

**Government of India**  
**Ministry of Communications, Department of Telecommunications**  
**National Telecommunications Institute for Policy Research,**  
**Innovation & Training ALTTC Campus, Ghaziabad (UP)-201002**

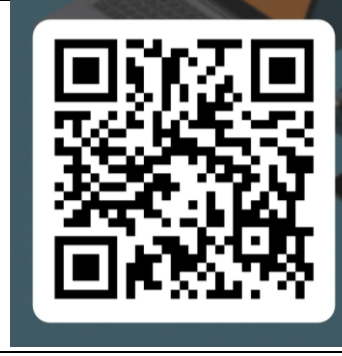
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Dated 25.03.2023

**Subject:** Inviting nominations for Batch 4 of online certification course in 5G Mobile Communications for Officers of Government of India being conducted by NTIPRIT w.e.f. 10th April 2023

1. In pursuance of the objective of training and capacity building and to spread awareness about the 5G technology, 5G's socio-technical impacts including in automaton and deployment of various solutions for the benefit of the nation and considering requests for training on 5G from
  - a. Various units of Department of Telecommunications
  - b. NCCS, DoT Bangalore requesting to arrange training on 5G for prospective Telecom Security Test Labs (TSTLs)
  - c. Telecom Sector Skill Council (TSSC) for imparting training to their master trainers in the 5G domain.
  - d. Central Ministries/State Governments
  - e. Few LSAs for training the faculty of Engineering Institutions of the state on 5G.
2. National Telecommunications Institute of Policy Research, Innovation and Training (NTIPRIT) is conducting 1 week (15 hours) online certification course in 5G from 10<sup>th</sup> April 2023 to 14<sup>th</sup> April 2023. The structure of one week long (15 hours) online certification course in 5G has been designed as part of the **Mission Karmayogi** and with this objective officer are able to understand the key policy issues, fundamental Principle and technical pillars of 5G needed to engage in and contribute towards proliferation of this revolutionary technology in various sectors across India.
3. Training will be conducted in online mode for 3 hours on a daily basis. The first session of the day will be held from 11.00 to 12.30 hours and the second session will be held from 15.00 to 16.50 hours.
4. An e-brochure of this certification course is attached. Accordingly, it is requested to circulate the information about this certification course among officers of your respective Units/Divisions/LSAs/Wings/Officers of Central and State Government and nominate a panel of 2-3 officers for this certification course. The nominated officers may register for this course at below link / QR code.
5. Eligibility:
  - a. The applicant should be an engineering graduate.
  - b. Central and State Government Officials are eligible to apply for the Course.
  - c. The Master trainers of TSSC are eligible to apply through Skill Development Division of DoT HQ.
  - d. The officials of TSTLs are eligible to apply through NCCS, DoT
  - e. The officials of PSUs/Autonomous Bodies of DoT
6. It is mandatory to fill up the online registration form at below link.

<https://forms.office.com/r/qDJ1xG6ENb>



7. After successful registration on above link, nominated officers need to send an email enclosing duly filled and submitted registration form along with recommendation of the controlling officer /organisation to the Course Coordinator [dikshu.yadav@gov.in](mailto:dikshu.yadav@gov.in) and Course Director [atul.wakhle@gov.in](mailto:atul.wakhle@gov.in)
8. It may be noted that the **last date of registration for this certification course is 3<sup>rd</sup> April 2023.**
9. In respect of nominations of Master Trainers from TSSC, TSSC may ask the master trainers to apply directly on the above link and TSSC sends the consolidated recommended list through Skill Development Division of DoT HQ to NTIPRIT. Similarly, in respect of nominations of officials from TSTLs, NCCS may ask them to directly apply on the link and NCCS sends the recommended consolidated list to NTIPRIT.
10. Any difficulty in registration may kindly be brought to the notice of the Course Coordinator Ms Dikshu Yadav AD (Wireless Access), NTIPRIT at [dikshu.yadav@gov.in](mailto:dikshu.yadav@gov.in)

*Atul Wakhle*

(Atul Wakhle)  
Director (Wireless Access)  
(atul.wakhle@gov.in)

Encl as above

To

1. The Secretaries, Central Ministries
2. DG (Telecom), DoT HQ
3. DG (NICF)
4. All the Heads of LSAs / CCA / WPC / WMO
5. Sr. DDG (TEC)
6. Sr. DDG (NCCS)
7. All Sr DDG/DDGs DoT HQ
8. DDG(SD) DoT HQ
9. The Chief Secretary, State Governments
10. CMD/CEO BSNL, MTNL, ITI Ltd, CDOT, TCIL

With a request to nominate officers for this certification course in 5G Mobile Communications as per details above.

Copy for kind Information to

1. Sr.PPS to Member (Services)/Member (Technology)/Member (Finance), Digital Communications Commission, Sanchar Bhawan, New Delhi.
2. Sr. PPS to Director General (Telecom), Sanchar Bhawan, New Delhi.
3. Sr. PPS to Wireless Advisor, Sanchar Bhawan, New Delhi
4. PPS to Director General (NTIPRIT), Ghaziabad.
5. DDG (Training)/Director (Training) DoT HQ — with a request to upload the notification and e-brochure on DoT Website.
6. DDG (Training) NTIPRIT.
7. All Officers of NTIPRIT, Ghaziabad.

*Atul Wakhle*

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# CERTIFICATE COURSE IN 5G MOBILE COMMUNICATIONS BATCH - 4

Course Starting on  
**10<sup>th</sup> April 2023**

SCAN to Register for the course   
or  
Visit: <https://forms.office.com/r/qDJ1xG6ENb>



## LEARN 5G FOR A PROFESSIONAL EDGE

Gain a broad, technical understanding of this revolutionary technology through certification course from NTIPRIT, the premier Training Academy of Department of Telecommunications, Government of India.

National Telecommunications Institute (NTIPRIT) announces 4th Batch of 5G certification course to train and certify Officers of Central / State Government of India and other stake holders. The registration for the course is open to Officers of Government of India and Officers of State Governments of India and other stake holders.

## BACKGROUND

5G networks are now a commercial reality and have more than 100 crore subscriber world wide. In India 5G services were launched on 1st October 2022 and as on date there are more than one lakh BTSs operational. India's 5G deployment is fastest in the world. This next generation of mobile technology, with features such as Enhanced Mobile Broadband, Ultra Reliable Low Latency Communication and Massive IoT, is set to radically re-shape today's mobile networks. This is why NTIPRIT has launched certification course on 5G for officers of Government of India.

The salient features of this course are:

1. Customized for Information and Communication Technology Professionals
2. 15-hour content spread over 1week with 3 hours sessions/ day
3. Blend of sessions by NTIPRIT faculty and domain experts from industry / R&D and Academia
4. Content delivery in online mode on MS Teams
5. Regular Assignments and Quizzes
6. Recorded sessions for the course content to be made available

## TRAINING DELIVERY

The 5G certification course will be an online Live Training on MS Teams. There will be 15 hours of sessions spread over a week and 3 hours per day. Participants are expected to keep themselves free from other work and concentrate of the certificate course and devote rest of the time of the day in going through resource material shared with them. Participants can study when and where they want, on a PC, tablet or smart phone. The Topics covered in this certification course would include: -

1	EVOLUTION OF MOBILE TECHNOLOGIES
	Early Mobile Telephony
	1G- 5G Evolution in nutshell
	1G Radio Characteristics
	1G Network and features
	Evolution to 2G
	2G Network and features
	Evolution to 3G Network
	Evolution of 3G to HSPA+
	3GPP releases of 3G
	3G Network and features
	Evolution to 4G
	4G Network and features
	High Level 5G System
	5G Technologies

	5G use cases
	Evolution towards 6G
	Potential technologies for 6G
	6G Use cases
2	INTRODUCTION TO 5G, KEY TECHNOLOGIES, USE CASES
	Role of International Telecommunication Union
	Role of SDOs / 3GPP
	IMT 2020 vision and requirement of ITU
	IMT – International Mobile Telecommunications
	3GPP releases timelines
	5G Adoption and Proliferation
	5G Usage Scenarios and Key Capabilities
	ITU defined 5G Usage Scenarios
	5G Enhanced Mobile Broadband (eMBB)
	eMBB Use Cases
	5G Ultra Reliable Low Latency Communications (uRLLC)
	uRLLC Use cases
	5G Massive Machine Type Communications (mMTC)
	mMTC Use Cases
	SA and NSA 5G
	5G Releases by 3GPP
	5G for Public Safety
	5G For Agriculture
	5G for Experience, Education and Entertainment
	5G Connected XR
	5G for Health Sector
	5G for Industries
	Example
3	5G CORE
	High Level 5G System
	5G reference point Architecture
	PDU Sessions and QoS Flow
	5G Network Functions
	-AMF
	-SMF
	-UPF
	-PCF
	-UDM
	5G reference point Architecture
	5G SBA Architecture
	Network Functions
	NRF
	AF
	AUSF
	NEF
	NSSF
	CUPS Architecture : 4G Core to 5G Core Migration
	5G Service Based Interface
	5G Roaming Architecture
	Data Storage
	Non 3GPP Access
	Untrusted non 3GPP Access
	Trusted 3GPP Access
	5G RG Access
	Wireline Access
	FN-RG Access

	N5CW Access
	Access Traffic Steering Switching & Splitting (ATSSS)
	Interworking of 4G core and 5G core
	SMS over NAS
	5G LAN
	5G Network Deployment Options
	5G Network Slicing
	5G MEC
<b>4</b>	<b>5G RAN</b>
	Frequency Bands supported by 5G NR
	Channel Bandwidth Supported in 5G New Radio
	Waveform and Modulation used in 5G NR
	5G NR Numerologies, Sub Carrier Spacing and Resource Block
	Relation between 5G NR Numerologies, Supported Bandwidth, Frequency bands, cell size and its Usages
	Carrier Aggregation (CA)
	Bandwidth Part (BWP)
	Frame Structure Concept
	Frame structure for numerologies 0 to 4
	Visualisation of Frame , Subframe, Slot and Symbols for each of the Numerologies
	5G NR Resource Grid
	Slot based and Mini Slot based Scheduling
	Timing Unit in 5G
	Cyclic Prefix
	SS Block - PSS and SSS
	5G-NR Cell: Physical Cell ID
	Location of SSB in Frequency Domain & Global Synchronisation Channel Number (GSCN)
	Location of SSB in Time Domain
	SSB Burst Set
	SS Block - PSS and SSS
	Synchronization procedure
<b>5</b>	<b>5G IDENTITIES</b>
	UE Identities
	SUPI (IMSI,NAI,GCI,GLI)
	SUCI
	GUTI /S TIMSI
	PEI (IMEI/IMEISV/MAC)
	MSISDN
	RNTI
	UE Radio Capability Id
	Network Identities
	AMF Identifier (AMF ID )
	NR Cell Global Identifier (NCGI )
	gNB Identifier (gNB ID)
	Global gNB ID
	Tracking Area identity (TAI) / Registration Area
	Single Network Slice Selection Assistance information (S-NSSAI)
	5G Core FQDN
	Home Network Domain
	PLMN level and Home NF Repository Function (NRF) FQDN
	Network Slice Selection Function (NSSF) FQDN
	AMF Name
	5GS Tracking Area Identity (TAI) FQDN
	AMF Set FQDN
	AMF Instance FQDN
	SMF Set FQDN
	NF FQDN
<b>6</b>	<b>5G QoS</b>
	PDU Session and QoS Flow
	5G QoS Architecture

	Comparison with 4G
	Default QoS Flow
	GBR QoS Flow
	QoS Rule, QoS Profile and SDF Template
	QoS Flow and Network Slice
	QoS Types and parameters
	Alternate QoS Profile
	5QI Characteristics
	Standard values of 5QI
<b>7</b>	<b>MASSIVE MIMO, BEAM FORMING, INITIAL ACCESS</b>
	MIMO IN 5G
	Massive MIMO
	Beam Creation
	Massive MIMO
	Beam Sweeping
	Dedicated Beam
<b>8</b>	<b>INITIAL ACCESS AND RELATED PROCEDURES</b>
	Finding a Cell
	PLMN and Cell Selection
	RRC Setup
	Cell Reselection
	Measurements
	Xn Handovers
	Random Access Procedure
<b>9</b>	<b>5G SA / NSA CALL FLOWS</b>
	5G NSA Call Flow
	5G SA Call Flow
	5G Registration
	PDU Session Establishment
<b>10</b>	<b>5G SECURITY FEATURES</b>
	Privacy Protection of UE Identity SUPI/SUCI/GUTI
	Mutual Authentication / Unified Authentication Framework
	Integrity and Confidentiality Protection of NAS and RRC
	Integrity and Confidentiality Protection of User Data
	Security for Roaming scenario / SEPP/IPUP
	Security in Backhaul
	Security in Network Slice
	Security in Virtualised Environment
	Home Control
	SEAF
<b>11</b>	<b>5G ARCHITECTURE FOR LAWFUL INTERCEPTION</b>
	High Level LI Architecture (SA/NSA)
	Administration Function (ADMF)
	Lawful Interception Control Function (LICF)
	Lawful Interception Provisioning Function (LIPF).
	System Information Retrieval Function (SIRF)
	Point of Interception (POI)
	Directly provisioned and triggered POIs
	Triggering Function
	IRI-POIs and CC-POIs
	Mediation and Delivery Function (MDF)
	LEMF – Law Enforcement Monitoring Facility
	5G core-anchored LI architecture
	5G EPC-anchored LI architecture
	H1 and X Interface
	Provisioning for Interception
	Intercept Control Flow
	Interception Process
	Target identities
	IRI events and Parameters



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