1.3	**Sleepers Fastenings & Ballast** Functions, Types & Sleeper Density, Requirements of PRC sleepers-their advantages and disadvantages. Rail to Rail fastenings, Rail to Sleeper fastenings, Functions & Specifications of Ballast.	2
1.4	**Points & Crossings** Functions & Important terminology, Constituents of Turnout. Switch Angle, Flange way clearance, Heel divergence, Throw of switch, Types of Crossings, Crossing number & Main constituents of Built-up Crossing.	2
1.5	**Welding of Rails& LWR** Evil effects of Rail joints, Different types of Welding.	

TOPIC	TOPIC DETAILS	PDS
	S.W.R/L.W.R/C.W.R , Theory of Welded rails.	2
1.6	**Track Renewals, Maintenance of Track, Engineering Restrictions & Indicators** Classification of Track Renewals. Provisions on Works incidental to Regular Track maintenance with thrust on Deep Screening. Emergency Protection of track: Single Line &DoubleLine, Detonators & Flare Signals.	2
1.7	**Curves** Necessity of curves: their types, TTP, CTP &Transition lengths, Radius, Degree, Versine & Field Measurement. Super-elevation: Cant deficiency, Cant excess, Cant gradient, Equilibrium cant, Negative Super-elevation, Gauge widening.	2
1.8	**Schedule of Dimensions** Different Schedules, Standard Dimensions, Loading Gauge, ODC.	2
1.9	**Types of Track Machines** Introduction of Track Machines in chronological order, their functions and output.	2
1.10	**Introduction to IRTMM and RDSO TM Reports** Track Machine Organization & Duties of Operator & Technician, Rules for Movement & Working of Track Machines, Planning, Operation & Monitoring of Track Machines. RDSO TM Reports.	2

TOPIC	TOPIC DETAILS	PDS
PART - II ELECTRICAL & ELECTRONICS SYSTEM		**44**
1.1	**Fundamentals of Electricity & Electrical Components** Symbols, Basic Concept of voltage and current, Ohm's law, Power law, Resistor: Definition, Unit, Symbol, Power Rating, Tolerance, Types Capacitor & Inductor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting	4
1.2	**Auto Electrical** Battery: Definition of Cell & Battery, Types, Rating, Specific Gravity, Construction, Working of Lead-acid Cell & Battery. Maintenance, Testing by Hydrometer and Load tester Alternator, Regulator & Self starter: Construction, Working, Maintenance and Troubleshooting. Relay: Definition, Construction, Operation, Types, Pin diagrams, Testing; Demonstration, checking and testing of Relays in Electronics Model Room. Engine Circuit & Z.F. Circuit and safety and Lighting circuit: Description, Functions, Types, Safety Components, Faults& Troubleshooting	8
1.3	**Fundamentals of Electronics Semiconductor Components** Symbols, Nomenclatures, Fundamentals of Electronics & Applications, Active components & Passive components	2
	Semiconductor Diode: Construction, Working, Forward bias and Reverse bias, V-I Characteristics of P.N. Junction. Types of Diodes, Construction, Working, Application of Zener Diode, LED, PhotoDiode. Transistor: Construction, Description of Terminals, NPN & PNP Transistor, Mode of Connections, Applications as Switch and Amplifier, Testing Electronics model room for demonstration & checking of Electronic components	6
1.4	**Transducer** Definition, Principle, Classification, Types, Tamping Depth Transducer, Pendulum &Height Transducer. Lining Transducer, Measuring Transducer, Satellite Transducer, Hook Transducer, Encoder: Function and Calibration Electronics model room for demonstration, checking and calibration of Transducers.	6
1.5	**Operational Amplifier** Definition, Symbol, Function of each terminal, Open loop, Close loop, +ve feed back, –ve feed back, Characteristics, Application of Operational Amplifier as Buffer, Inverter, Non Inverter, Adder, Sub- tractor, Integrator etc.	2

TOPIC	TOPIC DETAILS	PDS
1.6	**Power Supply** Need, Types, DC to DC Converter & Regulator, Functional description of Power supply PCBs EK813SV, EK816SV,EK 819SV EK851SV, Calibration, Testing & Troubleshooting, Electronics Model Room for demonstration, checking and calibration of PCB EK813SV	2
1.7	**Programmer unit and Logic Plan** Function and Description of Programmer Unit, Description of different PCBs of Programmer Unit i.e. EK 501P, EK553P, EK552P, EK554P, Multi-check PCB EK28V,EK 207V, Different Parts of LogicPlan. Demonstration of Programmer unit & Logic Plan in Electronics Model Room	.4
1.8	**Tamping Unit Control Circuit DUO/CSM/3X/Unimat's** Functional Description of Tamping Unit Control Circuit, Different Positions of Tamping Unit & their Description, Current of Proportional valve, Calibration, Troubleshooting & Faultfinding Demonstration, of Tamping Unit Control Circuit in Electronics Model Room	4
1.9	**Front Input Circuit: DUO/CSM/3X/09-3X Dynamic /Unimat** Functional Description ofFront Input Circuit, Front Input Potentiometer, Slew, Versine, General Lift etc. Basic idea of ALC, and LaserLining	2
1.10	**Lining Control Circuit, DUO/CSM/3X/09-3X Dynamic/Unimat's** Functional Description of Lining Control Circuit & Lining PCBs, Basic concept of 3 Point Regulator / 3 Stage Regulator, calibration , troubleshooting & Faultfinding.	2
1.11	**Leveling & Lifting Control Circuit of DUO/ CSM/3X/093X Dynamic / Unimat's** Functional Description of Leveling Control Circuit & Leveling PCBs, Basic concept of 3 Point Regulator / 3 Stage Regulator, calibration troubleshooting & Faultfinding	2
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TOPIC	TOPIC DETAILS	PDS
PART - III HYDRAULICS, PNEUMATICS & MECHANICAL		**44**
1.1	**Fundamentals, Symbols, Oil, Tank and Filter** Introduction, Hydraulic Symbols, Functions and Properties of Hydraulic oil, Functions and Parts of Hydraulic Tank, Functions and Types of filters, Importance of filtration.	2
1.2	**Accumulator, Hydraulic Seal, 'O' Ring, Hose and Fitting** Functions, Types, Working of Bladder Accumulator, Charging of Accumulator, Precautions during providing Hydraulic Seals, Causes of Failure, Hose specification: DIN, SAE & EN standards, Hydraulic Fittings, Precautions during mounting Hydraulic Hoses and Fittings.	2
1.3	**Hydraulic Pump** Definition, Functions, Classification, Working and Construction of Vane pump, Gear pump, Axial Piston Pump, Precautions during mounting, Troubleshooting, Aeration& Cavitation.	2
1.4	**Pressure Control Valve** Working and Construction of Relief Valve, Unloader valve, Pressure Reducing valve, Trouble shooting.	2
1.5	**Direction Control Valve** Spring offset valves, Check valve, POC valve, Troubleshooting.	2
1.6	**Proportional Valve, Servo Valve and Flow Control Valve** Function and Troubleshooting.	2
1.7	**Hydraulic Cylinder and Motor** Function, Types and Parts, Working of Vane motor, Gear motor and. Axial Piston motor, Troubleshooting.	2
1.8	**Hydraulic Transparent Models** Demonstration of Hydraulic Motor, D.C. Valves, Cylinder, ccumulator, Pressure Gauge, Pressure control valves, A Flow control valve, Check Valve, Pilot Operated Check Valve etc.	2
1.9	**Practical Disassembly & Assembly of Hydraulic Components in Model Room** Vane pump & Axial Piston pump. Proportional valve, Servo valve and Relief valve.	4
1.10	**Hydraulic Circuits** Constant pressure circuit, Closed loop circuit, Regenerating circuit of 3X, CSM, DUO, Unimat.09-3X Dynamic.	2
1.11	**Demonstration of Hydraulic Equipment Sets** Demonstration of Hydraulic circuits using Fluidsim H Software & Work exercises.	2
1.12	**Pneumatic Symbols and Pneumatic Components** Pneumatics symbols and Application of air on Track machines, Working and maintenance of Air Compressor, Cooling Coil, Safety valve, Air dryer, Water separator, Air oiler, DC Valve,KE Valve Cylinder and Pneumatic Hoses.	2
1.13	**Pneumatic Circuits (Braking system included) and Troubleshooting** Pneumatic Working circuits and Brake circuits, Failure Analysis and Troubleshooting of Pneumatic Assemblies.	2
1.14	**Demonstration of Pneumatic Equipment Sets** Demonstration of Pneumatic circuits using FluidsimP Software & Work exercises.	2
1.15	**Power Transmission** Block Diagram, Types of Power Transmission, Mechanical Transmission, 'V' belt, Chain, Pulley, Cardon Shaft.	2
1.16	**Gear Box and Clutch Assembly in DUO, Driving Axle** Working, Construction and Maintenance practices of Main gear box, Clutch assembly, Reversing gear box, Six speed gear box and distributor Gear Box, setting of crown & tail pinion on Driving Axle.	2
1.17	**Z. F. Hydrodynamic Gear Box** Function and Construction, Precautions during working and Maintenance aspects, Failure Analysis and Trouble shooting.	2
1.18	**Funk Gear Box, Reduction Gear Box and Satellite Axle GearBox.** Working, Construction and Maintenance practices.	2
1.19	**Tamping Unit, Lifting and Lining Unit, Bearings.** Function and Parts, Precautions during working & repairing, Maintenance schedule, Setting of bearings and spacers on vibration shaft, Failure Analysis and Troubleshooting.	2
1.20	**Lubrication** Oil and Lubricants used in different Gearboxes, Tamping unit, Lifting unit, Screen Drum etc., types and their capacities.	2
1.21	**Maintenance Schedules** Maintenance Schedules and IOH/POH of machines.	2

TM-2 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - IV I.C. ENGINE & WORKSHOP TECHNOLOGY		**44**
1.1	**General** I.C. and E.C. Engine, Advantages and disadvantages, Classification of I.C. Engine and Main Systems of I.C. Engine.	2
1.2	**Working Principle of I.C. Engine** T.D.C., BDC, Swept volume, Clearance volume, Compression ratio, Stroke length, Cylinder bore, Working Principle of 4 Stroke Diesel Engine (Diesel cycle). Working Principle of 2 Stroke Diesel Engine and 2 & 4 Stroke Petrol Engine (Otto cycle). Demonstration in I.C. Engine Model Room Combustion of fuel, Actual Working cycleof4 Stroke Diesel Engine. Deviations between Actual Working cycle and theoretical cycle, Firing orders and VT diagram, Power flow in Multi cylinder engine.	10
1.3	**Air Supply system of Diesel Engine** Requirement of Air, Types of Air cleaner, Cleaning and checking of Dry type Air cleaner. Draw backs of choking of Air Cleaner, Supercharging, Turbo charger and After cooler, Importance of After cooling.	2
1.4	**Fuel Supply system of Diesel Engine** Functions and classification of Fuel supply system, Block diagram Fuel Injection Pumps, Injectors and Filters. Mico Bosch and Cummins PT Fuel supply system and Difference between them. Cetaine Number, Octane Number, Delay Period and Knocking of fuel, Drawbacks of keeping low HSD Oil level in tank, Removing of Air Lock.	6
1.5	**Lubricating System of Diesel Engine.** Different type of Lubricating system, Blow bye, Crank case ventilation, Reasons of Low lubricating oil pressure and high Oil consumption, Lubricating Circuit.	2
1.6	**Cooling system of Diesel Engine** Air Cooling system, Water Cooling system Drawbacks of over cooling and reasons for over heating, Demonstration in I.C. Engine Model Room.	2
1.7	**Maintenance Steps and Maintenance schedule** Maintenance steps & Maintenance schedule Precautions in providing Piston ring on Piston and assembling in Cylinder liner, Adjustment of Valve (Tappet) clearance. Adjustment of Injection timing, Inspection of Crankshaft, Troubleshooting. Demonstration in Model Room.	8
1.8	**Welding and Related Processes** Types of Welding, Gas Welding, Arc Welding. Related Processes: Soldering, Brazing etc.	2
1.9	**Bench Work and Fitting, Fits and Surface Quality** Various Tools, their uses and Bench work, Interchangeability, Limits, Fits, Allowances, Tolerances and Surface finish and Measuring Instruments.	2
1.10	**Workshop Machines** Lathe Machines, Different Lathe Machines Operations. Drilling and Boring Machines. Shaper and Planner, Slotting. Milling Machine and Gear Cutting Machines, Different types of threads.	8

TM-2 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - V TRACK MACHINES & WORKING PRINCIPLES		**48**
1.1	**08-Duomatic and WST/VPR**	
	Main features, Main assemblies and components, Working Principle and Power Transmission.	2
1.2	**09-32-CSM**	
	Main features Main assemblies and components, technical data.	2
	Working Principle and Power Transmission.	2
1.3	**08-275-2S& 3S UNIMAT**	
	Main features, Main assemblies and components, Working Principle and Power Transmission.	2
1.4	**08-2754S UNIMAT**	
	Main features, Main assemblies and components, Working Principle and Power Transmission.	2
1.5	**Tamping Express.**	
	Main features, Main assemblies and components, Working Principle and Power Transmission.	2
1.6	**UTV, RBMV, MDU**	
	Main features, Main assemblies and components, Working Principle and Power Transmission.	2
1.7	**BCM: RM-76**	
	Main features, units and their functions.	2
1.8	**RM-80, 92U, HOTBCM**	
	Main features, units and their functions.	2
1.9	**FRM-80,85F**	
	Main features, units and their functions.	2
1.10	**B.R.M.**	
	Main features, units and their functions.	2
1.11	**TLE**	
	Main features, units, Yard Activities, Working Principle, Fabrication of Panels.	2
1.12	**TRT**	
	Main features, units, Yard Activities, Working Principle.	2
1.13	**T-28**	
	Main features, Units, Working Principle.	2
1.14	**DTS/DGS**	
	Main features of machines, Working Principle and mode of working.	2
1.15	**RGM**	
	Main features of machines, Working Principle and mode of working.	2
1.16	**Tamping Machines and BCM**	
	Tamping Machines: Pre-tamping, Post Tamping, during tamping attention. BCM: Pre- requisites, Operations prior to deployment, Operations during Traffic Block and Post Block Operations.	2
1.17	**Tamping and Other Machines**	
	Maintenance schedule of Tamping machines	2
	Maintenance schedule of other machines	2
1.18	**Lining**	
	Principle of Single chord lining, 4 Point lining & their Left Over error.	2
	Calculation of Vm value, 3 Point lining & their left over error and Design lining.	2
1.19	**Leveling**	
	Double chord leveling system, Criteria of Base line selection, General lift, ramp &Design leveling.	2
1.20	**Hands On**	
	OEMs Manual and Hands on training for using manual for finding Vm, Versines, K and X Correction	4
PART - VI ESTABLISHMENT, STORES & RAJBHASHA		**14**
1.1	**Leave Rules & Pass Rules**	
	Various types of Leaves, Eligibility & Various types of passes, Eligibility etc.	2
1.2	**D&A and Conduct Rules**	
	Minor and Major Penalties, Important Provisions of Service Conduct Rules.	2
1.3	**H O E R**	
	Classification and Duty roster.	2
1.4	**Introduction to Engg. Stores**	
	Stock heads of Accounts released and surplus materials.	2
	Indenting procedure, Issue note and Write-off statement.	2
1.5	**Medical Awareness Programme**	
	Family Welfare, AIDS, Family Management & First Aid.	2
1.6	**Rajbhasha**	
	Constitutional Provisions, Official Language Act 1963, Official Language Rules 1976, Policy Guidelines & Instructions.	2

TM-2 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - VII COMPUTER		**16**
1.1	**Microsoft Office** MS Word, MS Excel& MS PowerPoint Internet & Web -surfing,	
	e-mail and demonstration for making e-mail ID	6
1.2	**Automatic Guide Computer/ALC** Introduction of Automatic Guide Computer (ALC) & its Hardware. Introduction of Win ALC Software, DRP, CMS, CWS Hands on ALC	10

SUMMARY

S. No.	TOPIC DETAILS	PDS
1	Introduction to Railway Organisation, P.Way and Track Machines	20
2	Electrical & Electronics	44
3	Hydraulics, Pneumatics & Mechanical	44
4	I.C. Engine & Workshop Technology	44
5	Track Machines & Working Principles	48
6	Establishment, Stores &Rajbhasha	14
7	Computer	16
8	Technical Film Show	4
9	Library	6
10	Visit to CPOH & Track Machines WorkingSites	14
11	Examination (Theory/Practical/Viva-voce) & Valediction	32
	Total	**286**

PROMOTION COURSE FOR SSE/TRACK MACHINES (TM-3)

DURATION : 2 WEEKS

S.No.	Type of Training	Place of Training	Duration	
1	Promotion	Training institute at IRTMTC/ALD	2 Weeks	**Detailed training program as per TM-3**
2		Training in field / ZRTI	2 Weeks	Transportation training in train working rules as per ZRTI module
		Total	**4 WEEKS**	

TOPIC	TOPIC DETAILS	PDS
1.1	**Electrical & Electronics:** Electrical Components: Battery, Alternator, Self Starter, Relay; Engine & ZF Circuits and Troubleshooting. Electronics Components: Transducers &OpAmp. Power Supply PCBs. Programmer Unit, Logic Plan & Multi-check. Tamping Unit Control Circuit. Lining Control Circuit. Leveling & Lifting Control Circuit.	10
1.2	**Hydraulics, Pneumatics & Mechanical:** Hydraulic Components: Pumps, Motors & Valves, and Troubleshooting. Tamping Unit, Lifting & Lining Unit, Bushes & Bearings, Fast wearing mechanical parts and Troubleshooting. Power Transmission: Types, Mechanical & ZF Hydro-dynamic Gear Box and other related Assemblies and Troubleshooting. Hydraulic Circuits and their Demonstration using FluidsimH Software and Work exercises. Pneumatic Components & Circuits and their demonstration using Models/FluidsimP Software and Workexercises, brake system (KE Valve)	10
1.3	**I.C. Engine:** Working Principle of 4 Stroke Diesel Engine (Diesel cycle), Deviations between Actual Working cycle and Theoretical cycle. Main Systems of I.C. Engine: Air Supply System & Fuel Supply System and Troubleshooting. Main Systems of I.C. Engine: Lubricating System & Cooling System and Troubleshooting. Maintenance Steps to improve Performance & Maintenance Schedules of Cummins Engine. Firing orders, VT diagram, Adjustment of Valve (Tappet) clearance & Injection timing.	10
1.4	**Track Machines & Working Principles:** Provisions of IRTMM including Infrastructure requirements & manpower planning for mechanized track maintenance, Tamping Quality Control Rules for movement and Block working including action in case of machine breakdown. Periodic maintenance and TM Reports and Machine Manufacture's/ OEM's Literature Spares Management, Drawing & Specifications of Important Spares, Procurement & Inspection. Operation Main Assemblies & Trouble shooting of all tamping machines and DTS Session-4:Operation Main Assemblies & Trouble shooting of all tamping machines of BCM, SBCM, BRM	

TOPIC	TOPIC DETAILS	PDS
	Operation, Main Assemblies & Troubleshooting of PQRS, TRT & T-28, UTV and RBMV. Working Principles of Lining including Design Mode of working of Tamping Machines. Working Principles of Leveling including Design Mode of working of Tamping Machines.	14
1.5	**P.Way, Establishment, Stores & Accounts** Constituents of Railway Track, Points& Crossings, Curves, IRPWM Provisions on Regular Track Maintenance. IRPWM Provisions on Works incidental to Regular Track Maintenance, Maintenance of Track in Track Circuited Areas & Electrified Areas & Precautions during Machine working in Electrified Areas. Categories of Engineering Works, Engineering Fixed Signals/Indicators: Temporary and Permanent; Emergency Protection of track: Single Line & Double Line, Detonators & Flare Signals. HOER, Leave, Pass, D&AR & Conduct Rules. Stock heads of Accounts, Disposal of released and surplus materials, Indenting procedure, Issue note and Write-off statement. Stock verification and Inventory Control Technique.	4
1.6	**Computer:** Introduction to Automatic Guide Computer (ALC) Hardware & Win ALC Software, DRP,CMS,CWS Working in Geometry, Measuring Run & Design Mode. Hands on training on calculating Vm values in 4-point lining and Versine ,X and K values for 3 point lining and Levelling using OEM'S manual. Hands On training on using ALC measuring run data to computing best curve. Also making data file for known Track Geometry and Front Offset's.	8
1.7	**Technical Film Show**	2
1.8	**Library**	2
1.9	**Visit to CPOH & Track Machines WorkingSite**	8
1.10	**Examination & Valediction**	2
	Total	70

REFRESHER COURSE FOR SSE/JE/TM (TM-4)

DURATION : 2 WEEKS

TOPIC	TOPIC DETAILS	PDS
1.1	**Electrical & Electronics:** Electrical Components: Battery, Alternator, Self Starter, Relay; Engine & ZF Circuits and Troubleshooting. Electronics Components: Transducers &Op Amp. Power Supply PCBs. Programmer Unit, Logic Plan & Multi-check. Tamping Unit Control Circuit. Leveling & Lifting Control Circuit.	**10**
1.2	**Hydraulics, Pneumatics & Mechanical:** Hydraulic Components: Pumps, Motors & Valves, and Troubleshooting. Tamping Unit, Lifting & Lining Unit, Bushes & Bearings, Fast wearing mechanical parts and Troubleshooting. Power Transmission: Types, Mechanical & ZF Hydro-dynamic Gear Box and other related Assemblies and Troubleshooting. Hydraulic Circuits and their Demonstration using Models/Fluidsim H Software and Work exercises. Pneumatic Components & Circuits and their demonstration using Models/Fluidsim P Software and Work exercises. Brake system in Machines(KE Valve).	10
1.3	**I.C. Engine:** Working Principle of 4 Stroke Diesel Engine (Diesel cycle), Deviations between Actual Working cycle and Theoretical cycle. Main Systems of I.C. Engine: Air Supply System & Fuel Supply System and Troubleshooting. Main Systems of I.C. Engine: Lubricating System & Cooling System and Troubleshooting. Maintenance Steps to improve Performance & Maintenance Schedules of Cummins Engine. Firing orders, VT diagram, Adjustment of Valve (Tappet) clearance & Injection timing.	10
1.4	**Track Machines & Working Principles:** Provisions of IRTMM, Basic features of Track Machines &.Tamping Quality Control. Rules for movement and Block working including action in case of machine breakdown. Periodic maintenance and TM Reports and Machine Manufacture's/ OEM's Literature Session-3: Operation Main Assemblies & Troubleshooting of all tamping machines and DTS. Operation Main Assemblies & Trouble shooting of BCM, SBCM & BRM Operation Main Assemblies & Trouble shooting of PQRS, TRT T-28. UTV and RBMV. orking Principles of Lining including Design Mode of working of Tamping Machines. Working Principles of Leveling including Design Mode of working of Tamping Machines.	14
1.5	**P.Way, Establishment, Stores & Accounts** Constituents of Railway Track, Points& Crossings, Curves, IRPWM Provisions on Regular Track Maintenance. IRPWM Provisions on Works incidental to Regular Track Maintenance, Maintenance of Track in Track Circuited Areas & Electrified Areas & Precautions during Machine working in Electrified Areas. Categories of Engineering Works, Engineering Fixed Signals/Indicators: Temporary and Permanent; Emergency Protection of track: Single Line & Double Line, Detonators & Flare Signals. HOER, Leave, Pass, D&AR & Conduct Rules. Stock heads of Accounts, Disposal of released and surplus materials, Indenting procedure, Issue note and Write-off statement. Stock verification and Inventory Control Technique.	4
1.6	**Computer:** Introduction to Automatic Guide Computer (ALC) Hardware & Win ALC Software, DRP,CMS and CWS. Working in Geometry, Measuring Run & Design Mode. Hands on training on calculating Vm values in 4-point lining and Versine ,X and K values for 3 point lining and Levelling using OEM'S manual. Hands On training on using ALC measuring run data to computing best curve. Also making data file for known Track Geometry and Front Offset's.	8
1.7	**Technical Film Show**	2
1.8	**Library**	2
1.9	**Visit to CPOH & Track Machines Working Site**	8
1.10	**Introduction &Valediction**	2
	Total	70

INITIAL COURSE FOR TECHNICIAN-III/TM (TM-5)

DURATION : 13 WEEKS

TOPIC	TOPIC DETAILS	PDS
PART - I INTRODUCTION TO RAILWAY ORGANISATION, P.WAY AND TRACK MACHINES (MORE EMPHASIS TO BE GIVEN ON TRACK MACHINES		**36**
1.1	**Introduction to Railway Organization.** History of Railways, Zonal Railways, Divisions, Production units. Track machine Organization on Indian railways, Organization at headquarters and Divisional levels, CPOH etc.	2
1.2	**Railway Track and Rails** Constituents of Railway Track. Requirements of Good Railway Track, Classification of Routes. Different Gauges. Functions, Types & Standard Rail Section, Standard length, Rolling marks & UTS.	2
1.3	**Sleepers and Fastenings** Functions, Types & Sleeper Density, Requirements of PRC sleepers their advantages and disadvantages. Rail to Rail fastenings, Rail to Sleeper fastenings.	2
1.4	**Points & Crossings** Functions & Important terminology. Constituents of Turnout. Switch Angle, Flange way clearance, Heel divergence, Throw of switch. Types of Crossings, Crossing number & Main constituents of Built-up Crossing. Yard Visit	6
1.5	**Welding of Rails** Evil effects of Rail joints. Different types of welding	6
1.6	**Track Renewals** Classification of Track Renewals.	2
1.7	**Maintenance of Track** Provisions on Works incidental to Regular Track Maintenance with thrust on Deep Screening. Provisions on Maintenance of Track in Track Circuited Areas as contained in IRPWM. Provisions on Maintenance of Track in Electrified Areas as contained in IRPWM & Precautions during Machine working.	4
1.8	**Engineering Restrictions & Indicators** Categoriesof Engineering Works, Engineering Fixed Signals/ Indicators: Temporary and Permanent Emergency Protection of track: Single Line& Double Line, Detonators & Flare Signals.	2
1.9	**Railway Curves** Necessity of curves: their types, TTP, CTP& Transition lengths. Radius, Degree, Versine and Field Measurement. Super-elevation: Cant deficiency, Cant excess, Cant gradient.	

TOPIC	TOPIC DETAILS	PDS
	Equilibrium cant. Field Visit curve	6
1.10	**Track Tolerances** Different Track Parameters and their service tolerances.	2
1.11	**IRTMM** Introduction of Track Machines in chronological order, different types of track machines on Indian Railways, their functions and output. Duties of AEN, SSE, Operator & Technician.	2
PART-II ELECTRICAL & ELECTRONICS SYSTEM		**74**
1.1	**Fundamentals of Electricity** Symbols, Basic Concept of Voltage and Current, Ohm's law, Power law, Resistor: Definition, Unit, Symbol, Power Rating, Tolerance, Types	2
1.2	**Electrical Components** Resistor: Color coding, Combination, Application, Faults & Troubleshooting. Capacitor: Definition, Unit, Symbol, Types, Combinations, Application, Faults and Troubleshooting Inductor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting Demonstration, Checking of Resistor, Capacitor and Inductor in Electronics Model Room	8
1.3	**Auto Electrical** Battery: Definition of Cell & Battery, Types, Rating, Specific Gravity, Construction Working of Lead-acid Cell & Battery, Maintenance, Testing by Hydrometer and Load Tester Alternator, Regulator: Construction, Working, Maintenance and Troubleshooting Self starter: Construction, Working, Maintenance and Troubleshooting Relay: Definition, Construction & Operation, Types, Pin diagrams, Testing. Demonstration, checking and testing of Relays in Electronics Model Room Engine Circuit & Z.F. Circuit: Description, Functions, Types, Safety Components, Faults& Troubleshooting. Lighting circuits of different machines, Safety and warning circuits of different machines, Locking and unlocking circuit.	14
1.4	**Fundamentals of Electronics** Symbols, Nomenclatures, Fundamentals of Electronics and Applications, Active components & Passive components.	2

TOPIC	TOPIC DETAILS	PDS
1.5	**Semiconductor Theory** Difference between Conductor, Semiconductor & Insulator, Properties of Semiconductor, Covalent Bonds, Energy Bands, Types of Semiconductor i.e. Intrinsic,Extrinsic- P Type & N Type	2
1.6	**Semiconductor Diode:** Semiconductor Diode: Construction, Working, Forward bias & Reverse bias, V-I Characteristics of P.N. Junction	2
	Application as Rectifier - Half wave & Full wave Rectifiers- Centre Tap and Bridge Rectifier, Polarity, Protection Device	2
	Types, Construction, Working, Application of Zener Diode, LED, Photo Diode.	2
1.7	**Transistor** Transistor: Construction, Description of Terminals, NPN &PNP Transistor, Mode of Connections, Amplifying function, Applications as Switch & Amplifier, Testing Demonstration, checking and testing of Diodes And Transistors in Electronics Model Room	4
1.8	**Transducer** Definition, Principle, Classification, Types, Tamping Depth Transducer, Pendulum, Height Transducer, Encoder: Function and Calibration Lining Transducer, Measuring Transducer, Satellite Transducer, Hook Transducer: Function and Calibration Demonstration, checking and calibration of Transducers in Electronics model room	6
1.9	**Operational Amplifier** Definition, Symbol, Function of each terminal, Open loop, Close loop, +ve feed back, –ve feed back, Characteristic, Application as Buffer, Inverter, Non Inverter, Adder, Sub-tractor, Integrator etc.	2
1.10	**Digital Electronics** Number system i.e. Binary, Decimal, Hexadecimal, Logic Gates , Basic Idea of Microprocessor	2
1.11	**Electronic Circuits and PCBs:** Discrete Circuit & Integrated Circuit: Advantage & Disadvantage, PCBs used in different machines: Description, Name Quantity and Functions	2
1.12	**Power Supply** Need, Types, DC to DC Converter & Regulator,	

TOPIC	TOPIC DETAILS	PDS
	Functional description of Power supply PCBs EK813SV, EK816SV,EK819SV,EK851SV, Calibration, Testing & Troubleshooting Demonstration, checking and calibration of PCB EK813SV in Electronics Model Room	4
1.13	**Programmer unit and Logic Plan** Function and Description of Programmer Unit, Description of different PCBs of Programmer Unit i.e. EK 501P, EK553P,EK552P, EK554P, Different Parts of Logic Plan Demonstration of Programmer unit & Logic Plan in Electronics Model Room	4
1.14	**Multi-check/Multiplexer PCB** Description of Multi-check PCB EK28V and demonstration of measurements.	
1.15	**Tamping Unit Control Circuit UNO/DUO/CSM/3X/3X** Functional Description of Tamping Unit Control Circuit, Different Positions of Tamping Unit & their Description, Current of Proportional valve Calibration, Troubleshooting & Fault finding	2 4
1.16	**Dynamic / Unimat Front Input Circuit: UNO/DUO/ CSM/3X/3X Dynamic /Unimat** Functional Description of Front Input Circuit, Front Input Potentiometer, Slew, Versine, General Lift, Basic idea of ALC, GVA and Laser Lining etc.	2
1.17	**Lining Control Circuit, UNO/DUO/ CSM /3X/3X Dynamic/ Unimat** Functional Description of Lining Control Circuit and Lining PCBs Basic concept of 3 Point Regulator / 3 Stage Regulator, calibration, troubleshooting & Faultfinding	4
1.18	**Leveling & Lifting Control Circuit of UNO/DUO/ CSM/3X/ 3X Dynamic /Unimat** Functional Description of Leveling Control Circuit and leveling PCBs, calibration troubleshooting & Fault finding.	2
1.19	**Plasser Intellegent Control System (Pics)** Description of Plasser Intellegent Control System (Pics), Electronics Model Room for demonstration and calibration of Plasser Intellegent Control System (Pics)	2

TOPIC	TOPIC DETAILS	PDS
PART - III HYDRAULICS, PNEUMATICS & MECHANICAL		**72**
1.1	**Fundamentals & Hydraulic Symbols** Introduction, Advantages of Hydraulic system, Hydraulic Symbols	2
1.2	**Hydraulic Oil, Hydraulic Tank** Functions and Properties of Hydraulic oil, Functions and Parts of Hydraulic tank.	2
1.3	**Hydraulic Filter and Hydraulic Cooler** Functions, Types, Importance of filtration, function of Hydraulic Cooler, Maintenance aspects.	2
1.4	**Hydraulic Hose and Fitting** Functions, Types, Hose specification: DIN, SAE & EN standards, Hydraulic Fittings, Precautions during mounting Hydraulic Hoses and Fittings.	2
1.5	**Hydraulic Seal and 'O'Ring** Functions, Types, Precautions during providing hydraulic Seals, Causes of Failure.	2
1.6	**Hydraulic Pump** Definition, Functions and Classification, Working and Construction of Vane pump & Gear pump, Axial Piston Pump. Precautions during mounting, Troubleshooting, Aeration & Cavitation	4
1.7	**Pressure Control Valve** Working and Construction of Relief Valve & Unloaded valve, Pressure reducing valve, Troubleshooting.	2
1.8	**Direction Control Valve** Function and Types such as Spring centered valves; Spring offset valves, Check valve, POC valve, Trouble shooting.	2
1.9	**Proportional Valve, Servo Valve and Flow Control Valve** Function and Troubleshooting.	2
1.10	**Accumulator** Functions, Types, Working of Bladder & Diaphragm Type Accumulator, Charging of Accumulator.	2
1.11	**Hydraulic Cylinder** Function, Types and Parts.	2
1.12	**Hydraulic Motor** Definition, Working of Vane motor, Gear motor and. Axial Piston motor, Troubleshooting.	2
1.13	**Demonstration of Hydraulic Transparent Models** Hydraulic motor, D.C. Valves, Cylinder, Accumulator, Pressure Gauge, Pressure control valves, Flow control valve, Check Valve, Pilot Operated Check Valve etc.	2
1.14	**Practical Disassembly & Assembly of Hydraulic Components in Model Room** Vane pump and Vane motor. Axial Piston pump. D.C. valve, Proportional valve, Servo valve. Relief valve and Unloader valve.	8
1.15	**Hydraulic Circuits** Constant pressure circuit, Closed loop circuit, Regenerating circuit of 3X, CSM, DUO, Unimat.	2
1.16	**Demonstration of Hydraulic Equipment Sets** Demonstration of Hydraulic circuits using Fluidsim H Software & Work exercises. Demonstration of Hydraulic circuits using Fluidsim H Software & Work exercises.	4
1.17	**Pneumatic Symbols** Pneumatics symbols and Application of air on Trackmachines.	2
1.18	**Pneumatic Components** Working and maintenance of Air Compressor, Cooling Coil, Safety valve, Air dryer, Water separator, Air oiler, DC Valve, Cylinder and Pneumatic hoses.	2
1.19	**Pneumatic Circuits and Troubleshooting** Pneumatic Working circuits and Brake circuits, Failure Analysis and Troubleshooting of Pneumatic assemblies.	2
1.20	**Demonstration of Pneumatic Equipment Sets** Demonstration of Pneumatic circuits using Fluidsim P Software & Work exercises. Demonstration of Pneumatic circuits using Fluidsim P Software & Work exercises.	4
1.21	**Power Transmission** Block Diagram, Types of Power Transmission, Mechanical Transmission, 'V' belt, Chain, Pulley, Cardon Shaft.	2
1.22	**Gear Box and Clutch Assembly in UNO/DUO** Working, Construction and Maintenance practices of Main gear box, Clutch assembly, Reversing gear box, Six speed gear box and distributor Gear Box.	2
1.23	**Driving and Running Axle** Function, Parts and Maintenance aspects, setting of crown & tail pinion.	2
1.24	**Z.F. Hydro-Dynamic Gear Box** Function and Construction, Precautions during working and Maintenance aspects, Failure Analysis and Troubleshooting.	2
1.25	**Funk Gear Box, Reduction Gear Box and Satellite Axle Gear Box** Working, Construction and Maintenance practices.	2

TOPIC	TOPIC DETAILS	PDS
1.26	**Tamping Unit** Function and Parts, Precautions during working & repairing. Maintenance schedule, setting of bearings and spacers on vibration shaft, Failure Analysis and Troubleshooting.	2
1.27	**Lifting and Lining Unit, Bearings** Function, Assembly and Maintenance aspects.	2
1.28	**BCM Assemblies** Working, Construction and Maintenance practices of Excavation Chain, Conveyor Belts and Screens.	2
1.29	**Lesson-IX-Lubrication** Oil and Lubricants used in different gear boxes, Tamping unit, Lifting unit, Screen -drum etc., types and their capacities.	2
1.30	**Maintenance Schedules** Maintenance Schedules and IOH/POH of machines.	2
PART-IV I.C. ENGINE & WORKSHOP TECHNOLOGY		**70**
1.1	**General** I.C. Engine & its classification and Main Systems of I.C.Engine.	2
1.2	**Constructional Details of Engine** Cylinder, Cylinder head, Piston and Piston rings, Connecting rod & Crank shaft. Fly wheel, Cam shaft and Sump, Inlet and Exhaust valve, Push rod, Rocker arm, Valve clearance, Valve operating mechanism. Demonstration of Engine components in I.C. Engine Model Room.	6
1.3	**Basic Terminology & Working Principle of I.C. Engine** T.D.C., BDC, Swept volume, Clearance volume, Compression ratio, Stroke length, Cylinder bore, Firing Order, Working Principle of 2 Stroke Diesel Engine	2
1.4	**Air Supply system of Diesel Engine** Requirement of Air, Types of Air cleaner, Cleaning and checking of Dry type Air cleaner. Draw backs of choking of Air Cleaner. Supercharging,Turbocharger and After cooler, Importance of After cooling, Demonstration in I.C. Engine Model Room	4
1.5	**Fuel Supply system of Diesel Engine** Functions and classification of Fuel supply system, Block diagram, Fuel Injection Pumps, Injectors and Filters. Mico Bosch and Cummins PT Fuel supply system. Difference between Mico Bosch and Cummins PT Fuel supply system, Air lock, Demonstration in I.C. Engine Model Room. Demonstration in I.C. Engine Model Room.	6
1.6	**Lubricating system of Diesel Engine** Concept of lubrication and functions of Lubricating oil, Properties of Lubricant and Lubricating circuit. Different types of Lubricating systems, Oil pump, Relief Valve, Filters, Oil Cooler, Strainer, Oil Pressure Gauge, Oil PressureIndicating light.Blow bye, Crank case ventilation, Reasons of Low lubricating oil pressure and high Oil consumption. Demonstration inI.C.Engine Model Room	6
1.7	**Cooling system of Diesel Engine** Necessity of Cooling, Different methods of Engine cooling, Air Cooling system, Water Cooling system. Drawbacks of over cooling and reasons for over heating, Demonstration in I.C. EngineModel Room.	4
1.8	**Maintenance Steps** Maintenance Schedules.Adjustment of Valve (Tappet) clearance. Adjustment of Injection timing and testing of Nozzles Troubleshooting of Engines. 1 day visit to TM Workshop, PD/MGS.	14
1.9	**Welding and Related Processes** Types of Welding, Gas Welding, Arc Welding and Electrodes, RelatedProcesses:Soldering, Brazing etc. Procedure for welding of tamping tool anddefects in Tamping Tool welding.Welding of BCM turret gears, main links,intermediate links and cutter bar and grindingoperation.	4
1.10	**Bench Work and Fitting** Various Tools, their uses and Bench work.	2
1.11	**Measurement and Inspection** Standards of Measurement, Classification of Measuring Instruments and Linear Measurement.	2
1.12	**Limits, Fits and Surface Quality** Interchangeability, Limits, Fits, Allowances, Tolerances and Surface finish.	2
1.13	**Workshop Machines** Lathe Machines, Different Lathe MachinesOperations. Drilling and Boring Machines. Shaper and Planner. Milling Machine and Gear Cutting Workshop visit to Plasser India.	14
1.14	**Threads** Different types of threads.	2

TOPIC	TOPIC DETAILS	PDS
PART -V	**TRACK MACHINES & WORKING PRINCIPLES**	**70**
1.1	**08-Duomatic/WST/VPR** Main features, Main assemblies and components, Working Principle and Power Transmission	2
1.2	**09-32-CSM** Main features, Main assemblies & components.Working Principle and Power Transmission.	4
1.3	**08-275-2SUNIMAT** Main features, Main assemblies & components.Working Principle and Power Transmission	4
1.4	**08-275-3S, 4S UNIMAT** Main features, Main assemblies & components, Working Principle and Power Transmission, Difference between 2S & 3S Unimat.	2
1.5	**09-3x Tamping Express., 3X Dynamics** Main features, Main assemblies & components Working Principle.	2
1.6	**BCM: RM-76** Main features main units and their functions, Working Principle.	2
1.7	**BCM: RM-8092U and HOTBCM** Main features main units and their functions, Working Principle.	2
1.8	**FRM-80, 85F** Main features main units and their functions, Working Principle.	2
1.9	**B.R.M.** Main features main units and their functions, Working Principle.	2
1.10	**TLE** Main features main units and their functions,Yard Activities, Fabrication of Panels, Rake Formation, Amenities at Base Depot.Working Principle, Auxilliary Track and Mode of working.	4
1.11	**TRT** Main features main units and their functions, Yard activities, Modified BRHs & RakeFormation, Working Principle & SRs after relaying.	2
1.12	**T-28** Main features main units and their functions, Working Principle	2
1.13	**DTS/DGS** Main features main units and their functions, Power Transmission	2
1.14	**RGM-72** Main features main units and their functions, Power Transmission	2
1.15	**UTV, RBMV, MDU** Main features main units and their functions, Power Transmission	2
1.16	**Tamping Machines** Pre-requisites, Pre-tamping Operations, Operations during tamping and Post tamping Operations.	2
1.17	**BCM** Pre-requisites, Operations prior to deployment, Operations during Traffic Block and Post Block Operations.	2
1.18	**TLE, TRT & T-28** Pre-requisites, Operations prior to deployment, Operations during Traffic Block and Post Block Operations.	2
1.19	**Tamping Machines** Maintenance schedules of Tamping machines.	2
1.20	**BCM & FRM** Maintenance schedules of RM-76, RM-80, FRM-80 and FRM-85.	2
1.21	**DTS & BRM** Maintenance schedules of DTS & BRM.	2
1.22	**UNIMAT** Maintenance schedule of 2S & 3S,4s-Unimat.	2
1.23	**Introduction to IRTMM and RDSO TM Reports** Ch 4 & 5: Rules for Movement & Working of Track Machines and Planning, Operation &Monitoring of Track Machines. Brief on other Chapters of IRTMM and RDSO TM Reports.	4
1.24	**Lining** PrincipleofLining,Singlechordsystem,Type of lining i.e. 4 Point & 3 Point lining.Principle of 4 Point lining & Left over error.Calculation of Vm value on Transition & Reverse Curve, Toggle switch Direction, Non- suitability of 4 Point lining on Straight, Vm value feeding at Reverse & Compound curve.3 Point lining & Left over error, Calculationof 'V' value, Method of feeding 'V' value. Design lining, Laser lining and measuring run method, Potentiometers & their calibration.	10
1.25	**Leveling** Types of leveling system, Double chord system, General lift, ramp in & rampout,Criteria for selection of Base line. Double chord follow up system & fixed chord system, Proportional leveling, Error reduction ratio, Method of feeding of Cant on CSM,Method of feeding of Cant on other machinesFunction of Pendulum- Front, Middle, Rear Pendulum & Twist correction, Method of data feeding on Tamping Machines - Manually and by Computer (ALC	6

TOPIC	TOPIC DETAILS	PDS
PART - VI ESTABLISHMENT, STORES & RAJBHASHA		**20**
1.1	**Leave Rules** Various types of Leaves, Eligibility etc.	2
1.2	**PassRules** Various types of passes, Eligibility etc.	2
1.3	**D&A Rules** Minor & Major Penalties.	2
1.4	**HOER** Classification and Duty roster.	2
1.5	**Introduction to Engg. Stores & Inventory Control** Stock heads of Accounts, Disposalof released and surplusmaterials.	2
	Indenting procedure, Issue note and Write-off statement.	2
	Stock verification and Inventory Control Technique.	2
1.6	**Medical Awareness Programme** Family Welfare, AIDS, Family Management & First Aid.	2
1.7	**Rajbhasha** Constitutional Provisions, Official Language Act 1963, Official Language Rules 1976.	2
	Policy Guidelines & Instructions.	2
PART - VII GROUP INTER PERSONAL SKILL DEVELOPMENT (GIPSD)		**14**
1.1	**Communication** Communication Skills and Importance in Railway Organization.	2
1.2	**Work Culture** Work Culture.	2
1.3	**Inter Personal Relations** Need for Inter Personal Relations in Railway Organization.	2
1.4	**Motivation** Motivation Skills.	2
1.5	**Attitude Building** Importance of Positive Attitude.	2
1.6	**Team Work** Team Work and Team Building.	2
1.7	**Self Development** Self Development.	2

TOPIC	TOPIC DETAILS	PDS
PART- VIII COMPUTER		**18**
1.1	**Microsoft Offic** MS Word MS Word MSPowerPoint MSPowerPoint MS Excel	8
1.2	**Internet & E-mail** Internet & Web-surfing,e-mailand demonstration for making e-mailID	2
1.3	**Automatic Guide Computer/ALC** Introduction of Automatic Guide Computer (ALC) & its Hardware, CMS,CWS,DRP Introduction of Win ALC Software and hands on.	8

SUMMARY

SN	TOPIC DETAILS	PDS
1	**Introduction to Railway Organisation, P.Way and Track Machines**	**36**
2	**Electrical & Electronics**	**74**
3	**Hydraulics, Pneumatics & Mechanical**	**72**
4	**I.C. Engine & Workshop Technology**	**70**
6	**Track Machines & Working Principles**	**70**
7	**P.Way, Establishment, Stores &Rajbhasha**	**20**
8	**Group Inter Personal Skill Development (GIPSD)**	**14**
9	**Computer**	**18**
10	**Technical Film Show**	**10**
11	**Library**	**8**
12	**Visit to CPOH & Track Machines WorkingSites**	**40**
13	**Examination (Theory/Practical/Viva-voce)**	**32**
14	**Introduction & Valediction**	**2**
	Total	**466**

PROMOTION COURSE FOR TECHNICIAN-III/TM (TM-6)

DURATON : 6 WEEKS

TOPIC	TOPIC DETAILS	PDS
PART - I INTRODUCTION TO RAILWAY ORGANISATION, P.WAY AND TRACK MACHINES		**16**
1.1	**IIntroduction to Railway Organization** History of Railways, Zonal Railways, Divisions, TT Organization, CPOH.	2
1.2	**Railway Track** ConstituentsofRailwayTrack.Formation , Ballast, Requirements of GoodRailwayTrack, Classification of Routes. DifferentGauges.	2
1.3	**Rails, Sleepers and fastenings** Functions, Types & Standard Rail Section Standard length, Rolling marks &UTSFunctions, Types & Sleeper Density, Requirements of PRC sleepers-their advantages and disadvantages.Rail to Rail fastenings Rail to Sleeper fastenings Functions &Specifications	2
1.4	**Points & Crossings** Functions & Important terminology Constituents of Turnout.Switch Angle, Flange way clearance, Heel divergence, Throw of switch Types of Crossings, Crossing number & Mainconstituents of Built-up Crossing.	2
1.5	**Welding of Rails & LWR** Evil effects of Rail joints, Differenttypesof welding. Development of Welded rails,weldingTerminology.	2
1.6	**Engineering Restrictions & Indicators** Emergency Protection of track: Single Line& Double Line, Detonators & FlareSignals.	2
1.7	**Curves** Necessity of curves: their types, TTP, CTP &Transition lengths, Radius, Degree,Versine & Field Measurement.Super-elevation Cantdeficiency, Cantexcess, Cant gradient, Equilibrium cant.	2
1.8	**Types of Track Machines** Introduction of TrackMachinesin chronological order their functions and output.	2

TOPIC	TOPIC DETAILS	PDS
PART - II ELECTRICAL & ELECTRONICS SYSTEM		**32**
1.1	**Fundamentals of Electricity & Electrical Components** Symbols, Basic Concept of Voltage and Current, Resistor: Definition, Unit, Symbol, Power Rating, Tolerance, Types, Capacitor & Inductor: Definition, Unit, Symbol, Types, Combinations, Application, Faults and Troubleshooting	2
1.2	**Auto Electrical** Battery: Definition of Cell & Battery, Types, Rating, Specific Gravity, Construction, Working of Lead-acid Cell & Battery,Maintenance, Testing by Hydrometer and Load tester Alternator, Regulator &Self starter: Construction, Working, Maintenance and Troubleshooting Relay: Definition, Construction & Operation, Types, Pin diagrams, Testing; Demonstration, checking and testing of Relays in Electronics Model Room Engine Circuit & Z.F. Circuit: Description, Functions, Types, Safety Components, Faults & Troubleshooting	8
1.3	**Fundamentals of Electronics** Symbols, Nomenclatures, Fundamentals of Electronics and Applications, Active components & Passive components	2
1.4	**Semiconductor Components** Semiconductor Diode: Construction, Working, Forward bias and Reverse bias, V-I Characteristics of P.N. Junction, Types of Diodes, Construction, Working Symbol and Application of Zener Diode, LED, Photo Diode Transistor, Construction, Description of Terminals, NPN & PNP Transistor, Mode of Connections, Applications as Switch andAmplifier, Testing	4
1.5	**Transducer** Definition, Principle, Classification, Types, Tamping Depth Transducer, Pendulum, Height Transducer, Encoder: Function and Calibration Lining Transducer, Measuring Transducer, Satellite Transducer, HookTransducer: Demonstration, checking and calibration of Transducers in Electronics modelroom	6
1.6	**Power Supply** Need, Types, DC to DC Converter & Regulator, Functional description of Power supply PCBs EK813SV, EK816SV, EK819SV, EK851SV, Calibration, Testing &Troubleshooting	2

TOPIC	TOPIC DETAILS	PDS
1.7	**Programmer unit and Logic Plan.Multi-check/Multiplexer PCB** Function and Description of Programmer Unit, Description of different PCBs of Programmer Unit i.e. EK 501P, EK553P, EK552P, EK554P, Different Parts of Logic Plan, Multiplexer PCB MultiplexerPCB Demonstration of Programmer unit & Logic Plan, Multiplexer PCB in Electronics Model Room	4
1.8	**Tamping Unit Control Circuit** Functional Description of Tamping Unit Control Circuit, Different Positions of Tamping Unit & their Description, Current of Proportionalvalve	2
1.9	**Lining & leveling Control Circuit.** Functional Description of Lining & leveling Control Circuit and Lining & Leveling PCBs	2
PART - III HYDRAULICS, PNEUMATICS & MECHANICAL		**32**
1.1	**Fundamentals, Symbols, Oil, Tank, Filter & Accumulator** Introduction, Hydraulic Symbols, Functions and Properties of Hydraulic oil, Functions and Parts of Hydraulic Tank, Functions and Types of filters, Importance of filtration, Functions, Types, ChargingofAccumulator	2
1.2	**Hydraulic Seal, 'O' Ring, Hose and Fitting, Hydraulic Cylinder** Precautions during providing hydraulic Seals, Causes of Failure, Hydraulic Hose, Hydraulic Fittings, Precautions during mounting Hydraulic Hoses and Fittings, Functions and type ofcylinder.	2
1.3	**Hydraulic Pump and Motor** Definition, Functions and Classification, Working and Construction of Vane pump, Axial Piston Pump, Functions and types of motor, Precautions during mounting,Troubleshooting, Aeration & Cavitation.	2
1.4	**Pressure Control Valve** Working and Construction of Relief Valve & Unloader valve, Pressure reducing valve, Troubleshooting.	2
1.5	**Direction Control Valve, Proportional and Servo Valve** Function and Types such as Spring centered valves; Spring offset valves, Check valve, POC valve, Function of Proportional & Servo Valve, Troubleshooting.	2
1.6	**Hydraulic Transparent Models** Demonstration of Hydraulic motor, D.C. Valves, Cylinder, Accumulator, Pressure Gauge, Pressure control valves, Flow control valve, Check Valve, PilotOperated Check Valve etc.	2

TOPIC	TOPIC DETAILS	PDS
1.7	**Practical Disassembly & Assembly of Hydraulic Components in Model Room** Vane pump, Axial Piston pump. Proportional valve, Servo valve, Relief valve	4
1.8	**Demonstration of Hydraulic Equipment Sets** Demonstration of Hydraulic circuits using FluidsimH Software & Work exercises.	2
1.9	**Pneumatic Symbols and Pneumatic Components** Pneumatics symbols and Application of air on Track machines, Working and maintenance of Air Compressor, Cooling Coil, Safety valve, Air dryer, Water separator, Air Oiler, DC Valve, KE Valve Cylinderand Pneumatic hoses.Braking System	2
1.10	**Demonstration of Pneumatic Equipment Sets** Demonstration of Pneumatic circuits using FluidsimP Software & Work exercises.	2
1.11	**Power Transmission, Lubrication** Block Diagram, Types of Power Transmission, Mechanical Transmission, 'V' belt, Chain, Pulley, Cardon Shaft, Oil and Lubricants used in different gear boxes, Tamping unit, Lifting unit,Screen Drum etc., types and their capacities.	2
1.12	**Z.F. Hydro dynamic Gear Box** Function and Construction, Precautions during working and Maintenance aspects, Failure Analysis and Troubleshooting.	2
1.13	**Distributor Gear Box, Funk Gear Box, Reduction Gear Box, Satellite Axle GearBox, Driving Axle** Working, Construction and Maintenance practices, setting of crown & tail pinion on Driving Axle	2
1.14	**Tamping Unit, Bearings.** Function and Parts, Precautions during working & repairing. Maintenance schedule, setting of bearings and spacers on vibration shaft, Failure Analysis and Troubleshooting.	2
1.15	**Maintenance Schedules** Maintenance Schedules and IOH/POH of machines.	2

TM-6 contd.....

TOPIC	TOPIC DETAILS	PDS
PART - IV I.C. ENGINE & WORKSHOP TECHNOLOGY		**32**
1.1	**General** I.C. and E.C. Engine, Classification of I.C. Engine and Main Systems of I.C.Engine.	2
1.2	**Constructional Details of Engine** Cylinder, Cylinder head, Piston and Piston rings, Connecting rod, Crank shaft, Flywheel, Cam shaft and Sump. Inlet and Exhaust valve, Push rod, Rocker arm, Valve clearance, Valve operating mechanism. Demonstration of Engine components in I.C. Engine Model Room.	4
1.3	**Basic Terminology** T.D.C., BDC, Swept volume, Clearance volume, Compression ratio, Stroke length, Cylinder bore.	2
1.4	**Working Principle of I.C. Engine** Working Principle of 4 Stroke Diesel Engine (Diesel cycle). Demonstration in I.C. Engine ModelRoom. Firing orders and VT diagram,Requirementof Air, Types of Air cleaner	6
1.5	**Air Supply system of Diesel Engine** Cleaning and checking of Dry type Air cleaner, Turbocharger and After cooler, Demonstration in I.C. Engine Model Room	2
1.6	**Fuel Supply system of Diesel Engine** Functions and classification of Fuel supply system, Block diagram, Fuel Injection Pumps, Injectors and Filters.	2
1.7	**Lubricating system of Diesel Engine** Functions of Lubricating oil, Oil pump, Relief Valve, Filters, Oil Cooler, Strainer, Oil Pressure Gauge, Oil Pressure Indicating light.	2
1.8	**Cooling system of Diesel Engine** Different methods of Engine cooling, Air Cooling system, Water Cooling system, reasons for over heating, Demonstration inI.C. Engine Model Room.	2
1.9	**Maintenance Schedule and Maintenance Steps** Maintenance Schedules, Adjustment of Injection timing & Troubleshooting	2
1.10	**Welding and Related Processes** Types of Welding, Arc Welding, Related Processes: Soldering, Brazing etc., Procedure for welding of tamping tool and defects in Tamping Tool welding, Welding of BCM turret gears, main links, intermediate links and cutter bar and grinding operation.	2
1.11	**Bench Work and Fitting** Various Tools, their uses and Bench work.	2
1.12	**mits, Fits and Surface Quality** Measuring Instruments.	2
1.13	**Threads** Different types of threads.	2
PART - V TRACK MACHINES & WORKING PRINCIPLES		**32**
1.1	**08-Duomatic & WST/VPR** Main features, Main assemblies, Working Principle and Power Transmission.	2
1.2	**09-32-CSM** Main features, Main assemblies, Working Principle and Power Transmission	2
1.3	**08-275-2S & 08-275-3S, 4S UNIMAT** Main features, Main assemblies, Working Principle, Power Transmission and difference between UNI-2S &UNI-3S.	2
1.4	**09-3x Tamping Express/3X Dynamics** Main features, Main assemblies, Working Principle, Power Transmission and difference between UNI-2S &UNI-3S.	2
1.5	**BCM: RM-80** Main features main units and assemblies and working principle.	2
1.6	**RM-80- 92U/HOTBCM** Main features main units and assemblies and working principle.	2
1.7	**FRM-80,85** Main features main units and assemblies and working principle.	2
1.8	**B.R.M/DGS/ RBMV/UTV/MDU** Main features main units and assemblies and working principle.	2
1.9	**TLE** Main features Fabrication of Panels, Rake Formation, Yard Activities, mode of working	2
1.10	**TRT** Main features Yard Activities, Modified BRHs & Rake formation mode of working.	2
1.11	**T-28** Main features Working Principle.	2
1.12	**Quality Control** Pre-tamping, Post tamping and during tamping attention, Maintenance Schedule of Tamping Machine & Non-tampers.	2

TM-6 contd.....

TOPIC	TOPIC DETAILS	PDS
1.13	**Lining** Principle of Single chord lining, 4 Point lining & left over error. 3 point lining and left over error and concept of Design Lining. Introduction to ALC, DRP,CMS, CWS	4
1.14	**Leveling** Double chord system, General left, ram in and out, selection of baseline.	4
PART - VI ESTABLISHMENT & RAJBHASHA		**8**
1.1	**Leave Rules** Various types of Leaves, Eligibility etc.	2
1.2	**Pass Rules** Various types of passes, Eligibility etc.	2
1.3	**D&A Rules** Minor & Major Penalties	2
1.4	**Rajbhasha** Constitutional Provisions, Official Language Act 1963, Official Language Rules 1976. Policy Guidelines & Instructions.	2

SUMMARY

S.N.	TOPIC DETAILS	PDS
1	Introduction to Railway Organisation,P.Way and Track Machines.	16
1	Electrical & Electronics System	32
2	Hydraulics, Pneumatics & Mechanical	32
3	I.C. Engine & Workshop Technology	32
4	Track Machines & Working Principles	32
5	Establishment &Rajbhasha	8
6	Technical Film Show	6
7	Library	8
8	Visit to CPOH & Track Machines WorkingSites	14
9	Examination (Theory/Practical/Viva-voce)	32
10	Introduction & Valediction	2
	Total	214



REFRESHER COURSE FOR TECHNICIAN/TM (TM-7)

DURATION : 2 WEEKS

TOPIC	TOPIC DETAILS	PDS
1.1	**Electrical & Electronics:** Electrical Symbols, Electrical Components: Battery, Alternator, Self Starter,Relay. Schemsatic Diagram of Engine & ZF Circuits and Troubleshooting. Electronics Components & Transducers.Power Supply PCBs. Programmer Unit, Logic Plan &Multi-check. Tamping Unit Control Circuit. Lining Control Circuit & Leveling & Lifting ControlCircuit.	12
1.2	**Hydraulics, Pneumatics & Mechanical:** Hydraulic Components: Filter, Hoses & Fittings, Seal & O Ring, Pumps, Motors Cylinder, & Accumulators and Troubleshooting. Pressue Control, Directional Control & Flow Control Valves and Troubleshooting. Tamping Unit, Lifting & Lining Unit, Bushes & Bearings, Fast wearing mechanical parts and Troubleshooting. Power Transmission: Types, Mechanical & ZF Hydro-dynamic Gear Box and other related Assemblies and Troubleshooting. Pneumatic Components: Air Compressor, Cooling Coil, Safety valve, Air dryer Water separator, Air oiler, DC Valve, Cylinder and Troubleshooting. Braking system(KE Valve). Demonstration of Hydraulic & Pneumatic Models.	12
1.3	**I.C. Engine:** Constructional Details of Engine. Basic Terminology, Working Principle of 4 Stroke Diesel Engine (Diesel cycle), Firing orders. Main Systems of I.C. Engine: Air Supply System & Fuel Supply System andTroubleshooting. Main Systems of I.C. Engine: Lubricating System & Cooling System and Troubleshooting. Maintenance Schedules of Cummins Engine, Adjustment of Injection timing & Removing of Air Lock	10
1.4	**Track Machines & Working Principles:** Provisions of IRTMM, Basic features of Track Machines & Tamping Quality Control. Rules for movement and Block working including action in case of machine breakdown. Periodic maintenance andTM Reports and Machine Manufacture's/OEM's Literature Operation & Main Assemblies &Troubleshootingof all tamping machines. Operation Main Assemblies and troubleshooting of BCM, SBCM & BRM Operation & Main Assemblies & Trouble shooting of PQRS, TRT T-28. UTV and RBMV. Operation & Main Assemblies & Trouble shooting of RGM Working Principles of Lining including Design Mode of working of TampingMachines. Working Principles of Leveling including Design Mode of working of TampingMachines.	14
1.5	**P.Way, Establishment & Stores** Constituents of Railway Track, Points& Crossings,Curves. Maintenance of Track in Track Circuited Areas & Electrified Areas & Precautions during Machine working in Electrified Areas. Categorioes of Engineering Works, Engineering Fixed Signals/ Indicators: Temporary and Permanent; Emergency Protection of track: Single Line & Double Line, Detonators & FlareSignals. Leave, Pass, D&AR & Conduct Rules, Indenting procedure, Issue note.	4
1.6	**Computer** Introduction to Automatic Guide Computer (ALC) Hardware & WinALC Software. DRP, CMS and CWS Working in Geometry, Measuring Run & Design Mode using ALC.	4
1.7	**Technical Film Show**	2
1.8	**Library**	2
1.9	**Visit to CPOH & Track Machines WorkingSite**	8
1.10	**Introduction &Valediction**	2
	Total	70

BRIDGES & DRAWINGS

INDUCTION COURSE (SSE / JE / BRIDGE)(B-1)

DURATION: 1 YEAR

SN.	Type of Training	Place of Training	Duration	Remarks
1	Induction PH-I	Training institute	8 Weeks	Detailed Training Program (PH I) as per Annexure B-1 (a)
2	Induction PH-II	Engineering Workshop, RDSO & Tiruchirapalli	10 Weeks	TRAINING MODULE FOR ENGINEERING WORKSHOP, RDSO AND WELDING TRAINING AT TIRUCHIRAPPALLI as per Annexure B-1 (b)
3	Induction PH - III	Training in field	10 Weeks	TRAINING MODULE FOR FIELD TRAINING IN OPEN LINE as per Annexure B-1 (c)
4	Induction PH - IV	Training Institute	7 Weeks	TRAINING MODULE FOR TECHNICAL TRAINING as per Annexure B-1 (d)
5	Induction PH - V	Training in field	10 Weeks	TRAINING MODULE FOR FIELD TRAINING IN CONSTRUCTION UNIT as per Annexure B-1 (e)
6	Induction PH - VI	Training Institute	4 Weeks	TRAINING MODULE FOR GENERAL TRAINING AT ZRTI as per Annexure B-1 (f)
7	Induction PH - VII	Training Institute	3 Weeks	POSTING EXAM as per Annexure B-1 (g)

INDUCTION COURSE PH-1 FOR (SSE / JE / BRIDGE)(B-1a)

DURATION : 8 WEEKS

Annexure B-1a

TOPIC	TOPIC DETAILS	PDS
1	**PART -I ORGANIZATION OF INDIAN RAILWAYS-AND DUTIES OF JE/SSE BRIDGE**	**8**
1.1	Organization of Indian Railway- PCE/CBE Office, DRM Office, DyCE Br Line / ABE/SSE-Bridges. RDSO (B&S), Engineering workshops, details, location, capacities. What are codes, Manuals, Rules, Circulars - Flow of authority	4
1.2	Duties of JE/SSE Br. – Inspection & maintenance of bridges and other structures. Knowledge of Rules and Regulations, Codes, Manuals, Circulars etc. Co-ordination with permanent way, works and officials of other Departments. Accompanying on Inspections of Higher officials, Execution of works, Action in case of Emergency, Establishment, Correspondence and records (Tech., Store, and Establishment.), H/O and T/O of charge/stores.	4
2	**Topics related to computer and software**	**30**
2.1	Basics about computer – introduction to MS office, MS project, use of internet, search engines, emails etc.	10
2.2	Hands on: on Item No. 2.1	20
3	**Topics related to basic engineering (24 days)**	**210**
3.1	**Survey-**	
3.1.1	Chain survey,	2
3.1.2	Levelling	2
3.1.3	Theodolite, Total Station, GPS etc.	2
3.1.4	Setting the layout for bridges.	2
3.1.5	Survey Tutorials	8
3.1.6	Survey hands on	8
3.2	Hydrological investigation, Calculation of design discharge for bridges having small catchment areas.	3
3.2.1	Tutorial on item no. 3.2	3
3.3	Structural analysis and Design-	
3.3.1	Strength of materials- Concept of stress & strain, Hooke's Law, Thermal stresses, Fatigue, etc.	8
3.3.2	Tutorial on item 3.3.1	4
3.3.3	Concrete Bridge Code, Steel Bridge Code- Relevant portion only	6
3.3.4	Basic Structural analysis (B.M & S.F, deflection for simply supported and cantilever spans)	8
3.3.5	Tutorial on 3.3.4	4
3.3.6	Basic design of RCC, PSC.	4
3.3.7	Tutorial on 3.3.6	4
3.3.8	Basic design of Steel structures - Tension , Compression and Bending steel members	6
3.3.9	Tutorial on 3.3.8	6
3.3.10	Basic design of Connections – riveted, welded, bolted	4
3.3.11	Tutorial 3.3.10	4
3.3.12	Basic design of lifting /launching arrangements for girders	6
3.3.13	Tutorial on 3.3.12	6
3.4	**Bridge Engineering –**	
3.4.1	Introduction	
3.4.1.1	Introduction to bridges,	1
3.4.1.2	Components of bridge.	1
3.4.1.3	Classification and types of Railway bridges.	1
3.4.2	Substructure of bridge-	
3.4.2.1	Soil investigation and IS classification.	4
3.4.2.2	Lab	6
3.4.2.3	Bearing /load carrying capacity of shallow and deep foundations	4
3.4.2.4	Tutorial on item 3.4.2.3	2
3.4.2.5	IRBM, Substructure Code, Well and Pile Foundation Code	4
3.4.2.6	Open foundation- construction aspects	3
3.4.2.7	Pipe and box culverts.	1
3.4.2.8	Well foundation - Components of wells, Setting out wells and piers on the top of well, construction aspects	2
3.4.2.9	Pile foundation – Basics of pile foundations, Load carrying capacity, and Pile load test. Acceptance criteria. Construction aspects. Under water concreting	4
3.4.2.10	Construction aspects of Pier, Abutment, Bed Blocks, Wing wall, and Return wall. Coffer dam.	4
3.4.2.11	River training and protection works.	4
3.4.3	Superstructure of Bridges	
3.4.3.1	Various type of Bridge Superstructure, (i) according to deck type (ii) according to materials.	4
3.4.3.2	Bridge Rules, CBC, SBC,	8
3.4.3.3	Basic understanding of design forces for Bridge Superstructures.	4
3.4.3.4	Basics of design of steel plate girders, trusses and composite girders	6
3.4.3.5	Tutorial on superstructures	8
3.4.4	Bearings	
3.4.4.1	functions of bearings	2
3.4.4.2	Types of bearing - Sliding bearing, Rocker & Roller bearing, Elastomeric bearing, Pot-PTFE bearing, spherical bearing,	4
3.4.4.3	Manufacturing of bearing. Quality control, inspection and approval while procurement of Bearings.	4

TOPIC	TOPIC DETAILS	PDS
3.4.4.4	Field visit to Manufacturing Unit of Elastomeric Bearing	8
3.4.5	TrackStructure On Bridges	
3.4.5.1	Railway track, its components	3
3.4.5.2	Track on bridges- composite, steel channel and H-beam sleepers on steel girder bridges, guard rails, laying of sleepers on Steel girder Bridges, Renewal of channel sleepers on Girder Bridges. Pathways and trolley / men refuges. IRPWM (only relevant aspects)	6
3.4.5.3	Field Visit to Bridge site	8
3.4.5.4	Safety at worksite including track protection	2
3.4.5.5	Working in traffic blocks	2
4	**Construction of concrete bridge**	**56**
4.1	Study of bridge drawings	4
4.2	Quality control measures at site, various registers to be maintained for progress, quality, and safety at site, Do's and don'ts for different works.	6
4.3	Materials: Aggregates, Cement, Reinforcement and Pre-stressing steel, Admixtures. Testing, Stacking and Handling of materials	4
4.4	Design Mix and Production of concrete,	6
4.5	Tutorial on mix design	4
4.6	Tests on fresh concrete, Tests on hardened concrete- Destructive & Non-Destructive.	2
4.7	Concrete Lab	4
4.8	Different types of Concrete PCC, RCC & PSC, RMC, High strength and high performance concrete	4
4.9	Various types of Formwork- Fabrication & erection of formwork, removal of formwork.	2
4.10	Preparation of Bed for casting of girders, Bottom and side shuttering,	2
4.11	Tutorial on form work and casting bed	2
4.12	Construction aspects of PSC: Pre stressing- equipment, method of pre stressing, formwork for PSC, stages of pre stressing, construction joints, grouting of ducts.	6
4.13	Tutorial on Pre-stressing	4
4.14	Load test for girders.	2
4.15	Relevant provisions of CBC and IS codes on Concrete bridges.	4
5	**Fabrication of Steel Bridges Girder and other Steel Structures**	**50**
5.1	**Fabrication of Bridge girders**	
5.1.1	Procurement of steel- specification, testing.	2
5.1.2	Various shops in Engineering Workshops, preparation for fabrication, Template making, cutting, jigs and fixture, CNC machine operations incl. Demo, drilling.	8
5.1.3	Riveting- Correct procedure for riveting, Rivet testing, Replacement of defective rivets (practical training).	4
5.1.4	HSFG Bolts,	4
5.1.5	Welding- Types of welding- Manual arc welding, Flux core arc welding with gas shielding, CO2 welding, and submerged arc welding.	4
5.1.6	Welding electrodes, welding methods, welding equipment, setting up techniques and safety precautions (practical training).	3
5.1.7	Defects of welding, Non-destructive test of welds, Rectification of defective welds. Quality control in welding – approval of weld joints, WPQR, WPSS.	4
5.1.8	Trial shop erection, working assembly and checking of girders before dispatch, shop painting.	3
5.1.9	Approval of steel works by RDSO, Zone etc.	2
5.1.10	Relevant provisions of Steel Bridge Code, IRS B1, Welded Bridge Code and IS codes on Steel bridges.	4
5.2	**Fabrication and Erection of other Steel Structures**	
5.2.1	FOB	4
5.2.2	Platform shelter, High7 roof structures for workshops, Steel water tank, Height gauge, Turn table and weigh bridges, Steel bearings.	8
	Total number of periods (45 minutes period duration)	**360**
	Total Days 45 x 8 = 360	

INDUCTION COURSE PH-II FOR (SSE / JE / BRIDGE) (B-1b)

DURATION : 10 WEEKS

Annexure B-1 (b)

TOPIC	TOPIC DETAILS	PDS
1	**Engg. Workshop training-**	**240**
1.1	Classroom training at Engineering Workshop - Steel girder fabrication process including NDT, procedure for passing the material, Record keeping (At MANMAD); including ISO Certification.	30
1.2	Tutorial on - study of drawings to work out material requirement, preparation of jigs and fixtures, templates etc.	30
1.3	Hands on - Practical training at shop floor in various sections	180
	Training duration at Engineering Workshop	
2	**RDSO Training -**	**120**
2.1	Training in Bridge Directorate - Understanding of bridge drawings, Camber, Inspection, Passing and Acceptance of Girders,	40
2.2	Training in M&C directorate – Testing of material, welding and quality control. WPSS, WPQR, Various Destructive and Non-destructive tests on Welding, USFD, Radiography, Micro etching, and deep penetration weld.	80
3	Welding Training at Tiruchirappalli (2 week Certification course)	96
	Total 57 x 8 = 456	**456**

INDUCTION COURSE PH-III FOR (SSE / JE / BRIDGE)(B-1c)

DURATION : 10 WEEKS

Annexure B-1 (c)

TOPIC	TOPIC DETAILS	PDS
1	Inspection and maintenance of Bridge	136
2	Rehabilitation of Bridges	88
3	Plant and machinery of the engineering department	24
4	Fabrication & Erection of steel structures	96
5	Tender and Contract management	32
6	Interaction with other departments	8
7	Disaster Management in open line Accident and breaches	16
8	Official procedures (Writing note, proposals, Estimate)	16
9	Bridge Management System	32
10	Stores	16
11	Modern Technologies, Modern Bridge Repair Techniques, and Trial items/ materials	16
	TOTAL 16 x 8 = 480	**480**

INDUCTION COURSE PH-IV FOR SSE / JE / BRIDGE (B-1d)

DURATION : 7 WEEKS

Annexure B-1 (d)

TOPIC	TOPIC DETAILS	PDS
1	**Topics related to computer and software**	**112**
1.1	Auto CAD	40
1.2	Hands on Item No. 1.1 auto cad	40
1.3	Introduction to IRCEP, RDSO Website (B&S Directorate), IRICEN website and Bridge management system,	8
1.4	Hands on BMS and Introduction to TMS	24
2	**Temporary staging, Crane Working and Erection of Bridge Super structure**	**49**
2.1	Temporary arrangements.	2
2.2	Material for temporary arrangements, Precaution in Erection of temporary arrangements.	2
2.3	C.C. crib, Use of steel trestles, Service girders of different types, Overall length effective span and clear span,	2
2.4	Tutorial/ plan preparation on temporary arrangements etc	4
2.5	Crane working - working rules - safety measures and safety gears - testing of tackles, chains rope etc. (to see actual testing at JMP workshop) - Capacity of - cranes in propelled and un-propelled conditions at different radii.	4
2.6	Tutorial/ plan preparation on crane working	2
2.7	Details of Calendar Hamilton span its transportation and erection.	2
2.8	Different methods of launching of girder.	2
2.9	Erection of girders by use of cranes, derricks.	2
2.10	End launching method, side slewing method, launching of triangulated girders on the trestle,	3
2.11	launching of girder by using service span, end launching of open web girders with help of launching nose,	2
2.12	Erection by cantilever methods, enveloping methods.	2
2.13	Erection of PSC box girder, segmental construction, Segmental erection, girder erection. Form work erection and removal.	4
2.14	Selection of a suitable method of girder erection,	2
2.15	Tutorial/ plan preparation for launching	4
2.16	De-launching of girders- critical assessment of 2-3 cases	6
2.17	Preliminary arrangements, precautions and safety measures in girder launching/erection.	2
2.18	Erection of bearings.	2
3	**Inspection and Maintenance of Bridges**	**90**
3.1	IRBM provisions regarding inspection of bridges-	
3.1.1	Method of Inspection, Accompany Inspection and action taken for the inspection,	2
3.1.2	Equipment required for Inspection of Bridges.	2
3.1.3	Numerical Rating System.	2
3.1.4	Tutorial on Item No. 3.1.3	2
3.1.5	Bridge inspection register and its movement, compliance of inspection notes and orders thereon.	2
3.2	Safety precautions track protection during bridge maintenance while executing works-	
3.2.1	Precaution while carrying out maintenance works on bridges, Responsibility of Engineering officials. Obtaining CRS sanction	2
3.2.2	Traffic Blocks and Track Protection during Rehabilitation/ Bridge maintenance works. Electrified/ non-electrified section and safety measures at work site, Safety of travelling public.	4
3.2.3	Plan preparation for track protection	2
3.2.4	Inspection and maintenance of welded/Riveted Steel girders- Camber measurement: purpose, method and procedure, record of camber details, Camber loss and reasons thereof,	4
3.2.5	Field hands on camber measurement	4
3.2.6	Cracks in steel work, strengthening of steel girders on	2
3.2.7	Rivet testing, Method of testing, Sample testing, loose rivet diagram, Replacement of loose and corroded rivets,	2
3.2.8	Field hands on rivet testing and preparation of lose rivet diagram	8
3.2.9	Steel work in bridges, rivet testing register, Weld test register, PSC bridge/Composite girder bridge inspection register, Annual inspection register.	2
3.2.10	Welded girders.	2
3.2.11	Composite girder	2
3.3	Painting of steel Bridges-	
3.3.1	Corrosion and its prevention, protective coating by painting, paint system used and schedule of painting, importance of surface preparation and correct painting procedure, paints film defects, ordinary paintings,	2
3.3.2	Metalizing and epoxy based paints,	2
3.3.3	Standard measurements and covering capacity of different paints, dry paint film thickness measurements.	2
3.3.4	Hands on paint covering capacity and dry film thickness measurement	2
3.4	Inspection and maintenance of RCC and PSC bridges-	
3.4.1	Camber measurement: purpose, method and procedure, record of camber details, Camber loss and reasons thereof,	2
3.4.2	Inspection of PSC Girder Bridges,	2
3.4.3	Inspection of RUB/ROB	2

TOPIC	TOPIC DETAILS	PDS
3.4.4	Instrumentation of bridges & structures, NDT techniques. Action to be taken after inspection of bridges.	4
3.4.5	Lab NDT	4
3.4.6	Protective coat for PSC & RCC superstructures,	2
3.4.7	Protective works and water way, Maintenance of Abutments, Piers, Wing walls, Return walls & Arches.	6
3.4.8	Under water Inspection, equipment, methods and report	4
3.4.9	Details of common repair techniques- Cement pressure grouting, Epoxy grouting, Shot creating/Guniting,	4
3.5	Inspection and maintenance of bearings –	
3.5.1	Thermal movement of girder – Steel bearings, Elastomeric bearings & POT-PTFE bearings.	2
3.5.2	Greasing of steel bearings, oil bath bearing, replacement of steel, elastomeric & POT-PTFE bearings	6
4	**Inspection and Maintenance of Misc. Structures-**	**4**
4.1	FOB, Platform shelters, Water tank, Flood light tower, Workshop structures, Gantry girder for EOT cranes, Micro wave towers.	4
5	**Rehabilitation of Bridges**	**24**
5.1	Reasons for rehabilitation, Priority for rehabilitation of bridges based on NRS, Special inspection Collection of site data,	4
5.2	Special strengthening of steel, PSC, RCCbridges. Imposition of speed restriction, Execution of rehabilitation works,	10
5.3	Strengthening of foundations strengthening/rebuilding of sub-structures, Shaken/displaced/cracked bed blocks.	8
5.4	Replacement of pipe culverts, Replacement of small openings.	2
6	**Plant and machinery**	**17**
6.1	Use of oxyacetylene gases - safety measures, different types of flames and their uses, Oxyacetylene torches for cutting and welding, gas cutting, pug cutting machines gas welding, electrodes.	2
6.2	Basics of Electrical circuits,	2
6.3	Basics of pneumatics and hydraulics, hydraulic circuit.	2
6.4	Control of plant and machinery, Engineering plant Reserve and machinery for maintenance, Plant and machinery procured for works against specific permission, Plant numbers/project, Register for Engineering plant reserve, Valuation of plant Maintenance, storage and repairs to plant, Requisition by DEN on plant depot, Use of Engineering reserve plant at site of work,	3
6.5	Debits for plant and staff supplied on departmental, Maintenance of Log book for plant, Log Book for plants, Log Book for Motor Trolley and Motor Vehicles, Hiring out of engineering plant, Plants and machinery, radial drills, pneumatic drilling machines. air compressed shear and punching machines, grinding machines, lathes and milling machines, grinding wheels, air pressure required for different pneumatic equipment,	4
6.6	Hydraulic jacks – case and maintenance screw jacks (Duff Norton types), Transverse bases, use of derricks including erection, pulley block guy ropes, wire and manila ropes, use of different types of knots, max-pull arrangement (practical training) case of equipment.	4
7	**Action during Accident and breaches (2 days)**	**12**
7.1	Duties of SSE/Bridges, sounding of hooters, & classification of accidents, action to be taken on reaching site, first aid, preservation of clues, assessments of men and material for restoration, expeditious restoration, breaches & its types, Action during breach, washout of bridges, temporary restoration, restoration of bridges, enquires, provisions of ARS, water ways, scour, flood discharges, protection works, sounding, flood register.	6
7.2	Preparation of Joint note and accident site sketch	3
7.3	Tutorial on Preparation of accident site plan	3
8	**Tender and Contract management**	**24**
8.1	Definition of Agreement/contracts, Types & forms of contracts, tenders, tender committee, Awarding of contract, Earnest money, SEM & security deposit, BSR, GCC & SCC, SOR.	8
8.2	Quality control measures at site, various registers to be maintained for progress, quality, safety of contractor's persons, safety measures at work site, account keeping of new and released material, issue and receipt from contractors, important points from vigilance angle, Dos and don'ts for different works.	16
9	**Vigilance aspects**	**8**
9.1	Do's and Don'ts and other precautions, Up-keep of records, contract and material management. Other related misc. items.	8
	TOTAL 42 Days x 8 PDS = 336	**336**

INDUCTION COURSE PH-V FOR SSE / JE / BRIDGE (B-1e)

DURATION : 7 WEEKS

Annexure B-1 (e)

TOPIC	TOPIC DETAILS	WEEK
1	Construction of various components of RCC & PSC bridges & launching of PSC girders	6
2	Fabrication and launching of steel girders	4

INDUCTION COURSE PH-VI FOR SSE / JE / BRIDGE (B-1f)

DURATION :4 WEEKS

Annexure B-1 (f)

TOPIC	TOPIC DETAILS	PDS
1	**GR & SR, SOD, CRS Sanction, Protection of Track**	**30**
1.1	General rules and subsidiary rules – important definitions, General rules Applying to Railway servants, Signal – General provisions, Descriptions of Fixed signals, Hand signals, Detonating signals, Flare signals, Defective fixed signals, Various systems of working.	10
1.2	Classification of stations – Simple layout & condition for granting line clear, single line working on double line, Reception of train on blocked line and starting from signalled line, interlocked working. General rules and procedure to be followed while carry out engineering works, protection of track, GRs provision,	10
1.3	working of lorries, trollies, motor trollies – works of short duration, works of long duration, engineering indicators, protection of track, single line, double line, safety during execution of works on bridges, Schedule of dimensions – B.G. & M.G., procedure for condonation, ODC, CRS sanction, Works requiring CRS sanction, safety certificate etc.	10
2	**Finance and Budget-** Revenue and works budget - maintenance of accounts – control over expenditure and completion reports, Works programme – PWP, FWP, August Review, Allocation of funds. Allocation and Heads of expenditure, CF, DF & CAP, DRF, OLWR, SF & SRSF.	10
3	**Stores**	**32**
3.1	DBR, DBI, DMTR, Ledger, requisition (stock & non stock items), local purchase T.P. item, charged off accounts – M.S., B.M., etc., DS -8, Maintenance of stores of BRI's	8
3.2	Disposal of scrap – stock sheet etc. Return of stores, Stock verification – verification of stores & account by AEN, DEN, Stock holder, ABC analysis.	16
3.3	Security of railway Materials.	4
3.4	Account keeping of new and released material, issue and receipt from contractors, important points from Vigilance angle.	4
4	**Establishment and Labour law**	**26**
4.1	Muster, Pay sheet, pay scales, Allowances, Pass and leave rules of unskilled, skilled and artisan staff, witnessing of payments, Railway servants conduct rules, Discipline and appeal rules, DAR enquiry and finalization of DAR cases.	12
4.2	Labour laws, Hour of employment regulations, Display of hours of duty, Payment of wages act. Permissible deductions, Registers to be maintained, workmen's compensation act, Action in case of injury on duty, Minimum wages Act & Factory Act.	12
4.3	RTI	2
5	**Disaster Management, Accident and breaches, safety and First Aid, health and hygiene**	**8**
5.1	DM Act 2005, NDMA, Role of NDRF, NPDM. Risk reduction, recovery, rehabilitation, fire hazard & fire fighting.	4
5.2	Medical aid- first aid, food and health	4
6	**Official language-** Directives in use of Rajbhasha in day to day working, Directives for implementation of Rajbhasha, Unicode usage on computer.	4
7	**Interaction with other departments -** Working in track circuited areas, working in Electrified sections, Co-ordination with other cadres of Engineering Department and with other departments like S&T, TRD, Operating, Personal, RPF etc.	18

Annexure B-1 (f) contd.....

TOPIC	TOPIC DETAILS	PDS
8	**Training on soft skills – Spoken, written and official procedures**	**24**
8.1	Managerial skill, Leadership, Personal Development and Soft Skill, Personal Management.	16
8.2	Meditation	8
9	**Ethics, Integrity, Prevention of Corruption and gender sensitization**	**24**
9.1	Ethical Training.	8
9.2	Work, duty, responsibilities etc. Moral values, Integrity, self-vigilance, importance of vigilance. Rules, regulation and Laws. It's Enforcing agency.	8
9.3	Respect for women, how to ensure gender equality. Related rules, regulation and Laws.	8
10	**Environment and Climate Change-** pollution control, environment management system and accreditation, energy management including energy audit, water management including water audit, solid waste management	16
	TOTAL 24 Days x 8 PDS = 192	**192**

INDUCTION COURSE PH-VII POSTING EXAM MODULE (B-1g)

DURATION : 3 WEEKS

Annexure B-1 (g)

TOPIC	TOPIC DETAILS	PDS
1	Classroom discussion for revision of entire course and doubt clearance. Discussion on modern Technologies, Techniques and trial items etc.	1 Week
2	Preparation and submission of project report based on field trainings and project presentation, viva-voice	1 week
3	Exam	1 week
	Total	**3 weeks**

S.No.	Exam Detail	Marks
1	Oral/ Written exam of each phase of 20 marks each to be conducted at the end of phase by the trainer imparting the field training (20x6).	120
2	Project Report & presentation	20
3	Interview (20 marks), including daily diary maintained at Open line and Construction training and EWS & RDSO (20 marks).	40
4	Posting Exam- 4 papers 80 marks each (4x80)	320
	Paper-I shall cover portions of class room training at ZRTI.	
	Paper-II & Paper-III shall cover the portion pertaining to induction training covered at Civil Engg. Training Institute and hands on training at engineering workshop and RDSO.	
	Paper-IV shall cover the portion pertaining to open line field training, and training at construction sites.	
	Total	**500**

REFRESHER COURSE FOR (SSE / JE / BRIDGE) (B-2)

DURATION: 3 WEEK

TOPIC	TOPIC DETAILS	PDS
1	**Duties of JE/SSE Bridges-**	**1**
2	**Stores - accountal of material, stock verification, preparation of indents etc.**	3
3	**Establishment rules-** Pass & Leave rules, conduct rules, D&A rules, HOER, Witnessing of payment, Minimum wages act, Factory Act & Workmen's compensation act.	3
4	**Rajbhasha -** Directives for implementation of Rajbhasha, Unicode usage.	1
5	**General rules and subsidiary rules and SOD**	**5**
5.1	General rules applicable to all Railway servants, Signals – General provisions, Descriptions of Fixed signals, Hand signals, Detonating signals, Flare signals, General rules and procedure to be followed while carry out engineering works, protection of track, working of lorries, trolleys, motor trolleys, works of short duration, long duration, engineering indicators, protection of track, single line, double line, safety during execution of works on bridges,	3
5.2	Schedule of dimensions - Dimensions and clearances of fixed structures for B.G. & M.G, ODC, CRS sanction, Works requiring CRS sanction.	2
6	**Interaction with other departments-** Working in track circuited & Electrified sections, Co-ordination with P. Way and Works; and with other departments like S&T, TRD, Operating, Personal, RPF etc.	2
7	**Training on soft skill-** Managerial skill, Leadership, Personal Development and Soft Skill, Personal Management. Meditation, Ethical Training.	2
8	**Navigation of RDSO site and IRCEP and IRICEN Website**	**1**
9	**Engineering codes/Manuals-** IRPWM, IRBM. Latest correction slips, PCE, CBE circulars. Steel Bridge Code, Welded bridge Code, IRS B1, BS report Nos. 102, 103, 110, 111, 113, 115	14
10	**Contract Management-**	**8**
10.1	Types & forms of contracts, tenders, GCC & SCC, SOR.	2
10.2	Quality control measures at site, various registers to be maintained for progress, quality, safety of contractor's persons, safety measures at work site, accountal of new and released material, issue and receipt from contractors, important points from vigilance angle, Do's and don'ts for different works.	4
10.3	Vigilance related issues- Do's and Don'ts and other precautions, Up-keep of records, contract and material management.	2
11	Field demo on layout for bridges and Camber measurement using total station	8

TOPIC	TOPIC DETAILS	PDS
12	**Bridge management system**	**4**
13	**Construction of Super Structure of Concrete bridges-**	**6**
13.1	Basic concept of Pre stressing- equipment for stressing, method of pre stressing, formwork for PSC, stages of pre stressing. Load test for girders.	4
13.2	Rehabilitation of Pre stressed concrete structures.	2
14	**Concrete Technology, Reinforcement and Formwork-**	**8**
14.1	Ingredients of concrete, Types of cement, Design Mix, Admixtures & chemicals, Mixing & Placing of Concrete, Curing.	2
14.2	Test on fresh concrete, Test on hardened concrete- Destructive & Non-Destructive.	2
14.3	Grade of steel, High tensile steel, bar bending and placement of reinforcement	2
14.4	Formwork- types, fabrication, erection and removal of formwork. Preparation of Bed for casting of girder, Bottom and side shuttering, placing of reinforcement and PSC duct.	2
15	**Fabrication of Steel Bridge girder and other steel structures-**	**21**
15.1	Procurement of steel- specification; testing.	2
15.2	Fabrication of steel girders and steel structures (FOB, platform shelters)	6
15.3	Welding- Types of welding, Manual arc welding, Flux core arc welding with gas shielding, CO2 welding, Submerged arc welding. Welding electrodes, welding methods, welding equipment, setting up techniques and safety precautions (practical training). Defects in welds, Non-destructive test of welds, Rectification of defective welds. Quality control in welding – approval of weld joints, WPQR, WPSS.	2
15.4	Approval of steel works by RDSO, Zone etc.	1
15.5	Visit to EWS	8
15.6	Fabrication and Erection of bearing- Manufacturing of bearing. Quality control, inspection and approval while procurement of Bearings. Erection and Replacement of Bearings.	2
16	**Temporary staging, Crane working and Erection of Girders-**	**11**
16.1	Various types of temporary arrangements. Material for temporary arrangements, Precaution in Erection of temporary arrangements.	2
16.2	C.C. crib, Use of steel trestles, Service girders deferent types, Overall length effective span and clear span,	2
16.3	Details of Callender Hamilton span its transportation and erection.	1
16.4	Crane Working rules - safety measures - testing of tackles, chains rope etc.	2
	Capacity of - cranes in propelled and un-propelled conditions at	

B-2 contd.....

TOPIC	TOPIC DETAILS	PDS
	different radii.	
16.5	Launching of girder-Preliminary arrangement before girder erection, precautions and safety measures in erection, Machinery/ Equipment for erection. Erection by use of cranes, derricks.	1
16.6	Launching of girder-End launching method, side slewing method, launching of triangulated girders on the trestle, launching of girder by using service span, end launching of open web girders with help of launching nose, erection by cantilever methods, enveloping methods., Erection of PSC box girder, segmental construction, Segmental erection, girder erection.	3
17	**Inspection, maintenance and repairs of bridges**	**17**
17.1	Schedule of inspection, Action to be taken after inspection of bridges.	1
17.2	Registers for inspection- Steel work in bridges, rivet testing register, Weld test register, PSC bridge/Composite girder bridge inspection register, Annual inspection register, movement of inspection registers.	1
17.3	Numerical Rating System.	2
17.4	Inspection and maintenance of concrete & PSC bridges - Girder alignment & seating, Structural condition of girder, Periodical Maintenance of PSC and RCC structures. Measurement of camber. Protective coat for PSC & RCC superstructures.	2
17.5	Inspection and maintenance of Steel/ Composite bridges - Girder alignment & seating, Structural condition of girder, Condition of steel work, painting. Camber measurement – method and procedure, Loss of camber in steel girders, cracks in steel work, strengthening of steel girder. Rivet testing, Method of testing, Sample testing, Loose rivet diagram, Replacement of loose and corroded rivets. Cracks in steel works – strengthening of weak girders, Maintenance of welded girders.	2
17.6	Bearings- Need of bearing, Selection of bearing, Types of bearing - Sliding bearing, Roller bearing, Rocker & Roller bearing, Elastomeric bearing, Pot-PTFE bearing, Thermal movement of girders , Greasing of bearings - Method and material used for greasing. Replacement of bearing.	3
17.7	Bed block- Details of common repair techniques- Cement pressure grouting, Epoxy grouting, and Shot creating/Guniting,	2
17.8	Painting of steel Bridges- Corrosion and its prevention, protective coating by painting, Types of paint systems used and schedule of painting, importance of surface preparation and correct painting procedure, paints film defects, Metalizing and epoxy based paints, standard measurements and covering capacity of different paints, paint film thickness measurements.	2
17.9	Under water inspection	2
18	**Rehabilitation of Bridges-** Reasons for rehabilitation, Special strengthening, Imposition of speed restriction, Priority for rehabilitation of bridges, Special inspection Collection of site data, Execution of rehabilitation works, Strengthening of foundations strengthening/rebuilding of sub-structures, Shaken/displaced/ cracked bed blocks, Replacement of non-standard girders, Replacement of pipe culverts, Arch bridges, small openings, Steel & PSC super structure.	3
19	**T&P of Engineering Department-**	**8**
19.1	Use of oxyacetylene gases - safety measures - different types of flames and their uses - Oxyacetylene torches for cutting and welding - gas cutting - pug cutting machines gas welding - electrodes.,	2
19.2	Control of plant and machinery, Engineering plant Reserve and machinery for maintenance, Plant and machinery procured for works against specific, Plant numbers/project, Register for Engineering plant reserve, Valuation of plant Maintenance, storage and repairs to plant, Requisition by DEN on plant depot, Use of Engineering reserve plant at site of work,	2
19.3	Debits for plant and staff supplied on departmental, Maintenance of Log book, Log Book for plants, Log Book for Motor Trolley and Motor Vehicles, Hiring out of engineering plant, Plants and machinery – radial drills, pneumatic drilling machines, air compressor, shear and punching machines, grinding machines, lathes and milling machines, grinding wheels, air pressure required for different pneumatic equipment,	2
19.4	Hydraulic jacks – case and maintenance screw jacks (Duff Norton types) – Transverse bases – use of derricks including erection – pulley block guy ropes, wire and manila ropes, use of different types of knots – Maxpull arrangement (practical training) case of equipment.	2
20	**Action during Accidents and breaches-** Accidents and breaches: Duties of SE/Bridges, sounding of hooters, & classification of accidents, action to be taken on reaching site, first aid, preservation of clues, assessments of men and material for	

B-2 contd.....

S.No.	TOPIC DETAILS	PDS
	restoration, expeditious restoration, breaches & its types, Action during breach, washout of bridges, temporary restoration, restoration of bridges, enquires, provisions of ARS – water ways, scour, flood discharges, protection works, sounding – flood register.	1
21	**Disaster management-** DM Act 2005, NDMA, Role of NDRF, NPDM. Risk reduction, recovery, rehabilitation, medical aid- first aid, food and health.	1
22	Field visit – Field visits at important constructions/project/ Regirdering site/Girder fabrication site.	16
	TOTAL 18 Days x 8 PDS = 144	**144**



DRAWING (DESIGN ASSISTANT)

INDUCTION COURSE FOR (SSE/JE/ DRAWING) (B-3)

DURATION: 52 WEEK

SN.	Type of Training	Place of Training	Duration	Remarks
1	Induction PH-I	Training institute	8 Weeks	Common Training for all SSE/JE drawing as per Annexure B-3 (a)
2	Induction PH-II	Training institute	4 Weeks	General Training at ZRTI as per Annexure B-3 (b)
3	Induction PH - II (a)	Training in field	13 Weeks	Field Training at the place of posting as per Annexure B-3 (c)
4	Induction PH - III	Training Institute	1 Weeks	Exam as per Annexure B-3 (d)
5		On Job Training	26 Weeks	At the place of Posting

INDUCTION COURSE FOR PH-1 (SSE/JE/ DRAWING) (B-3a)

DURATION : 8 WEEKS

Annexure B-3 (a)

Topic	TOPIC DETAILS	PDS
1	**Joining and Introduction**	**8**
1.1	Introduction	
1.2	Basic duties and role of SSE/JE Drawing in the organisation	
2	**Basics Of Railway Track**	**120**
2.1	Track Organisation	
2.2	Basic introduction to Railway Track: Type of rails, sleepers, track structure, ballast, formation etc.	
2.3	Route Classifications, an overview of Indian Railway Network, prescribed track structure for various routes etc	
2.4	Duties of P-way Staff	
2.5	Various types of track renewal proposals. Criteria for track renewals, initiation and scrutiny of proposals for track renewals	
2.6	Estimation of quantities of materials required for track renewal. Type estimates.	
2.7	Classification of released materials , their accountal and disposal	
2.8	Relevant portions of IRPWM, Track manual	
2.9	Curves : geometry, design of curves, realignment of curves, speed on curves, grade compensation, setting out of curves	
2.10	SOD	
2.11	Points and crossings. Layout calculations. Yard Planning. S&T provisions relevant to yard planning. Preparation of Yard Plan (trainees will be made to do yard planning for one yard and draw ESP)	
2.12	Study of drawings relating to track	
2.13	Track renewal policy	
2.14	Introduction to track machines	
2.15	Level crossings including policy for elimination, interlocking etc	
2.16	Speed certification	
2.17	Provisions relating to opening of new lines	

Topic	TOPIC DETAILS	PDS
3	**Basics of Bridges**	**80**
3.1	Bridge organisation	
3.2	Introduction to Railway Bridges. Definitions of basic terms associated with Railway Bridges. Understanding GAD of a Bridge.	
3.3	Various types of Bridge loadings- only introduction	
3.4	Introduction to various bridge related codes and manuals	
3.5	Policy guidelines for construction and rehabilitation of bridges	
3.6	Preparation of roll diagram and processing. Various type of ODCs	
3.7	Processing of CRS sanctions for opening of lines, Condonation of Railway Board , Certification of track and bridges for new rolling stock etc	
3.8	Speed certification of bridges	
3.9	Preparation of GADs for Bridges. (trainees will be made to draw one GAD for a new bridge and one GAD for rehabilitation of existing bridge)	
3.10	Reading and understanding of standard RDSO drawings for Bridges and structures	
3.11	Scrutiny of proposals for Bridge rehabilitation works	
3.12	Bridge Hydraulics: Design discharge estimation- water way calcula tions including assessment of catchment properties. Fixing of span arrangement & depth of foundation.	
4	**Works and Land Matters**	**112**
4.1	Works Organisation	
4.2	Important provisions of Engineering code specially relating to surveying, estimates, execution of works, measurement of works, works programme etc	
4.3	Passenger amenity works. Latest policy guidelines	
4.4	Works manual	

Topic	TOPIC DETAILS	PDS
4.5	Scrutiny of proposals for works programme	
4.6	Preparation of project sheets	
4.7	Land management. Protection of land	
4.8	Processing of SOR items for approval, framing of NS items, rate analysis. Collection of data for rate analysis. Escalation of rates etc	
4.9	Specification for works	
4.10	NOCs for construction of structures in vicinity of railway lines, track crossings etc, land licensing and leasing	

Topic	TOPIC DETAILS	PDS
5	**Computer Training**	**64**
5.1	MS office	
5.2	IRCEP, TMS, BMS, IRPSM	
5.3	Auto Cad (Introductory software training will be given at training institute. However, detailed computer training will be organised at their place of posting before they complete their probation).	
5.4	Zonal Railway may also decide to impart computer training in any other software being used in their office. For this purpose the services of reputed private training institutes may be obtained.	
	Total 48 DAYS X 8 PDS = 384	**384 PDS**

INDUCTION COURSE PH-II FOR (SSE/JE/ DRAWING)(B-3b)

DURATION: 4 WEEKS

Annexure B-3 (b)

Topic	TOPIC DETAILS	PDS
1	**G & SR, SOD, CRS sanction etc**	**48**
1.1	General and Subsidiary rules: Important definitions, General rules applying to Railway servants, Signals – General provisions, Description of fixed signals, hand signals, Detonating signals, Flare signals, Defective fixed signals, various systems of working	
1.2	Classification of stations – simple layout, conditions for granting line clear, single line working on double lines, reception of trains on blocked line, starting from signalled lines, interlocking	
1.3	General rules and procedures to be followed for carrying out engineering works, protection of tracks, working of lorries, trollies, motor trollies, works of short duration and long duration, engineering indicators, safety during working on bridges, SOD, CRS sanction, Works requiring CRS sanction, Safety certificate etc.	
2	**Finance & Budget**	**16**
2.1	Revenue and works budget. Maintenance of accounts, control over expenditure, completion reports. Works programme – PWP, FWP. Allocation and heads of expenditure, CF, DF, DRF, SF etc.	
3	**Stores**	**24**
3.1	DBR, DBI, DMTR, Ledger, requisition for stock and non-stock items. Local purchase. DS-8 etc	
3.2	Scrap disposal, stock verification	
3.3	Account keeping of materials, important points from vigilance angle.	
4	**Establishment and Labour Laws**	**32**
4.1	Muster, pay sheets, pay scales, allowances, passand leave rules,	
4.2	Conduct rules, D & AR, enquiries under D & AR.	
4.3	Labour laws, HOER, Payment of wages, Workmen's compensation act, action in case of injury on duty, Minimum wages act, Factory act etc	
4.4	RTI	
5	**Disaster Management, Accidents, first aid, health and hygiene**	**16**
5.1	DM Act 2005, NDMA, ROLE of NDRF, NPDM.	
5.2	First aid, safety, health and hygiene at work sites	
6	**Official Language**	**4**
6.1	Provisions regarding use of Rajbhasha. Directives regarding implementation and promotion of Rajbhasha	
7	**Training on Soft Skills**	**12**
7.1	Communication skills, Leadership, personal development, personal management	
7.2	Meditation and Yoga	
8	**Ethics, Integrity, Gender sensitisation, Prevention of corruption**	**28**
8.1	Following ethics at work place, Moral values,integrity, Self-vigilance	
8.2	Respect for women, sexual harassment at work places, related rules and guidelines	
9	**Environment and climate change**	**12**
9.1	Pollution control, energy management including energy audit, water management including water audit. Solid waste management	
	Total Duration (phase II) 24 DAYS X 8 PDS = 192	**192**

INDUCTION COURSE PH-II (A) FOR (SSE/JE/ DRAWING)(B-3c)
DURATION: 13 WEEKS

Annexure B-3 (c)

Topic	TOPIC DETAILS	PDS
1	**Various Topics** Field training: this training will be imparted at the place of posting. Trainees will be given exposure different sections by attaching them with different sections in Zonal or Divisional office. Detailed computer training in MS Office and Auto-Cad will be given either through departmental resources or by engaging professional agencies.	**624**

INDUCTION COURSE PH-III FOR (SSE/JE/ DRAWING) (B-3d)
DURATION: 1 WEEK

Annexure B-3 (d)

Topic	TOPIC DETAILS	PDS
1	**Training on ethics, Presentations and Exams**	**48**
1.	Panel discussion to address various doubts	
2.	Ethics at work place	
3.	Presentation by each trainee on the assigned topics	
4.	Examination to test the learning outcomes	

INDUCTION COURSE FOR SSE / JE / DESIGN (B-4)

DURATION: 1 YEAR

SN.	Type of Training	Place of Training	Duration	Remarks
1	Induction PH-I	Training institute	8 Weeks	Common Training for all SSE/JE drawing as per Annexure B-3 (a)
2	Induction PH-II	Training institute	4 Weeks	General Training at ZRTI as per Annexure B-3 (b)
3	Induction PH - III	Training institute	1 Weeks	Exam for Ph I and II as per Annexure B-3 (d)
4	Induction PH - IV	Training Institute	5 Weeks	Technical Training – Part I as per Annexure B-4 (a)
5	Induction PH - V	Training in field	20 Weeks	Field Training (OL/ Construction) as per Annexure B-4 (b)
6	Induction PH - VI	Training Institute	7 Weeks	Technical Training – Part II as per Annexure B-4 (c)
7	Induction PH - VII	RDSO	5 Weeks	Training at RDSO as per Annexure B-4 (d)
8	Induction PH - VIII	Training Institute	2 Weeks	PSpecial Topics, Presentations and Exams as per Annexure B-4 (e)

INDUCTION COURSE PH-IV FOR (JE/SSE/DESIGN)(B-4a)

DURATION: 5 WEEKS

Annexure B-4 (a)

Topic	TOPIC DETAILS	PDS
1	**Introductionand Duties of Design Assistants**	**4**
1.1	Introduction	
1.2.	Basic duties and role of design assistant in the organisation	
2	**Strength of material and analysis of structures**	**64**
2.1	Plain stress and strain, Hooke's law, Stress-strain diagrams, Elasticity and Plasticity. Shear stress and strain. Introduction to failure theories of materials.	
2.2	Moments of Inertia of Plane areas	
2.3	Simple bending theory, SF and BM, Stresses in Beams, Deflections of Beams, Slopes at supports.	
2.4	Concept of shear span. Cases where simple bending theory is not applicable for analysis of structural elements.	
2.5	Statically indeterminate beams and frames : simple cases	
2.6.	Torsion: basic concepts. Stress distribution due to torsion.	
3	**Hydraulics**	
	discharge estimate, water way calculations, fixing of span arrangements and foundation depth, Span arrangements.	
4	**PCC and RCC Design**	**112**
4.1	Basics of Working Stress method	
4.2	Design of gravity structures	
4.3	Various practical thumb rules for proportioning of structures	
4.4	Concepts of limit State Design.	
4.5	Understanding formulae for calculation of ultimate moment resistance of sections under flexure, axial and combined loadings. Understanding design concepts for shear and torsion. Concepts of bond, bearing, development length etc.	
4.6	Design of slabs, beams, deep beams, corbels, staircases, water tanks, shallow and deep foundations, concrete pavements, design of skew slabs etc. Using design aids for quick design.	
4.7	Introduction to analysis and design by using Strut and Tie method.	
4.8	Special emphasis to be given on detailing of reinforcement.	
4.9	Design of foundations: footings, rafts, piles, pile caps and wells. Design of foundations subjected to vibratory loads.	
4.10	Design and detailing of construction and expansion joints	
4.11	Relevant IS, IRS and IRC codes for design and detailing	
4.12	Tutorials on RCC design including preparation of structural drawings	
5	**Codes and Manuals**	**40**
5.1	Study of various IS, IRS, IRC, and UIC codes relevant to design of structures. (Part1)	
	Total Duration (Phase IV) 30 Days x 8 PDS = 240	**240**

INDUCTION COURSE PH-V FOR (JE/SSE/DESIGN) (B-4b)

DURATION: 20 WEEKS

Annexure B-4(b)

Topic	TOPIC DETAILS	PDS
6	**Various Topics**	**960**
6.1.	Trainees will be attached with design engineers working in PCE office for hands on practice on various designs being carried out / checked in PCE or CAO/c office.	
6.2	Trainees should be exposed to use of soft wares like MIDAS, STADD and Excel Sheets in use in the design office.	
6.3	Trainees will be exposed for learning: strength assessment of existing bridges, rehabilitation schemes of bridges, launching and de-launching schemes, design of various bridge components like abutments, piers, pile and shallow foundations; and design of framed buildings and steel structures etc.	
6.4	Trainees will also be deputed to sites of construction/ rehabilitation of important bridges for getting feel of actual field working conditions.	
	Total Duration (phase V) 120 DAYS X 8 PDS = 960	**960**

INDUCTION COURSE PH-VI FOR (SSE/JE/DESIGN) (B4c)

DURATION: 5 WEEKS

Annexure B-4 (c)

Topic	TOPIC DETAILS	PDS
1	**Basic soil mechanics and Foundation Engineering**	**64**
1.1	Basics of Soil mechanics.	
1.2	Soil Classification and Soil exploration. Trial pit and bore log details.	
1.3	Soil strength parameters. Laboratory testing of soil.	
1.4	Various types of soils and their properties with respect to their suitability for foundations of structures.	
1.5	Determination of bearing capacity for shallow and deep foundations. Settlement analysis. Differential settlement and practical methods to reduce its effects on structures. Pile load testing.	
1.6	Earth pressures.	
1.7	Embankment design and Stability of slopes.	
1.8	Relevant provisions of IS, IRS and IRC codes.	
1.9	Analysis of loads and their effects for substructures and foundations	
1.10	Analysis of reinforced earth structures.	
1.11	Tunnels. Design of tunnel linings, portals etc.	
2.	**Software-STAAD PRO or/and MIDAS**	**48**
	Note : only introductory Training on these soft wares will be given at training institute. Zonal Railway will organise detailed training by engaging services of reputed training institutes when the trainees are attached with the design office for field training.	
3.	**PSC design**	**48**
3.1	Basic Concepts of PSC.	
3.2	Materials for PSC.	
3.3	Analysis of sections for flexure. Bonded and un-bonded tendons.	
3.4	Shear, bond, bearing stresses. Camber, deflections, Pre-stressing cable layouts. Partial pre-stress and non-pre-stressing reinforcement. Pre-stressing losses.	
3.5	Analysis and design of PSC slabs, I girders and Box girders. Analysis for temperature effects and designing for the same.	
3.6	Tutorials on PSC design	
4	**Steel Design**	**48**
4.1	Design of Steel Bridges, Composite bridges	
4.2	Fatigue considerations in steel bridges	
4.3	Steel buildings, including industrial buildings	
4.4	Tutorials on steel design	
5	**Dynamic Analysis**	**24**
5.1	Basics of dynamic analysis	
5.2	Earthquake design as per IS and IRS codes	
6	**Corrosion related issues**	**8**
6.1	Basic mechanism of corrosion. Carbonation of concrete. Various codal provisions for corrosion prevention	
7	**Strength assessment of existing structures and Rehabilitation of Structures**	**24**
7.1	Non-destructive testing of structures.	
7.2.	Assessment of strength form results of NDT and strength parameters obtained from destructive testing.	
7.3.	Study of various failure patterns in structures.	
7.4.	Various method of structural rehabilitation including methods using new technologies like Carbon fibre based systems. Determination of acceptance criteria for rehabilitation schemes.	
7.5.	Strength assessment of masonry arch bridges. Ring software and empirical methods like Tabulation method and modified MEXI method. Finalising dismantling schemes for structures.	
9	**Bridge Bearings**	**16**
9.1	Requirement and functions of bearings.	
9.2	Various types of bearings. Design of common type of bearings.	
10	**Temporary structures, launching schemes etc.**	**16**
10.1	Temporary structures. Load assessment and design of temporary structures. Erection loads. Crane working. Finalisation of launching and de-launching schemes. Temporary restoration of traffic at accident sites.	
11	**Codes and Manuals (Part 2)**	**40**
11.1	Study of various IS, IRS, IRC, and UIC codes relevant to design of structures.	
	Total Duration (Phase VI) 42 DAYS X 8 PDS = 336	**336**

INDUCTION COURSE PH-VII FOR (JE/SSE/DESIGN)(B-4d)

DURATION: 5 WEEKS

Annexure B-4 (d)

Topic	TOPIC DETAILS	PDS
1	**Various topics**	**240**
1.1	Study of Standard drawings for RCC, PSC, 30 (Five weeks) Steel bridges for Railways and ROBs.	
1.2	Conversion of discrete wheel loads into EUDL	
1.3	Rail structure analysis	
1.4	Design of Railway and Highway Bridges. Trainees will be made to actually carryout designs of at least one through girder bridge for Railway, and one PSC bridge for Highway	

INDUCTION COURSE PH-VIII EXAM MODULE (JE/SSE/DESIGN)(B-4e)

DURATION: 2 WEEKS

Annexure B-4 (e)

Topic	TOPIC DETAILS	PDS
1	**Special Topics**	**16**
1.1	Rail Structure Interaction Analysis.	
1.2	Basic concepts of LWR as relevant to RSI analysis.	
1.3	Track transitions on bridge approaches	
1.4	Green building concepts	
2	**Strength assessment of existing structures and Rehabilitation of Structures**	**32**
2.1	Non-destructive testing of structures.	
2.2	Assessment of strength form results of NDT and strength parameters obtained from destructive testing.	
2.3	Study of various failure patterns in structures.	
2.4	Various method of structural rehabilitation including methods using new technologies like Carbon fibre based systems. Determination of acceptance criteria for rehabilitation schemes.	
2.5	Strength assessment of masonry arch bridges. Ring software and empirical methods like Tabulation method and modified MEXI method. Finalising dismantling schemes for structures.	
3	**Estimation of quantities** Estimation of quantities for various structures	**8**
4	**Design Reports** Preparation of Design Reports	**4**
5	**CRS sanction etc** Speed Certification of bridges, CRS sanction.	**4**
6	**Exams** Project presentation and examination	**24**
	Total Duration (Phase VIII) 12 DAYS X 8 PDS=96	**96**

WORKS

INDUCTION COURSE (SSE / JE WORKS) (W-1)

DURATION OF COURSE: 12 MONTHS

SN	Types of Training	Place of Training	Duration	Remarks
1	Induction PH-1	Training institute	3 Months	Detailed training programme as per Annexure W-1 (a)
2	Induction PH-1	Training in field	2 Months	Trainee will be given exposure of working in open line for a duration of Two months. To make him conversant with following. **Open line – (Two Month)** Inspection, record keeping and action required. 1. Buildings 2. Steel Structure 3. Passenger amenities 4. Water supply 5. Sanitary Arrangement 6. Land management 7. Surveying 8. Soil Mechanics 9. Concrete Technology 10. Estimate
3	Induction PH-2	Training institute	3 Months	Detailed training programme as per Annexure W-1 (b)
4	Induction PH-2	Training in field	2 Months	Trainee will be given exposure of working in Construction Organization for a duration of Two month to make him conversant with following. **Construction org – (Two Month)** i) Bridge work site ii) Building Site iii) Survey and Land Acquisition iv) Work site protection near running lines. v) Formation and cuttings vi) Steel fabrication
5	Induction PH-3	Training in field	Six Weeks	On the Job Training i.e. attachment with SSE/Works Open line/Construction depar ment where he is likely to be Posted.
6	Posting Exam	Training Institute	Two Weeks	Posting Exam Module Detailed training programme as per Annexure W-1 (c)

INDUCTION PH - I (JE/WORKS) (W-1a)

DURATION OF COURSE: 3 MONTHS

TOPIC	TOPIC DETAILS	PDS
1	**RAILWAY ORGANISATION**	**8**
1.1	Organizational structure of open line ,at zone, Division, Sub Division and Supervisor level	2
1.2	Construction organization at CAO/Const., Dy/CE/Const,XEN and AXEN, Supervisor level	2
1.3	Associate of finance dept. at various levels in open line and construction organization.	1
1.4	Other Dept. --Elect, Mech, S&T, Optg., Store etc. and their function	1
1.5	Diff. gauge and classification of Railway Routes	1
1.6	Other associated organizations viz. IRCON, RITES,DFC,RVNL,CRIS,CONCOR,METRO RAIL etc.	1
2	**DUTIES**	**8**
2.1	Duties of Asst. Engineer, General, Essential duties of Assistant Engineer regarding administration, Inspection and maintenance, store, Establishment and staff matters.	2
2.2	Duties of JE/SE/Works General duties, Knowledge of rules and regulations, Co-ordination with permanent way, Bridge and other staff , Inspections and maintenance of building and structure, accompanying higher official during inspection, preparing inspection notes and compliance of inspection notes. Execution and measurement of works, Establishment and staff matter, Store and account, Correspondence, Relinquishment of charge etc.	6
3	**PLANNING,LAYOUT OF VARIOUS BUILDINGS, CONSTRUCTION OF BUILDINGS,PLATFORM ETC**	**38**
3.1	Siting of buildings, Planning, Design and layout of building. Staff colonies. Construction of various building, platform etc., Provision of NBC-2016	6
3.2	Provision of water supply to stations and staff quarters	4
3.3	Sanitation and drainage,	5
3.4	Basic amenities in staff quarters	2
3.5	Type of flooring, Wall surface and colour of wood and steel work in general, New materials, Construction and maintenance of service buildings , Additions and alterations to quarters	6
3.6	Green building concepts, seismic resistance in buildings	5
3.7	Field Visit to Green Building Site	8
3.8	Building registers, Transfer of buildings, Responsibilities of staff occupying quarters, Vacant railway buildings.	2
4	**INSPECTION AND MAINTENANCE OF BUILDING**	**14**
4.1	Colony Maintenance, Inspection and repairs, Monitoring of maintenance, Periodical maintenance works.	6
4.2	Standard measurement registers for buildings, Petty repairs book, and Complaint register.	2
4.3	Precaution during monsoon regarding leakage of building	2
4.4	Water proofing-Leakages from terraces, bathroom and WC dampness at Plinth, Plinth protection etc.	4
5	**INSPECTION OF STEEL STRUCTURE AND TIMBER WORK**	**14**
5.1	Erection of steel work and roof trusses. Different method of erection	6
5.2	Inspection and maintenance of steel structure.	4
5.3	Handing over of commissioned assets by construction organization to open line	2
5.4	Structural steel & timber work inspection register	2
6	**SANITARY ARRANGEMENT AND HYGIENIC CONDITION**	**32**
6.1	Sanitary arrangements in stations yard, Service buildings & colony cleaning of drains/sewer lines prior to monsoon	4
6.2	Railway sanitation committees, Colony care committee, Area housing committee, Service improvement group, Colony Inspection Group etc.	5
6.3	Inspection and record of minutes of meetings.	1
6.4	Field visit to a railway colony location	6
6.5	Conservancy work, Sanitary and protection of installation.	3
6.6	Precautions against infectious diseases and disinfection of quarters.	1
6.7	Waste Water Recycling, Bio Toilets	4
6.8	Field Visit to Waste Water Recycling Plant	8
7	**PASSENGER AMENITIES**	**24**
7.1	Latest Guidelines on Categorization of stations.	8
7.2	Minimum, recommended and desirable amenities.	4
7.3	Model , Adarsh station, World Class stations Station redevelopment	2
7.4	Passenger amenity booklets, feeding data into PAMS, Facilities for physically handicapped, latest guidelines.	4
7.5	Station name, platform sign boards and colour scheme, Pictogram.	2
7.6	Design aspects for layout of station complexes, station buildings, approach roads and circulating area.	4
8	**WATER SUPPLY**	**52**
8.1	General, Important circular on water supply. Water audit	4
8.2	Schemes for new and augmentation of existing water supply, Review of water supply arrangements.	3
8.3	Design aspects while constructing a new Water Supply pipeline system	4

TOPIC	TOPIC DETAILS	PDS
8.4	Estimating requirements of water, Sources of water, Infiltration gallery, Infiltration well, Radial collector wells, Intake arrangements, Outside sources, Capacity of source, Site selection.	4
8.5	Tutorial : Assessment of quantity of water supply of a SSE jurisdiction including Colonies,Sheds,offices etc.	2
8.6	Various checks and precaution for drilling, sinking of tube well, Verticality and yield test, Determination of size, Improving yield in open wells, Failure of wells and the remedial measures.	2
8.7	Capacity of storage & pumping system.	3
8.8	Method and process of water purification, treatment and disinfection of water ,Sampling of water, R.O. Process	6
8.9	Field Visit to Water Treatment/Filtration Plant	6
8.10	Inspection and maintenance of water supply installation.Various layout of distribution systems, Valves fitting, Residual pressure.	4
8.11	Preventive maintenance, Cleaning of tank, Protection against pollution near sewer and drains.	2
8.12	Carriage watering system, responsibilities of engineering, mechanical, electrical departments.	2
8.13	Field Visit to Train Watering Station for Understanding	6
8.14	Rain Water Harvesting	2
8.15	Tutorial on Rain Water Harvesting System	2
9	**LAYING & MAINTENANCE OF SANITARY ARRANGEMENT**	**17**
9.1	Preparation of scheme of sewerage, Calculation for quantity of sewerage and designing of sewerage system, Alignment, laying of sewer pipes & precautions.	5
9.2	Sewage treatment and disposal, Septic tanks, Soak pit, Aqua privy latrines, Bio-latrines.	3
9.3	Inspection and maintenance of sewerage, drainage and conservancy at station and colonies.	2
9.4	Model room Visit showing different components of Sanitary fittings , accessories etc.	4
9.5	JPO on various works to be done by different departments and their responsibilities	2
9.6	Periodical cleaning of drainage system, Various sanitary fittings and specification.	1
10	**PLANTATION & HORTICULTURE**	**12**
10.1	Role of engineering staff, Planning for plantation, Nursery.	3
10.2	Care of young trees, Maintenance of gardens in offices, Rest houses and colonies, Provision of lawns and hedges in bungalow. Ornamental trees, Seasonal flowers.	3
10.3	Sale of trees by auction or by tender or to state forest corporations etc., Fixing of reserve price of lots, Auction or tender notices and agreement, Register of sales of natural products.	1
10.4	Licensing of tanks and borrow pits for agriculture.	1
10.5	Felling of trees, Felling outside railway limits, In compound of staff, quarters, Near electrical or telegraph wires.	1
10.6	Afforestation on railway land by forest department, Survey of surviving trees, Harvesting of matured trees.	3
11	**MANAGEMENT OF LAND**	**44**
11.1	Acquisition, management, relinquishment of railway land, Land record at sub div, division and at CE office.	6
11.2	Classification of railway land	4
11.3	Application and procedure for acquisition of land	4
11.4	Custody of land, Demarcation of boundary by pillar, boundary wall, fencing ditch etc. Inspection & verification of land boundary,Land boundary register, Authentication of land plan.	2
11.5	Encroachments and its removal ,PPE Act, Religious structure	4
11.6	Maintenance of right of way, Responsibility at various levels and departments.RLDA.	2
11.7	Lease and license, sample lease agreement, Surplus land, Utilization and development of land, Leasing/ licensing to govt. dept, welfare organizations, private schools, bulk oil installation,Construction of buildings in nearby railway area, NOC etc.	6
11.8	Earning from railway land,. Disposal of surplus land.	2
11.9	Latest Railway Board Circular on Land Policies	2
11.10	TMS- Land Module , Hands -on also	6
11.11	Visit to land cell of Engineering Branch of Division office	6
12	**PLANS & DRAWINGS.**	**5**
12.1	General procedure, Plans for other departments.	1
12.2	Drawing Equipment, Sizes of drawings, titles and numbering of drawings, Scale of drawings, Details on drawing, Symbols and colours on drawings, Standard drawings.	1
12.3	Plans issued by the chief engineer's office, Plans in divisions/dy. Chief engineer's, assistant engineer's and section engineer's office.	1
12.4	Completion drawings, Care and filing of tracings.	2
13	**STORAGE AND USE OF EXPLOSIVE.**	**4**
13.1	General, Authority and Instructions on storage and use of explosives, Observance of rules.	2

W-1a contd.....

TOPIC	TOPIC DETAILS	PDS
13.2	Carriage of explosives, Protection to trains and railway property.	1
13.3	Precautions to be observed during blasting, Misfires with electrical method of firing, Explosives disposal.	1
14	**POLICE JURISDICTION AND SECURITY OF RAILWAY MATERIALS:**	**4**
14.1	General, Police jurisdiction, Lodging of complaints, cooperation with government railway police,	2
14.2	Cognizable offences , Non-cognizable offences , Powers of arrest by railway staff, Warrants against railway staff , Action by railway staff in cases of attempted sabotage, Answering of court summons,	1
14.3	Prevention of trespass, Disposal of human bodies found run over, Disposal of cattle found dead on the line, Proforma for lodging FIR. miscellaneous	1
15	**PROJECT DEVELOPMENT PROCESS.**	**9**
15.1	Classification of surveys, Techno-Economic surveys, Reconnaissance survey, Preliminary investigation, Traffic survey.	2
15.2	Terms of reference. Estimates of gross earnings of a new line project. Assessment of goods traffic earning and expenses, Financial appraisal.	2
15.3	Project completion report, Form of completion report, Accounts verification of completion reports., Completion reports of unfinished works, Completion statements,	2
15.4	Assets register, Commissioning of project Opening for goods and passenger traffic, Handing over new line for opening.	3
16	**ENGINEERING SURVEY-**	**4**
16.1	Reconnaissance, Preliminary and final location surveys, Techno economic survey report and feasibility report.	2
16.2	Project report -(introduction, characteristics of project area, standards of construction, route selection, project engineering, estimation of cost and construction schedule, conclusion & recommendation)	2
17	**INVESTMENT PLANNING & WORK BUDGET**	**5**
17.1	Works programme preparation	2
17.2	Financing of work budget	1
17.3	Advance planning, Scrutiny of schemes, Preparation of preliminary works programme, Final work programme,	2
18	**ESTIMATES & CONTRACTS---**	**30**
18.1	Kinds of estimates, Abstract estimates, Detailed estimates. Supplementary estimates, Revised estimates, Project abstract estimates, Construction estimates, Completion estimates. Check on estimates	2
18.2	Completion report and completion statement Estimate of junction arrangements, Estimate of deposit work,	2
18.3	Verification of estimate, Competency of sanction, Currency of sanction, Register of estimates.	2
18.4	Definition of contract, Forms of works contracts, service contract	2
18.5	List of approved contractors, Classification of contractor Contracts for zone works,	2
18.6	Tender, Tender forms, Tender notice, E-tender. General condition of contract, Special conditions of contract, .Earnest money. Security deposit, PG, Forms in which earnest money and security deposit is acceptable.	3
18.7	Specification & drawing, Opening of tenders, Constitution of tender committee. Contract agreement, Briefing notes for the tender committee , Acceptance of tender, Refund of earnest money, GCC Provisions	6
18.8	Measurement book, Recording of measurements, Standard measurements, test check, Measurement of ballast, Contractor payment, finalization of agreement, GST.	4
18.9	Advances to contractors, Issue of railway materials and tools & plant to contractors.-Extension of completion period, Site order book-Liquidated damages, Variation in quantity of work during the execution of work, vitiation, Arbitration.	3
18.10	Execution of works in emergency, Daily report of labour employed, Muster sheet, Register of wages	2
18.11	Model SOP	2
19	**EXECUTION OF WORKS,**	**6**
19.1	Urgency certificate, Material modification & minor modification,	1
19.2	Temporary work establishment, Field book, Departmental charges for deposit work,	1
19.3	Work required for Defense purpose, Assisted sidings etc.	2
19.4	Registers to be maintained during execution of works.	2
20	**BUILDING & RENTS**	**8**
20.1	Conditions for provisions of staff quarters, Classification of quarters, Scale of accommodation for staff, Accommodation for officers.	1
20.2	Assessed rent. Recovery of charges, Provision of furniture and other amenities, Rent for temporary huts and tented accommodation, Club, house for officer, Occupation of railway rest houses or rest rooms, rent agreement.	2
20.3	Accommodation for railway co-operative societies, Rent for premises let out to recognized unions and federations.	1

TOPIC	TOPIC DETAILS	PDS
20.4	Military building on railway land, Service buildings, Information for preparation of rent rolls, service charges etc.	2
20.5	Conservation of Heritage structures	2
21	**SCHEDULE OF DIMENSION -**	**5**
21.1	Standard dimensions pertaining to works, Moving Dimension, Station yard, rolling stock dimensions as per Schedule-I etc.	4
21.2	Existing infringing dimensions as per schedule-II connected with works, ODC, Extra Clearances on Curves.	1
22	**NEW BUILDING MATERIAL**	**4**
22.1	Light weight concrete, Decorative surface and laminates, Vacuum dewatered concrete. Anti-corrosive treatments ,various type of glasses, various tiles, various stones slab, false ceiling material, paver block etc.	2
22.2	PVC Pipes, Bitumastic sheet, Hard and soft board, Particle board, PVC door, window and other fitting, Fly Ash Brick, Concrete interlocking Paver blocks, Galvoaluminium sheets, Auto Clave blocks etc.	2
23	**SOR & SPECIFICATIONS**	**16**
23.1	Earth work and carriage of material	2
23.2	Plain and reinforced cement concrete	2
23.3	Brick and stone masonry	1
23.4	Wood, Steel and Aluminium work	1
23.5	Flooring and Roofing	2
23.6	Water supply, sewerage and drainage	2
23.7	Road Bridge, Fencing, supply of material	1
23.8	Painting and miscellaneous Building work	1
23.9	Other works	2
23.10	Common Building Materials and relevant codes	2
24	**TUTORIAL ON ANALYSIS OF RATES FOR NEW ITEM**	**6**
25	**SURVEYING**	**18**
25.1	General purpose of Surveying, Introduction to common survey terms and principles of surveying & levelling.	2
25.2	Exposure to commonly used instruments/tools that measure angles &distances i.e. Theodolite, Dumpy Levels, Total stations, GPS etc. Curve setting	3
25.3	First-hand experience of carrying out topographic surveys at various scales, Interpretation and presentation/ reporting of survey data.	2
25.4	Custody handling and upkeep of instrument, numbering and allotment of instrument.	1
25.5	Adjustment and Repairs of Surveying Instruments.	1
25.6	Hands on - Use of Total station including setting out for a structure	5
25.7	Advance Survey Methods (Drone Survey, GPS etc.)	4
26	**SOIL MECHANICS**	**20**
26.1	Water content, Void Ratio, Porosity, Degree of saturation, Atterberg Limits, Coefficient of uniformity, Coefficient of curvature, Determination of water content, Classification of soil, Compressibility etc.	2
26.2	Foundation and bearing capacity,	2
26.3	Consolidation, Compaction, Different type of rollers, Rehabilitation of weak formation, Soil exploration, Guide lines for quality control in earth work, GE-1 & GE-14	2
26.4	Basics of embankment design	2
26.5	Design of Cuttings , maintenance and Stabilization measures	2
26.6	Blanketing material - Specification and quality control	2
26.7	GE/Soil Lab.	4
26.8	Geo-technical & Geo-physical investigation for earthwork.	2
26.9	Slope stability analysis.	2
27	**BRIDGES**	**13**
27.1	Classification of a bridge, Responsibility of the engineering officials, Schedule of inspection, Bridge inspection register, Technical inspection.	5
27.2	Construction of well and pile foundation. Cofferdam, composite construction	6
27.3	Imposition of Speed Restriction on Bridges , if required ,Numerical Rating System, Action to be taken after inspection of bridges,	2
28	**CONCRETE TECHNOLOGY**	**39**
28.1	Ingredient of concrete such as RCC,PSC, and mass concrete and use of codes,	2
28.2	Concrete production and quality control, including Mix Design, RMC	4
28.3	Tutorial on design mix of concrete	2
28.4	Lab.- Mix design	4
28.5	Rehabilitation of RCC structures.	4
28.6	Washable apron drawing detailing, execution & maintenance issues	1
28.7	Basics of PSC, construction aspects of PSC, concrete bridge code provisions, prestressing losses (increased by 2 pds)	4
28.8	Study of PSC girder Drawing, working out cable profile prepressing and grouting	3
28.9	Field visit to PSC construction site	6

TOPIC	TOPIC DETAILS	PDS
28.10	Working of Railway Crane and Road Crane	2
28.11	Temporary Arrangement	2
28.12	LHS/ROB/RUB planning and Railway Board Guidelines	2
28.13	Launching of PSC Girder	1
28.14	NDT including latest methods	2
29	**MISCELLANEOUS(REPORTING, CIVIL DEFENSE, SEMINAR, SUPW, MID TERM EXAM & 2 EXAMINATIONS)**	**74**
30	**STUDY TRIP TO IMPORTANT CONSTRUCTION PROJECTS TO STUDY EARTHWORK, BRIDGE CONSTRUCTION, BUILDING CONSTRUCTION METHODS ETC. OF CONSTRUCTION MACHINERIES , EARTH MOVING MACHINERIES AND ASPECTS OF CONSTRUCTION AND SAFETY DURING CONSTRUCTION (5 DAYS, 1 WEEK)**	**40**
31	**SAFETY AT WORKSITE, PRECAUTIONS DURING DISMANTLING OF STRUCTURES, MACHINERY AND VEHICLES WORKING NEAR TO TRACK ETC.**	**3**
	Total	**576**
	Note: 8 Periods are considered of 0.45 Hour Duration each day. (Working days = 72 Days*8periods = 576 Periods)	

S.No.	SUMMARY	PDS
A.	**Class room**	**393**
B.	**Hands-on**	**13**
C.	**Technical Films**	**0**
D.	**Field Visit**	**72**
E.	**Model Room**	**4**
F.	**Tutorials**	**12**
G.	**Laboratory**	**8**
H.	**Miscellaneous**	**74**

INDUCTION PH - II (JE/WORKS)(W-1b)

DURATION OF COURSE: 3 MONTHS

TOPIC	TOPIC DETAILS	PDS
1	**COMPONENTS OF P. WAY.**	**35**
1.1	Formation, Ballast, Sleeper, Rail, Fittings & Fastenings).	4
1.2	Definition Of LWR,SWR ,Introduction and Maintenance of level crossing and gate lodge	4
1.3	Specification of Track Ballast. Measurement of Track Ballast	4
1.4	Track structure on special location	4
1.5	Sketch of formations with dimension in Cutting. Filling, in curve, Single/Double line	2
1.6	Definition, Sand hump, dead ends, Catch & Slip siding , Gathering line Fouling marks, Distance pieces to platform lines:	1
1.7	Level crossing infrastructures and Maintenance issues	2
1.8	Field Visit to a Level Crossing, Yard etc for Rails, Sleepers and other P-Way features.	8
1.9	Model Room Visit related to components of P.Way	6
2	**TURNOUTS**	**16**
2.1	Brief idea of different types of Turnouts, Definition and description of components and terms, Contrary and Similar flexure turnouts:	8
2.2	Field Visit to a yard for understanding features of Turnouts , Yard Layouts etc.	8
3	**HOROZONTAL & VERTICAL CURVES**	**30**
3.1	Types of curves, Degree of curve, Relation between Degree & Radius, Chord and Versine, Super Elevation, Equilibrium cant, Maximum cant for normal and high speed trains, Cant deficiency and cant excess.	6
3.2	Calculation for Setting out of horizontal curves by Linear methods and with Theodolite Cubic parabola off sets for setting out transition curve, Shift , Extra clearance on curves. Need for vertical curve, Grades, grade compensation, Equivalent radius, Calculations for setting out a vertical curve, Level pegs for accurate maintenance.	8
3.3	Equilibrium speed, permissible speed, Transition length, Maximum cant gradient, Rates of running out of cant and cant deficiency.	8
3.4	Field Visit - Curve setting by Theodolite/Total Station	8
4	**DRAINAGE IN YARDS,**	**8**
4.1	Slope on top of formation, Side and catch water drains, Longitudinal and cross drain in yards.	4
4.2	Introduction Push Trolly, Lorry and Rail Dolly working and protection of Track.	4
5	**ACCIDENTS BREACHES--**	**22**
5.1	Classification of accidents, Sounding of hooters, Action during accident, Reporting of accident to station master.	4
5.2	Action at site, Examination of site and preparation of sketch, Preservation of clues, Attendance of police, Restoration of traffic, Accident enquiry.	4
5.3	Diversion, material for emergency, Service span and Rail Cluster, Railway affecting works,	8
5.4	Breach, Pre monsoon precautionary measure, Observance of rule.	6
6	**TRANSPORTATION-**	**12**
6.1	G&SR, Various systems of working, Absolute & Automatic block system,	4
6.2	Classification of stations, Condition for granting permission to approach, Single line working on double line, Reception of train on blocked line and starting from non-signaled line.	4
6.3	TFC, Interlocking, Recovery time, Trailing point, Facing point, Isolation, Station limit, Block section, Track circuit, mixed train, ODC movement	4
7	**CRS SANCTION**	**4**
8	**COMMISSIONING OF NEW WORK,ADDITION AND ALTERATION**	**4**
9	**ENGINEERING INDICATOR AND EMERGENCY PROTECTION**	**6**
10	**BRIDGES**	**100**
10.1	Field Visit to Bridge Well/Pile construction Site	16
10.2	Painting of bridges,Maintenance of foundations, Substructure Protective works, Superstructure,Cement Pressure Grouting,Epoxygrouting,Shotcreting / Guniting, Jacketing.	6
10.3	Loss of camber in steel girders,Corrosion and its prevention,Maintenance and replacement of Bed Blocks, Sleeper & CC cribs, Rail Cluster.	6
10.4	Types of bearing, Maintenance of bearings,Precautions while carrying out maintenance works on bridges,oiling and greasing of bearings,Special inspection during monsoon,Pitching stone, boulder and other monsoon reserves,Flood records after the monsoon&during monsoon	6
10.5	River training works, Guide bunds, Marginal bunds, Spurs/Groynes, Aprons, Closure bunds, Assisted cut offs, Approach banks	5
10.6	Temporary arrangement & launching of girders (PSC& Steel).	6
10.7	Field Visit to Road Crane Working Site/ Crane Location	8
10.8	Inspection & maintenance of Concrete Bridges	6
10.9	Fabrication of Steel Girders, FOB structures etc.	4
10.10	Field Visit to Steel Girder Fabrication Workshop or Site	8

W-1b contd.....

TOPIC	TOPIC DETAILS	PDS
10.11	Types of Bridges, HFL, DL, LWL, RAT/Raw, etc.	4
10.12	Water way calculation,Planning for Bridge spans HFL ,DL,RAT/ RAW etc.	6
10.13	Fixing of spans of a bridge	4
10.14	LHS works, Box pushing , cut and cover techniques,	4
10.15	Tutorial on Bridge Water Way Calculation	3
10.16	Model Room Visit for types of Bridges,TemporaryArrangements, River Training Works etc.	4
10.17	Laboratory for NDT Testing , Corrosion Monitoring etc	4
11	**TUNNELS**	**10**
11.1	Maintenance of tunnels, schedule of inspection, maintenance of approach of tunnel, ventilation shaft, Weep hole etc.	6
11.2	Drainage system, catch water drain, loose boulders in cutting	4
12	**FINANCIAL ASPECTS**	**10**
12.1	Financial Organization on the Railways,Canons of financial propriety,	2
12.2	Railway Budget, Allocation & Heads of expenditure (CF, DF,CAP, DRF, OLWR, SF, SRSF etc.), preparation, submission &, compilation of budget Demands for Grants, Appropriation Bills, Voted expenditure, Charged expenditure, Re- appropriation etc.	4
12.3	Contingency fund, Consolidated fund of India, Financial powers of Engineering Officers, Budgetary review	3
12.4	Exchequer control, Public Account Committee.	1
13	**STORE & ACCOUNTS**	**13**
13.1	Store Organization and working of store departments Classification of stores & stock.	1
13.2	Price list, Initial Accountal of revenue and work expenditure, Issue & Receipt of materials,Day book, Issue note, Credit note, RMC note, Indemnity Bond, Damurage, Wharfage, Imperest store, MAS store, Surplus store & its disposal,Charged off store, Store return	4
13.3	Procurement of store, Stock,and Non Stock item,Stationaryitem,Accountal of material, Use &Transaction of material,	4
13.4	Safe custody of material,Gate-pass,Stacking of materials,Stockverification,Stocksheet,Over hauling, Ballast train return, Inventory control	4
14	**CONTRACT**	**32**
14.1	GCC- Provisions related to execution of works	8
14.2	IRPSM & Works programme	4
14.3	Different types of plan heads and allocation of expenditure	2
14.4	Project Management Technique, With Hands -On	8
14.5	Pre tender planning, guidelines, documents including tender schedule and condition	6
14.6	Basics of Arbitration	4
15	**ESTABLISHMENT-**	**16**
15.1	Pay sheet, Service Record, Leave rules, Pass rule, Old and New Pension Scheme,PF.VPF,Gratuity, Medical attendance,	4
15.2	SBF,Promotion,Tradetest,Minimum Wages Act,Payment of Wages Act,Workmen Compensation Act,HOER, RTI.	6
15.3	Union matters PNM,JCM, PREM,	2
15.4	Conduct Rule, Discipline and Appeal rule.	4
16	**RAJBHASHA-**	**4**
16.1	Directives in use of Raj Bhasha in day-to-day working,	2
16.2	Various prizes/ schemes.	2
17	**COMPUTER & THEIR USAGE---**	**40**
17.1	Hands -On : Computer Applications,Windows,MS- Office: Word, Excel, Access, Power Point, AUTO-CAD	32
17.2	Hands - On :Use of Internet and search engine, Latest advancement in Information Technology & E-mail, Track Management System software related to works engineering, IRICEN mobile/website, IRCEP portal, RDSO website	8
18	**HUMAN RESOURCE MANAGEMENT**	**2**
19	**MANAGERIAL SKILL**	**2**
20	**PERSONNEL DEVELOPMENT AND SOFT SKILL**	**2**
21	**LEADERSHIP**	**2**
22	**QUALITY CONTROL**	**5**
23	**OFFICE CORRESPONDENCE AND DRAFTING OF LETTER**	**2**
24	**FIRST AID**	**1**
25	**DISASTER MANAGEMENT**	**4**
26	**Ethical training Related to DoPT Guidelines**	**2**
27	**FIRE FIGHTING**	**1**
28	**VIGILANCE ASPECTS**	**4**
29	**BASICS OF SIGNALING AND PRECAUTIONS DURING EXECUTION OF WORKS, FOR UNDERGROUND CABLES ETC.**	**6**
30	**PRECAUTIONS DURING WORKING IN ELECTRIFIED TERRITORIES**	**2**
31	**STUDY TRIP TO IMPORTANT CONSTRUCTION PROJECTS TO STUDY EARTHWORK,BRIDGECONSTRUCTION,BUILDING CONSTRUCTION METHODS ETC OF CONSTRUCTION**	

TOPIC	TOPIC DETAILS	PDS
	MACHINERIES, EARTHMOVING MACHINERIES AND ASPECTS OF CONSTRUCTION AND SAFETY DURING CONSTRUCTION (12 DAYS, 2 WEEKS)	96
32	Compassion towards Differently Abled Persons	2
33	Building/works management system	2
34	Correction slips --of all codes and manual	5
35	Miscellaneous	74
	Total Duration of Phase II Course.	576
	NOTE: 8 Periods are considered of 0.45 Hour Duration each day. (Working days = 72 DaysX8 periods = 576 Periods)	

S.No.	SUMMARY	PDS
A.	Class room	293
B.	Hands-on	40
C.	Field Visit	152
D.	Model Room	10
E.	Tutorials	3
F.	Laboratory	4
G.	Technical Films	0
H.	Miscellaneous	74
	Grand Total	576

REFRESHER (SSE/JE/WORKS) (W-2)

DURATION : 12 DAYS

TOPIC	TOPIC DETAILS	PDS
1	**PLANNING, LAYOUT OF VARIOUS BUILDINGS**	**5**
1.1	Siting of buildings, Planning, Design and layout of building. Staff colonies. construction of various building, platform etc, Provision of NBC-2016	2
1.2	Construction and maintenance of service buildings , Additions and alterations to quarters	1
1.3	Building registers, Transfer of buildings, Responsibilities of staff occupying quarters, Vacant railway buildings.	1
1.4	Green Building - LEED & GRIHA rating system, repair, maintenance & retrofitting of building	1
2	**INSPECTION AND MAINTENANCE OF BUILDING**	**2**
2.1	Inspection and repairs, Monitoring of maintenance, Periodical maintenance works.	1
2.2	Standard measurement registers for buildings, Petty repairs book, and Complaint register.	1
3	**INSPECTION OF STEEL STRUCTURE**	**2**
3.1	Inspection and maintenance of steel structure.	2
4	**SANITARY ARRANGEMENTAND HYGIENIC CONDITION**	**4**
4.1	Railway sanitation committees, Colony care committee, Area housing committee, Service improvement group, Colony Inspection Group etc.	2
4.2	JPO, Inspection and record of minutes of meetings.	2
5	**PASSENGER AMENITIES**	**3**
5.1	Model , Adarsh station, World Class stations	1
5.2	Passenger amenity booklets, Facilities for differently abled, latest guidelines.	2
6	**WATER SUPPLY**	**6**
6.1	Various checks and precaution for drilling, sinking of tube well, Verticality and yield test, Determination of size, Improving yield in open wells, Failure of wells and the remedial measures.	2
6.2	Method and process of water purification, treatment and disinfection of water ,Sampling of water, R.O. Process and Technical Film	2
6.3	Preventive maintenance, Cleaning of tank, Protection against pollution near sewer and drains.	2
7	**LAYING & MAINTENANCE OF SANITARY ARRANGEMENT**	**3**
7.1	Inspection and maintenance of sewerage, drainage and conservancy at station and colonies.	1
7.2	Periodical cleaning of drainage system, Various sanitary fittings and specification.	2

TOPIC	TOPIC DETAILS	PDS
8	**PLANTATION & HORTICULTURE**	**2**
8.1	Care of young trees, Maintenance of gardens in offices, Rest houses and colonies, Provision of lawns and hedges in bungalow. Ornamental trees, Seasonal flowers.	1
8.2	Sale of trees by auction or by tender or to state forest corporations etc. , Fixing of reserve price of lots, Auction or tender notices and agreement, Register of sales of natural products. Afforestation on railway land by forest department, Survey of surviving trees, Harvesting of matured trees.	1
9	**MANAGEMENT OF LAND**	**5**
9.1	Encroachments and its removal ,PPE Act, Religious structure	1
9.2	Maintenance of right of way, Responsibility at various levels and departments. RLDA.	1
9.3	Lease and license, Surplus land, Utilization and development of land, Leasing/ licensing to govt. dept, welfare organizations, private schools, bulk oil installation, Construction of buildings in nearby railway area, NOC etc.	2
9.4	Earning from railway land, Disposal of surplus land.	1
10	**POLICE JURISDICTION AND SECURITY OF RAILWAY MATERIALS:**	**1**
10.1	General, Police jurisdiction, Lodging of complaints, cooperation with government railway police	1
11	**EARTHWORK AND FORMATION**	**4**
11.1	RDSO Earthwork Guidelines GE-1 and GE-14, Aspects of Compaction, Selection of Suitable Soil for Embankment, Blanketing Material etc.	4
12	**ESTIMATES & CONTRACTS---**	**7**
12.1	Completion report and completion statement Estimate of junction arrangements, Estimate of deposit work,	2
12.2	Verification of estimate, Competency of sanction, Currency of sanction, Register of estimates.	1
12.3	Contracts for zone works	1
12.4	Any change in General condition of contract, Special condition of contract, Earnest money, security deposit	3
13	**BUILDING & RENTS**	**2**
13.1	Assessed rent. Recovery of charges, Provision of furniture and other amenities, Rent for temporary huts and tented accommodation, Club, house for office, Occupation of railway rest houses or rest rooms	1
13.2	Rent for premises let out to recognized unions and federations.	1

TOPIC	TOPIC DETAILS	PDS
14	**SCHEDULE OF DIMENSION -**	**3**
14.1	Standard Dimensions pertaining to works, Moving Dimension, Station yard, rolling stock dimensions as per Schedule-I etc.	3
15	**NEW BUILDING MATERIAL**	**3**
15.1	Light weight concrete, Decorative surface and laminates, Vacuum dewatered concrete. Anti corrosive treatments ,	2
15.2	Model Room : PVC Pipes, Bitumastic sheet, Hard and soft board, Particle board, PVC door, window and other fitting, Fly Ash Brick, Concrete interlocking Paver blocks, Galvoaluminium sheets, Auto Clave blocks etc.	1
16	**SURVEYING**	**4**
16.1	Field Visit : Exposure to commonly used instruments/tools that measure angles &distances i.e. Theodolite, Dumpy Levels, Total stations, GPS, drone survey etc. curve setting	3
16.2	Custody handling and upkeep of instrument, numbering and allotment of instrument, Hands-On- Adjustment and Repairs of Surveying Instruments.	1
17	**RAIN WATER HARVESTING**	**2**
18	**DRAINAGE IN YARD**	**2**
18.1	Slope on top of formation, side and catch water drains, Longitudinal and cross drain in yards.	2
19	**ACCIDENTS BREACHES--**	**3**
19.1	Classification of accidents, Sounding of hooters, Action during accident, Reporting of accident to station master.	1
19.2	Action at site, Examination of site and preparation of sketch, Preservation of clues, Attendance of police, Restoration of traffic, Accident enquiry.	1
19.3	Material for emergency, Service span and Rail Cluster, Railway affecting works, Breach, Premonsoon precautionary measure, Observance of rule.	1
20	**BRIDGES**	**6**
20.1	Rehabilitation of Bridges, Imposition of Speed Restriction on Bridges, if required ,Numerical Rating System ,Action to be taken after inspection of bridges,	2
20.2	Painting of bridges, Maintenance of foundations, Substructure Protective works, Superstructure, Cement Pressure Grouting, Epoxy grouting, Shotcreting / Guniting, Jacketing.	2
20.3	Precaution while carrying out maintenance work on bridges, oiling and greasing of bearing, special inspection during monsoon, monsoon reserves, flood records after the monsoon & during monsoon	2

TOPIC	TOPIC DETAILS	PDS
21	**TUNNELS**	**2**
21.1	Maintenance of tunnels, schedule of inspection, maintenance of approach of tunnel, ventilation shaft, Weep hole, Drainage system, catch water drain, loose boulders in cutting	2
22	**STORE & ACCOUNTS**	**3**
22.1	Store return, Accountal of material, use & transaction of material, safe custody of material, gate pass, stacking of materials, stock verification, stock sheet, over hauling	3
23	**ESTABLISHMENT-**	**3**
23.1	Conduct Rule, Discipline and Appeal rule.	2
23.2	Office correspondence, Pay sheet, service record, Leave rules, Pass rules, RTI	1
24	**CONCRETE TECHNOLOGY**	**9**
24.1	Ingredient of concrete, Tutorial : Designing of concrete mix 4	
24.2	Plain Concrete, RCC, Cement, it's grade, Steel, PSC	1
24.3	Model Room: Equipment for prestressing	1
24.4	Lab: Test on fresh and hardened concrete	1
24.5	Model Room : Various grade of steel	1
24.6	Compaction of concrete, different types of vibrators	1
25	**TECHNICAL FILMS : CONSTRUCTION MACHINARIES**	**1**
26	**CORRECTION SLIPS - OF ALL CODES AND MANUALS**	**1**
27	**MISCELLANEOUS**	**4**
28	**NGT - PROVISIONS**	**2**
29	**SAFETY AT WORKSITE**	**2**
	Total Periods	**96**
	NOTE : 8 Periods are considered of 0.45 Hour Duration each day. (Working days = 12 Days * 8 Periods = 96 Periods)	

	SUMMARY	
A.	**Class room**	**79**
B.	**Hands-on**	**1**
C.	**Technical Films**	**2**
D.	**Model Room**	**4**
E.	**Tutorials**	**2**
F.	**Laboratory**	**1**
G.	**Field Visits**	**3**
H.	**Miscellaneous**	**4**
	GRAND TOTAL	**96**

Ministry of Railways

Indian Railways Institute of Civil Engineering, Pune