

	<u>BHARAT HEAVY ELECTRICAL LIMITED</u> <u>CENTRAL FOUNDRY FORGE PLANT</u> <u>TECHNICAL SPECIFICATION FOR DIRECT</u> <u>READING SPARK TYPE OPTICAL EMISSION</u> <u>SPECTROMETER</u>	Spec. No. : CFF/SMS/2017/01 Rev.: 02 Page 1
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CL. No.		Vendors Comment
1.0	<u>Objective:</u> - State of the-art Direct reading spark type <u>OPTICAL EMISSION SPECTROMETER</u> complete with all necessary auxiliary equipment based on optical emission spectroscopy for Chemical analysis of all elements simultaneously in Plain carbon steel, Low alloy steel, Creep resistant steel, Cast iron, Stellite material, Advanced ultra-super critical nickel base alloys, Al- alloys in solid state with high accuracy and precise measurement. - The equipment shall be computer controlled direct reading and shall be used for fast and accurate analysis of chemical constituents in steel samples with high accuracy and precision for simultaneous measurement of elements (C, Mn, P, S, Si, Al, Cu, Cr, Ni, Mo, V, W, Ti, B, Nb, Co, As, Pb, Sn, Sb, Mg, Te, Ca, Bi, N, O, Cd, etc.) - Separate channel for Nitrogen and oxygen shall be provided. - Typical analytical program for this spectrometer is indicated in Annexure-1 & 2 of this specification. - It shall be provided with facility for data transmission. - It shall be microprocessor based controlled, direct reading type, vacuum based optic system, latest technology of current control source and time resolved spectroscopy for better precision & improved detection limit & reduction of inter element effects, floor model with argon flushed spark stand for simultaneous measurement of elements as specified in Annexure-1&2 for Fe-base, Al-base, Co-base, Ni-base with facility for future upgradation and the entire operation from initiation of spark to printing of analytical results shall be fully automatic. - The equipment shall be designed for smooth efficient and trouble -free operation in tropical humid climate between 10°C to 50°C ambient with a maximum humidity of 85% for three (03) shifts.	
2.0	<u>Qualification for bidders</u> Vendors Confirming all the clause of Annexure-A (Separately attached) shall only qualify for bidding of this <u>OPTICAL EMISSION SPECTROMETER</u> complete with all necessary auxiliary Equipment.	
3.0	<u>Scope of supply</u>	
3.1	This technical specification covers Design, Manufacture, supply, installation, and commissioning of one number laboratory/floor model <u>OPTICAL EMISSION SPECTROMETER</u> complete with all necessary auxiliary equipment at CFFP BHEL site as per: Technical Parameters: (Ref. Clause 4.0)	

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BHARAT HEAVY ELECTRICAL LIMITED
CENTRAL FOUNDRY FORGE PLANT

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	b. Peripheral equipment (Ref. Clause 5.0) c. General Information (Ref. Clause 6.0) d. General Requirements (Ref. Clause 7.0) Equipment should be supplied complete in all respects. The items not covered in this specification but considered necessary for completeness of equipment and to attain desired features and performance in order to achieve the desired end Results shall be quoted by the vendor separately in his offer and should be the part of scope of supply.	
3.2	The vendor shall study technical parameters and other details thoroughly regarding the efficiency and workability of the Equipment to be supplied and will bear full responsibility for the guaranteed operation in respect of performance and smooth reliable working.	
3.3	All sundry materials required for installation and connection of all equipment of <u>OPTICAL EMISSION SPECTROMETER</u> will be in the scope of supply.	
3.4	All the equipment and components of <u>OPTICAL EMISSION SPECTROMETER</u> shall confirm to international specifications standards & international safety norms.	
3.5	All the equipment and related activities of <u>OPTICAL EMISSION SPECTROMETER</u> shall comply with statutory requirements of all applicable regulations at works.	
4.0	<u>Technical Parameters:</u>	
4.1	Ferrous and non-ferrous alloys to be analyzed broadly covers plain carbon steel, low alloy steel, creeps resistant steel, stainless steel, cast iron, stellite material, Al-alloys, Nitrogen bearing super-critical grades of steel & Advanced Ultra Super Critical nickel base alloys (IN625 grade). Annexure-1 and Annexure-2 attached, should be referred for alloys to be analyzed	
4.2	<u>The OES offered should confirm to:</u> a) ASTM E-1507-98(2003): Standard Guide for Describing and Specifying the Spectrometer of an Optical Emission Direct-Reading Instrument. b) ASTM E-1009 (latest revision): Standard Practice for Evaluating an Optical Emission Vacuum Spectrometer to Analyze Carbon and Low-Alloy Steel. c) ASTM E 1086-08: Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel by the Point-to-Plane Excitation Technique.	

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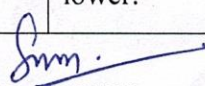
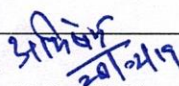
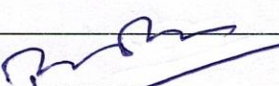
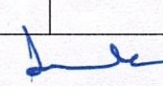
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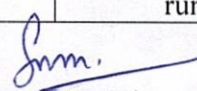
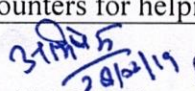
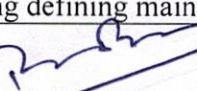
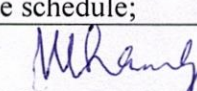
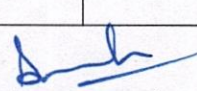
	Supporting data must be provided along with the offer.	
4.3	<u>Detectors & Optics of OPTICAL EMISSION SPECTROMETER</u> <u>A. Single Optical System:</u> - Paschen Runge optical mount, focal length: 750 mm or higher based on Rowland's circle - The optical system comprising with suitable resolution gratings as per spectral lines emitted from elements 1st order dispersion 0.50 nm/mm or better - Spectral field shall be covered from 120 nm to 700 nm or higher, depending on analytical program - Optics: vacuum optics for better stability - Purification system: self-regulated - Nos. of elements /analytical channels: 50 (min) or decided during basic engineering stage - Sampling rate: 400 in 200 micro-second discharge - Spark duration: 18 second or better <u>B. Thermoregulation:</u> The optical chamber and the electronics shall be mounted in a thermal controlled environment. The temperature shall be established $\pm 2^{\circ}\text{C}$ above the external temperature for avoiding thermal fluctuations and the stability of instruments. <u>C. Spectrometer control and data processing system</u> Electronic system with integrators channels and Data System Acquisition with Microprocessor <u>D. Spark stand</u> The spark stand shall be water cooling / refrigeration system, if required, and temperature invariant design and shall not be sensitive to room temperature fluctuations and shall be have lens/shutter system for optimisation of analytical results. The spark stand shall consume low argon. Auto-cleaning systems for spark stand shall be provided. <u>E. Detector system</u> Spectrometer control and data processing system by vacuum pump and all the elements being measured by using conventional photomultiplier tubes with photocathode & dynodes. <u>F. Vacuum pump (if system demand)</u> The system shall incorporate pump for creating primary vacuum and molecular drag pump / turbo molecular pump to achieve a final vacuum of 10^{-4} mbar or lower.	

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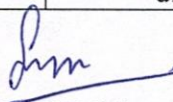
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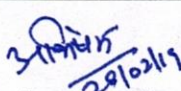
4.4	Hardware & Analytical software	
	<u>A. Hardware:</u> - Computer along with printer shall be the latest configuration and compatible with windows 7 or higher, 64-bit ultimate licensed software of latest version, along with MS Office-2010(latest version), updated Anti-Virus (with license). - Minimum configuration for computer: Make of PC: DELL/HP/APPLE/Lenovo, Intel i3/i5/i7 processor or better, RAM: 8GB or more, Hard Disk: 1 TB or more, 24" Led screen monitor with other essential peripherals and tools. - Instrument shall be capable of displaying the result at two places: one at the PC & another at the remote station located at a distance of 200 meters or above away through LAN. Data Communication: Software package for the transmission of results using network (through LAN) and serial communication (through RS232). <u>B. Analytical Software:</u> Windows operating system shall of latest version with lifetime licensed software and shall have the following operations/activities: - Modern, State-of-the-Art Graphic User Interface; - Quantitative analysis with analysis parameter template; - Powerful batch management for unknown samples analysis and other operations such as standardization, measurement of control, type standard and calibration samples or custom scripts execution; - Calibration curve determination using multi-variable regression with additives and multiplicative corrections; - Manual and automatic result processing; - Multi-purpose analysis result display and printing; - Measurement uncertainty combining in a single value the repeatability of the results when measuring an unknown sample and the uncertainty from the calibration; - Access to Key-to-Metals database: A multi-lingual steel and non- ferrous metals database, unlimited access to more than 30, 00,000 records for chemical composition, properties and specifications for metals. Easy direct export of grade concentration data to targeted grade limits. Search and cross reference tools; - Automatic method choice based on element(s), concentration(s) or sample identification; - Monitoring: instrument alarm monitoring, system event logging, peripheral device monitoring, up to 10 configurable sample measurement run counters for helping defining maintenance schedule;	

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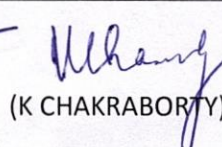
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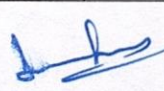
	k. Integrated instrument profile tool allowing overlaid graphical view of selected channels intensities; l. Integrated contextual help; m. Accounts with password protection with definable access and operational rights, database maintenance tools; n. Current Control Source (CCS) Spark shape editor; o. Text customization and translation into any language that have a set supported by the Windows operating system. Standard language delivery: English; p. System diagnostic software having the capability to observe the various parameters of the system and help diagnose the fault shall be preferably provided; q. ISO: 17025 compliances; r. Inclusion analysis software;	
4.5	<u>Standards & Calibration details</u> • Machine should be Factory calibrated for the following bases and program a) Fe Base- Cast Iron, Fe base- Cr-Ni Steel/Stainless Steel b) Low Alloy Steel c) Low Nitrogen calibration d) Co Base- General Sorting Stellite, e) Al Base - Global Al or range covering the annexure. f) Ni Base- Inconel Sorting calibration – g) Ni Base- General Sorting of Ni • Recalibration samples SUS - required for matrices to be configured in ferrous base, aluminum-base, cobalt-base, nickel-base will have to be supplied by vendor in sufficient quantity. • Certified Reference materials. Standard samples should be supplied in the below quantity and from following globally reputed and accredited suppliers ALCAN/BAS/Brammer/MBH only. • 2 nos. each for Low Alloy Steel, Stainless Steel /Cr-Ni, Cast Iron, Co-base, Inconel in Ni Base, General Sorting & Al base i.e. total 14 nos. at least. • Details of Primary and secondary standards should be clearly mentioned in offer.	
5.0	<u>Other Items to be included in scope of supply:</u> a. Interface and software for transmission of analytical results. b. Argon purifier (SIRCAL). c. Argon cylinders of 47 liters' capacity (2 Nos.) purity 99.995% with piping, regulators and manifolds (all 2nos.). d. Standard accessories and items recommended by manufacturer e. Kit for analysis of small samples: For quantitative analysis down to diameters of 3 mm and for semi-quantitative analysis.	


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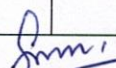
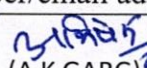
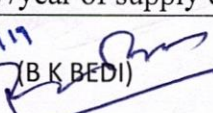
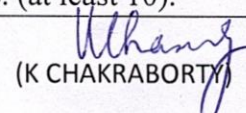

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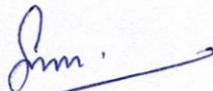
	f. Consumables to be quoted as recommended by manufacturer for their system. g. Un-interruptible power supply (UPS) of adequate capacity (15KVA or more) to cater OES data processing system and Argon purifier. ✓ It shall have provision of isolation transformer and adequate capacity of servo control voltage stabilizer in the by-pass line. ✓ A single, industrial, heavy duty sealed maintenance with battery bank designed for UPS to provide backup for the total load for a duration of 30minutes minimum	
6.0	<u>General Information:</u> Vendor has to provide following general information about the OPTICAL EMISSION SPECTROMETER:	
6.1	Model Identification No. And Year of launching the model offered	
6.2	Weight of OPTICAL EMISSION SPECTROMETER and peripheral equipment's	
6.3	Overall dimension of OPTICAL EMISSION SPECTROMETER and peripheral equipment.	
6.4	Space requirement for Installation of OPTICAL EMISSION SPECTROMETER and peripheral equipment's	
6.5	Power Ratings of OPTICAL EMISSION SPECTROMETER and peripheral equipment	
6.6	Specification and consumption figures for argon or any other gas used, with number of sparks in one standard cylinder (7 meter ³ capacity at 150 Kg/cm ²)	
6.7	Ambient temperature range & humidity for trouble free operation	
6.8	Auxiliary equipment's details.	
6.9	Requirement of test sample size.(Min & Max size)	
6.10	Analytical programs for all the metal bases given should be enclosed in the Offered specification.	
6.11	Year of launching the model offered.	
7.0	<u>General Requirements</u>	
7.1	Vendor has to comment point wise all the clauses of the technical specification for technical scrutiny of offer and recommendation of final technical suitability of offer.	
7.2	Supplier shall provide a list of users in India for similar type Conventional PMT based instrument system quoted giving name of organization, contact person, department address, FAX / Telephone number/email address /year of supply etc. (at least 10).	

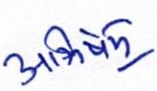
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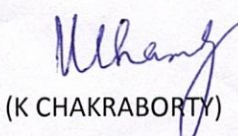
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	• Supplier shall have trained engineers (in India) on the specific instrument from Parent Organization and copy of training certificates should be attached herewith the item. • BHEL reserve the right to verify the information submitted by the vendor. In case the information is found to be incorrect the offer shall be rejected. • Supplier should submit along with quotation legible and sufficient technical literature in English language to understand its technical and application details. Attaching just a promotional brochure will not be sufficient. • Supplier shall provide detailed operation & maintenance manuals along with all circuit diagrams in soft copy (pen drive/portable hard disk) & also two sets of hard copies in English only. • The detailed addresses, Tel. Nos. of the service station along with details of factory trained personals be submitted. • Supplier shall attend Break down, if any within 3 working days of intimation from BHEL. • Suppliers shall inform availability of spare parts with service center in India and shall ensure the availability of spares for ten years.	
7.3	Any Optional accessories / attachment which can enhance performance / application of equipment must be quoted separately for consideration.	
7.5	The vendor shall submit a compliance report regarding Conformance to indented specifications, terms and conditions. Deviations if any shall be clearly indicated on a point-by-point basis. Vendor must write in detail the specification of its OES and other equipment's to be supplied against each point of the specification.	
7.6	Supplier shall quote his best and earliest delivery schedule in detail.	
7.7	Any item not explicitly mentioned in the specification but which may be required for demonstration of specification and smooth functioning of the equipment shall be within the scope of supply.	
8.0	<u>Facilities provided by BHEL</u>	
	a) BHEL will provide 230V± 10% 1 Φ, 50Hz AC Power supply system and space for indoor installation and operation of <u>OPTICAL EMISSION SPECTROMETER</u> at the site. b) Argon/Inert gas Cylinder	


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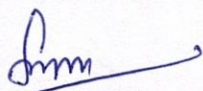
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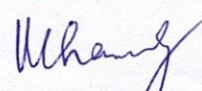
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	c) Supplier shall clearly specify in the offer any support facility /equipment requirement from buyer for installation / commissioning / operation of the spectrometer.	
9.0	<u>Pre-Dispatch Inspection</u> BHEL is authorized to pre inspect the equipment at vendor's works. Suppliers shall give PDI call at least 45 days in advance. Pre-Dispatch Inspection shall be done as per Scope of Supply. Manufacturer shall demonstrate the ability of equipment to meet BHEL/CFFP requirement. equipment's will be dispatched only after getting clearance from CFFP/BHEL	
10.0	<u>Installation</u> a. Equipment shall be supplied packed properly to bear transportation by air, ship & road routes. b. Vendor shall depute its representative for unloading of consignment at site. c. Vendor shall be responsible for Installation of the Equipment at site. Necessary tools, equipment's erection materials and fixing accessories required for erection shall be brought by the supplier. d. The pre-installation requirements should be communicated well in advance of the installation.	
11.0	<u>Commissioning</u> The equipment shall be commissioned at our works by manufacturer free of cost. All capabilities of the instrument and accessories as per scope of supply shall be demonstrated. Also provide at least 3 days' hands on training to the operation & Maintenance personal to enable them to operate / maintain instrument successfully. Supplier shall provide essential tools for commissioning and maintenance of the equipment. <u>OPTICAL EMISSION SPECTROMETER</u> will be considered as commissioned on the date of successful fulfillment of objectives as per Clause 1.0 at CFFP/BHEL by the vendor.	
12.0	<u>Performance Guarantee/Warranty</u> The Performance of equipment's as per Scope of Supply (At Clause 3.0) shall be guaranteed for a minimum period of 24 Months from the date of commissioning. If instrument remains out of order during this period, guarantee period will stand extended for the corresponding period. If any manufacturing defect is noted during guarantee period, it will be rectified free of cost within guarantee period/extended guarantee period.	


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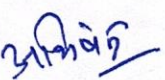

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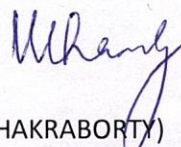

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13.0	<u>Training</u> Supplier shall provide training for minimum 01 weeks to 02 CFFP/BHEL personnel at manufacturer's works to familiarize the personnel with the equipment, maintenance, Automation, trouble shooting and process as well as working procedures.	
14.0	<u>After Sales services, Mandatory spares and Tools</u> - The supplier should provide a prompt after-sales service such as regular Instrument maintenance, troubleshooting and fixing during and after completion of Guarantee/Warranty period through its service centers in India for minimum 5 years after warranty period over. - Mandatory OEM spares & consumable required for 2 years of warranty period will be in vendor's scope of supply. List of these mandatory OEM spares & consumable is also to be submitted with the offer. - The supplier shall supply a list of recommended spares & consumable and quote separately item wise prices for them required for five years' operation of the equipment. - Essential tools for installation, commissioning and maintenance of the Equipment have to be provided by vendor. - Party should make 2 preventive maintenance visits (with interval of six month) per year and any nos. of breakdown visits during the warranty period of 24 months.	
15.0	<u>Drawings, Documents & Manuals</u> Supplier shall provide:	
15.1	Operation & maintenance manuals along with detailed work instructions and circuit diagrams in soft copy in portable hard disk (min. 1TB) & hard copies (two set English only).	
15.2	Backup of all software and programs installed/loaded on PC along with Licenses Documents	
15.3	List of Standards used for design and manufacturing of equipment.	
15.4	All other Documents which are necessary for other compliance.	




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Elements	Global iron Iron %	Cobalt base %	General sorting Ni%	Global Aluminium Base %
C	0.01- 4.4	0.800-1.500	0.05 Max.	
S	0.002 - 0.2	-	0.05 Max.	
P	0.005 - 0.2	-	0.01 Max.	
Si	0.02 - 3.5	0.010-3.500	0.2-0.4	10-13
Mn	0.010-7.000	0.010-1.500	0.4-0.6	0.3-0.7
Ni	0.02 - 40.0	0.010-5.000	0-balance	0.1 max
Cr	0.02 - 36.0	20.000-35.000	20-23	
Mo	0.002 - 2.5	0.010-2.500	8-10	
V	0.005-2.00	-		
Cu	0.010-2.00	-		0.1 max
Al	0.005 - 1.4	-	0.2-0.3	Remainder
Ti	0.005 - 1.0	-	0.2-0.3	0.2 max
Sn	0.002 - 0.4	-		0.05 max
As	0.002 - 0.1	-		
Sb	0.0005 - 0.2	-		
B	0.0005 - 0.1	-		
Co	0.005 - 2.0	Base	0.025 max	
W	0.01 - 6.0	2.500-7.000		
Pb	0.002 - 0.05	-		0.1 max
Nb	0.005 - 2.0	-		
Mg	0.003 - 0.15	-		0.2-0.6
Ca	0.0003 - 0.005	-		
N	0.03-0.08	-		
Fe	Base	0.010-4.000	3.5 max	0.6 max
Zr	0.005 - 0.1	-		
Zn	-	-		0.1 max
Cd	-	-		
Bi	-	-		
Ag	-	-		
Cd(Nb)+Ta			3.15-3.5	


(J D SAHANA)


(A K GARG)


(B K BEDI)


(K CHAKRABORTY)


(S N GHOSH)

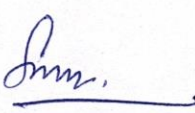
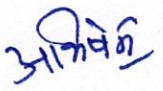
3

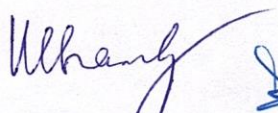
	<u>BHARAT HEAVY ELECTRICAL LIMITED</u> <u>CENTRAL FOUNDRY FORGE PLANT</u> <u>TECHNICAL SPECIFICATION FOR DIRECT</u> <u>READING SPARK TYPE OPTICAL EMISSION</u> <u>SPECTROMETER</u>	Spec. No. : CFF/SMS/2017/01 Rev.: 02 Page 11
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Annexure-2

Analytical and Calibration Requirement

Elements	Low Alloy Steel %	Cr-Ni steel	Cast Iron %
C	0.01-1.000	0.01-0.800	2.000-4.500
S	0.001-0.070	0.001-0.070	0.020-0.100
P	0.001-0.070	0.002-0.070	0.020-0.100
Si	0.010-1.000	0.05 -2.5	1.000-2.000
Mn	0.010-2.000	0.05-7.0	0.300-1.000
Ni	0.010-4.000	0.100-20.00	0.010-0.200
Cr	0.010-4.000	1.0 - 30.00	0.010-0.100
Mo	0.010-1.500	0.050-2.500	0.001-0.020
V	0.010-1.000	0.010-0.500	-
Cu	0.010-1.500	0.010 -0.200	0.010-0.200
Al	0.001-1.000	0.005 -0.15	0.005-0.050
Ti	0.001-0.200	0.002-0.3	0.005-0.050
Sn	0.001-0.200	0.005-0.10	0.005-0.020
As	0.001-0.100	0.005 - 0.02	0.005-0.020
Sb	0.005-0.100	0.005 - 0.1	-
B	0.0005-0.010	0.0005 - 0.02	0.0005-0.010
Co	-	0.02 - 0.5	-
W	0.005-0.500	0.010-2.000	-
Pb	0.002-0.100	0.002 - 0.004	0.005-0.010
Nb	-	0.010 - 0.8	-
Mg	0.001-0.100	-	-
Ca	0.0005-0.005	0.0005-0.005	-
N	0.010-0.10	0.030-0.10	-
Zr	-	To be reported	-




(J D SAHANA) (A K GARG) (B K BEDI) (K CHAKRABORTY) (S N GHOSH)