

**Indian National Physics Olympiad (INPhO)-2025**  
**HOMI BHABHA CENTRE FOR SCIENCE EDUCATION**  
 Tata Institute of Fundamental Research  
 V. N. Purav Marg, Mankhurd, Mumbai, 400 088

**Question Paper**

Date: 02 February 2025  
 Time: 09:00-12:00 (3 hours)

Maximum Marks: 75

Instructions

Roll Number: 2505 - 11110 - 0353

1. This booklet consists of 9 pages and total of 5 questions. Write roll number at the top wherever asked.
2. Booklet to write the answers is provided separately. Instructions to write the answers are on the Answer Booklet.
3. Non-programmable scientific calculators are allowed. Mobile phones cannot be used as calculators.
4. Please submit the Answer Sheet at the end of the examination. You may retain the Question Paper.

**Table of Constants**

Speed of light in vacuum	$c$	$3.00 \times 10^8 \text{ m-s}^{-1}$
Magnitude of electron charge	$e$	$1.60 \times 10^{-19} \text{ C}$
Value of $1/4\pi\epsilon_0$		$9.00 \times 10^9 \text{ N-m}^2\text{-C}^{-2}$
Avogadro's number	$N_A$	$6.022 \times 10^{23} \text{ mol}^{-1}$
Acceleration due to gravity	$g$	$9.81 \text{ m-s}^{-2}$
Universal Gas Constant	$R$	$8.31 \text{ J-K}^{-1}\text{-mol}^{-1}$
	$R$	$0.0821 \text{ l-atm-mol}^{-1}\text{-K}^{-1}$
Boltzmann constant	$k_B$	$1.3806 \times 10^{-23} \text{ J-K}^{-1}$
Permeability constant	$\mu_0$	$4\pi \times 10^{-7} \text{ H-m}^{-1}$

Question Number	1	2	3	4	5	Total
Maximum Marks	8	14	16	22	15	75

## F32june 2013 Paper

**Mr. Steven Phillips, Mr. Luis  
Catão, Mr. Luca Antonio  
Ricci, Mr. Rudolfs Bems, Ms. Mitali  
Das, Mr. Julian Di Giovanni, Ms. Filiz  
Unsal, Marola Castillo, Jungjin Lee, Jair  
Rodriguez, Mr. Mauricio Vargas**

### **F32june 2013 Paper:**

**The External Balance Assessment (EBA) Methodology** Mr. Steven Phillips, Mr. Luis Catão, Mr. Luca Antonio Ricci, Mr. Rudolfs Bems, Ms. Mitali Das, Mr. Julian Di Giovanni, Ms. Filiz Unsal, Marola Castillo, Jungjin Lee, Jair Rodriguez, Mr. Mauricio Vargas, 2014-01-13 The External Balance Assessment EBA methodology has been developed by the IMF's Research Department as a successor to the CGER methodology for assessing current accounts and exchange rates in a multilaterally consistent manner. Compared to other approaches, EBA emphasizes distinguishing between the positive empirical analysis and the normative assessment of current accounts and exchange rates and highlights the roles of policies and policy distortions. This paper provides a comprehensive description and discussion of the 2013 version 2.0 of the EBA methodology, including areas for its further development.

*Capital Flows are Fickle* Mr. John C. Bluedorn, Rupa Duttagupta, Mr. Jaime Guajardo, Petia Topalova, 2013-08-22 Has the unprecedented financial globalization of recent years changed the behavior of capital flows across countries? Using a newly constructed database of gross and net capital flows since 1980 for a sample of nearly 150 countries, this paper finds that private capital flows are typically volatile for all countries, advanced or emerging, across all points in time. This holds true across most types of flows, including bank portfolio debt and equity flows. Advanced economies enjoy a greater substitutability between types of inflows and complementarity between gross inflows and outflows than do emerging markets, which reduces the volatility of their total net inflows despite higher volatility of the components. Capital flows also exhibit low persistence across all economies and across most types of flows. Inflows tend to rise temporarily when global financing conditions are relatively easy. These findings suggest that fickle capital flows are an unavoidable fact of life to which policymakers across all countries need to continue to manage and adapt.

*Recent Advances in Psychiatry from Psycho-Neuro-Immunology Research: Autoimmunencephalitis, Autoimmune-Encephalopathy, Mild Encephalitis* Karl Bechter, David Brown, Souhel Najjar, 2019-08-12 Growing evidence derived from cerebrospinal fluid (CSF) neuropathological, imaging, genetic, and epidemiological studies link neuroinflammation and immune dysregulation to a subset of individuals with a variety of severe mental disorders (SMDs), including affective and non-affective psychotic disorders. Further, the recent discoveries of neuronal surface antibodies (NSAs) in autoimmune encephalitis (AE) presenting with diverse neuropsychiatric disorders, such as psychosis and cognitive decline among many others, provides further support to the notion that CNS autoimmunity and neuroinflammation can contribute to the neurobiology of psychiatric disturbances. Further, these immune mechanisms may contribute to a subset of patients currently diagnosed as having treatment-resistant SMDs, such as schizophrenia and major depressive disorder. Additionally, mounting data indicate that various infections can serve as an immunological trigger of aberrant immune responses, presumably by causing release of excess neural antigen, thereby giving rise to NSAs or aberrant immune cellular responses that give rise to primary or secondary psychiatric disorders, such as schizophrenia and those associated with AE, respectively. Collectively,

these findings support the mild encephalitis hypothesis of SMD. The significant overlap among AE associated psychosis, systemic autoimmune disorder associated psychosis, and psychotic disorders associated with pathological processes involving inflammation and immune dysregulation has also prompted some authors to adopt the term autoimmune psychosis (AP). This term reflects that this psychosis subtype is mechanistically linked to complex neuroimmune and inflammatory signalling abnormalities that can be responsive to early immunomodulatory treatment. It also suggests that a subset of AP might represent an incomplete or forme fruste subtype of AE presenting with dominant or pure psychiatric symptoms mimicking primary psychiatric illnesses. Because data indicate that delayed diagnosis and treatment may lead to permanent sequelae, early recognition of AP utilizing neurodiagnostic workup (e.g., CSF analysis, neuroimaging, and EEG) and its early treatment with appropriate immunotherapy are paramount to a meaningful recovery. This eBook will provide an overview of the current knowledge and research areas from epidemiology, risk factors, and diagnosis to the management of these conditions in this rapidly emerging field, helping to bridge the gaps in knowledge that currently exist in the disciplines of Psychiatry, Neurology, and Neuroimmunology.

**Diesel Emissions and Their Control, 2nd Edition** W. Addy Majewski, Hannu Jääskeläinen, 2023-12-20. Engineers, applied scientists, students, and individuals working to reduce emissions and advance diesel engine technology will find the second edition of *Diesel Emissions and Their Control* to be an indispensable reference. Whether readers are at the outset of their learning journey or seeking to deepen their expertise, this comprehensive reference book caters to a wide audience. In this substantial update to the 2006 classic, the authors have expanded the coverage of the latest emission technologies. With the industry evolving rapidly, the book ensures that readers are well informed about the most recent advances in commercial diesel engines, providing a competitive edge in their respective fields. The second edition has also streamlined the content to focus on the most promising technologies. This book is rooted in the wealth of information available on DieselNet.com, where the Technology Guide papers offer in-depth insights. Each chapter includes links to relevant online materials, granting readers access to even more expertise and knowledge. The second edition is organized into six parts, providing a structured journey through every aspect of diesel engines and emissions control: Part I: A foundational exploration of the diesel engine combustion and essential subsystems; Part II: An in-depth look at emission characterization, health and environmental impacts, testing methods, and global regulations; Part III: A comprehensive overview of diesel fuels, covering petroleum, diesel, alternative fuels, and engine lubricants; Part IV: An exploration of engine efficiency and emission control technologies, from exhaust gas recirculation to engine control; Part V: The latest developments in diesel exhaust aftertreatment, encompassing catalyst technologies and particulate filters; Part VI: A historical journey through the evolution of diesel engine technology, with a focus on heavy-duty engines in the North American market. ISBN 9781468605693, ISBN 9781468605709, ISBN 9781468605716, DOI 10.4271/9781468605709. [Spatially Resolved Operando Measurements in Heterogeneous Catalytic Reactors](#), 2017-11-13. [Spatially Resolved Operando Measurements in Heterogeneous Catalytic](#)

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**The Traffic Bulletin** ,1924 *Prentice-Hall ... Federal Tax Service Cumulative* ,1932 *Social Programmes, Poverty Eradication and Labour Inclusion* Laís Wendel Abramo, Simone Cecchini, Beatriz Morales, 2019 Diverse social programmes including conditional cash transfer programmes labour and production inclusion programmes and social pensions are being implemented in Latin American and Caribbean countries with the aim of ending poverty and reducing inequalities throughout the life cycle This book offers an up to date analysis of these programmes and the way they relate to labour inclusion and analyses ongoing debates regarding the possible incentives and disincentives they create in terms of the labour supply formalization and child labour among the target population Considering that poverty is a structural problem of highly unequal societies the thesis that poverty is due to a lack of effort on the part of the poor is argued to be an expression of the strong prejudice against those living in poverty the great majority of whom work or are actively seeking employment but are hampered by the large decent work deficits existing in the region From an integrated and rights based perspective public policies should simultaneously address the twofold challenge of social and labour inclusion in order to achieve basic thresholds of well being by ensuring income universal access to good quality social services and opportunities for decent work

**Bibliography of Agriculture** ,1945 *The Commercial and Financial Chronicle* ,1941-04

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