

Maharashtra State Eligibility Test for Lectureship

महाराष्ट्र राज्य व्याख्यातापदासाठी राज्यस्तरीय पात्रता चाचणी (सेट) परीक्षा

Conducted by University of Pune
(AS THE STATE AGENCY)

SYLLABUS

Subject: GENERAL PAPER ON TEACHING & RESEARCH APTITUDE

Code No. : 00

PAPER-I

The main objective is to assess the teaching and research capabilities of the candidates. The test aims at assessing the teaching and research aptitude as well. Candidates are expected to possess and exhibit cognitive abilities, which include comprehension, analysis, evaluation, understanding the structure of arguments, deductive and inductive reasoning. The candidates are also expected to have a general awareness about teaching and learning processes in higher education system. Further, they should be aware of interaction between people, environment, natural resources and their impact on the quality of life.

The details of syllabi are as follows:

Unit-I Teaching Aptitude

- Teaching: Concept, Objectives, Levels of teaching (Memory, Understanding and Reflective), Characteristics and basic requirements.
- Learner's characteristics: Characteristics of adolescent and adult learners (Academic, Social, Emotional and Cognitive), Individual differences.
- Factors affecting teaching related to: Teacher, Learner, Support material, Instructional facilities, Learning environment and Institution.
- Methods of teaching in Institutions of higher learning: Teacher centred vs. Learner centred methods; Off-line vs. On-line methods (Swayam, Swayamprabha, MOOCs etc.).

- Teaching Support System: Traditional, Modern and ICT based.
- Evaluation Systems: Elements and Types of evaluation, Evaluation in Choice Based Credit System in Higher education, Computer based testing, Innovations in evaluation systems.

Unit-II **Research Aptitude**

- Research: Meaning, Types, and Characteristics, Positivism and Post-positivistic approach to research.
- Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.
- Steps of Research.
- Thesis and Article writing: Format and styles of referencing.
- Application of ICT in research.
- Research ethics.

Unit-III **Comprehension**

- A passage of text be given. Questions be asked from the passage to be answered.

Unit-IV **Communication**

- Communication: Meaning, types and characteristics of communication.
- Effective communication: Verbal and Non-verbal, Inter-Cultural and group communications, Classroom communication.
- Barriers to effective communication.
- Mass-Media and Society.

Unit-V **Mathematical Reasoning and Aptitude**

- Types of reasoning.
- Number series, Letter series, Codes and Relationships.
- Mathematical Aptitude (Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc.).

Unit-VI Logical Reasoning

- Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Uses of language, Connotations and denotations of terms, Classical square of opposition.
- Evaluating and distinguishing deductive and inductive reasoning.
- Analogies.
- Venn diagram: Simple and multiple use for establishing validity of arguments.
- Indian Logic: Means of knowledge.
- Pramanas: Pratyaksha (Perception), Anumana (Inference), Upamana (Comparison), Shabda (Verbal testimony), Arthapatti (Implication) and Anupalabddhi (Non-apprehension).
- Structure and kinds of Anumana (inference), Vyapti (invariable relation), Hetvabhasas (fallacies of inference).

Unit-VII Data Interpretation

- Sources, acquisition and classification of Data.
- Quantitative and Qualitative Data.
- Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data.
- Data Interpretation.
- Data and Governance.

Unit-VIII Information and Communication Technology (ICT)

- ICT: General abbreviations and terminology.
- Basics of Internet, Intranet, E-mail, Audio and Video-conferencing.
- Digital initiatives in higher education.
- ICT and Governance.

Unit-IX People, Development and Environment

- Development and environment: Millennium development and Sustainable development goals.
- Human and environment interaction: Anthropogenic activities and their impacts on environment.
- Environmental issues: Local, Regional and Global; Air pollution, Water pollution, Soil pollution, Noise pollution, Waste (solid, liquid, biomedical, hazardous, electronic), Climate change and its Socio-Economic and Political dimensions.
- Impacts of pollutants on human health.
- Natural and energy resources: Solar, Wind, Soil, Hydro, Geothermal, Biomass, Nuclear and Forests.
- Natural hazards and disasters: Mitigation strategies.
- Environmental Protection Act (1986), National Action Plan on Climate Change, International agreements/efforts -Montreal Protocol, Rio Summit, Convention on Biodiversity, Kyoto Protocol, Paris Agreement, International Solar Alliance.

Unit-X Higher Education System

- Institutions of higher learning and education in ancient India.
- Evolution of higher learning and research in Post Independence India.
- Oriental, Conventional and Non-conventional learning programmes in India.
- Professional, Technical and Skill Based education.
- Value education and environmental education.
- Policies, Governance, and Administration.

- NOTE:**
- (i) Five questions each carrying 2 marks are to be set from each Module.
 - (ii) Whenever graphical/pictorial question(s) are set for sighted candidates, a passage followed by equal number of questions and weightage be set for visually impaired candidates.

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SYLLABUS

Subject: MARATHI

Code No: 01

घटक (Unit-1): भाषा, भाषा आविष्काराची रूपे आणि भाषाविज्ञान

(अ) भाषा आविष्काराची रूपे :

भाषेची ओळख, भाषिक व्यवहाराचे स्वरूप, आविष्कारणाचे प्रकार, (मौखिक व लिखित), भाषा आणि दृक-श्राव्य कला, भाषा आणि सादरीकरणाची कला, साहित्याचे माध्यम म्हणून भाषेचे कार्य, साहित्याच्या भाषेची वैशिष्ट्ये, भाषा आणि कथन,

(ब) व्याकरण:

शब्दाच्या जाती, विभक्ती, प्रयोग, क्रियापद विचार, समास, अलंकार, वृत्ते इत्यादी.

(क) भाषाविज्ञान:

भाषेची उत्पत्ती व उपपत्ती, भाषाकुल संकल्पना, स्वन, स्वनीम, स्वनांतर, पद, पदिम, पदांतर, वाक्यविचार, अर्थविचार, भाषाविज्ञानाच्या विविध अभ्यास पद्धती, मराठीचे लेखनविषयक नियम.

समाजभाषाविज्ञानाचे स्वरूप व व्याप्ती, समाजभाषाविज्ञान आणि इतर अभ्यासशाखा, तंत्रज्ञान व माहिती तंत्रज्ञान, संदेशनाची माध्यमे, तंत्रज्ञानाने प्रभावित होणारे संदेशनाचे घटक, मराठी भाषा व तंत्रज्ञान आणि नवभाषा निर्मिती. भाषा व बोली (अहिराणी, कोकणी, मालवणी, पावरा, मावची, तावडी, तडवी, चंदगडी, भिलाऊ, झाडी, वन्हाडी, घाटी, भिल्ली, डांगी, दखनी इत्यादी), भाषा व बोली यांचे समाजातील स्थान व सहसंबंध बोलीचे स्वरूप व वैशिष्ट्ये, बोलींची निर्मिती, बोलींमधील परिवर्तनाची प्रक्रिया व सीमा आणि इतर बोलींचा प्रभाव. बोली अभ्यासाचे महत्त्व,

बोली संरचना विचार, बोली अभ्यास, समाजभाषावैज्ञानिक दृष्टीकोन, बोलीसमोरील आव्हाने.

घटक (Unit-2): संस्कृती संकल्पना आणि वाङ्मयनिर्मिती

वाङ्मयीन संस्कृतीचे पारंपरिक घटक, मौखिक परंपरा, हस्तलिखिते, कथन, पठण, श्रवण, सादरीकरण (तमाशा, लळीत, भारुड, बोहाडा, निरुपण, कीर्तन, प्रेक्षक, श्रोता, कथनकार) वाङ्मय, धर्म, पंथ आणि राजाश्रयाचा सहसंबंध.

वाङ्मयीन संस्कृतीचे आधुनिक घटक: मुद्रिते, मुद्रक, नियतकालिके, वृत्तपत्रे, पुस्तके, संपादक, लेखक, प्रकाशक, वाचक, समीक्षक, वितरक, वाङ्मयीन संस्था, महामंडळे, संमेलने, पुरस्कार.

नागर आणि ग्रामीण अभिरुची, लेखक व वाचक यांच्यातील आदान प्रदान, वाङ्मयीन संस्कृती संघर्ष (अभिजन-बहुजन), भाषाशुद्धी व वाङ्मयशुद्धीबद्दलच्या संकल्पना, श्लीलअश्लील संबंधीचे वाद, अभिव्यक्ती स्वातंत्र्य व निर्बंध.

सामाजिक प्रबोधनात वाङ्मयीन संस्कृतीचे योगदान, (सत्यशोधकी जलसे, आंबेडकरी जलसे, मेळे इत्यादी), संयुक्त महाराष्ट्र चळवळीतील आविष्कार, वैचारिक, प्रबोधन-उदबोधन, निबंध वाङ्मय, प्रायोगिक नाटक व पथनाट्ये इत्यादी.

मराठी वाङ्मयीन संस्कृतीचा नकाशा, साहित्यसंमेलनातील परिवर्तने, वादविवाद, भूमिका, वाङ्मयबाह्य घटकांची वाङ्मयीन संस्कृतीवरील आक्रमणे, वाङ्मयीन संस्कृतीतील लेखकाची प्रतिमा, मराठी समाजमानस आणि ग्रंथव्यवहाराचा प्रभाव.

घटक (Unit-3): भारतीयत्वाची संकल्पना व भाषांतर मीमांसा:

भारतीय साहित्याची संकल्पना, आंतरभाषीय भाषा-भगिनीभाव संकल्पना, भाषांतराची संकल्पना, भाषांतर-अनुवाद आणि रूपांतर, आंतरभारतीय साहित्याचे मराठीतील भाषांतर, भाषांतरातील समस्या, प्रभाव अभ्यासाची संकल्पना, प्रभव, प्रभाव आणि अनुकरण, प्रभावाची कारण मीमांसा, प्रभाव आणि सत्तासंबंध, प्रभाव आणि निर्मितीप्रेरणा (तत्त्व-वैचारिक प्रवाहांच्या प्रेरणा), सामाजिक, राजकीय घटीतांमधून प्रेरणा, व्यक्तीच्या प्रभावातून प्रेरणा.

रचनाप्रकारांचा प्रभावानुरोधाने अभ्यास (सुनीत, कादंबरी, गझल, हायकू), अभंगाचा आधुनिक कवितेवर प्रभाव, पाश्चात्य नाट्यप्रवाहांचा व लोककलांचा मराठी रंगभूमीवरील प्रभाव.

घटक (Unit-4): लोकसाहित्य आणि विशेष साहित्य प्रवाह

लोकसाहित्य: संकल्पना, स्वरूप व व्याप्ती.

लोकसाहित्यातील लोकतत्वे, लोकभाषा, धार्मिकता आणि इहवाद, लोकसाहित्यातील संप्रदाय, लोकसाहित्यातील लोकप्रयोज्य कला व संशोधन.

दलित साहित्य: स्वरूप, प्रेरणा व तत्वज्ञान.

दलित साहित्याचा इतिहास:

(कथा, कविता, कादंबरी, रंगभूमी, आत्मकथने, वैचारिक साहित्य इत्यादी)

ग्रामीण साहित्य: स्वरूप व प्रेरणा

ग्रामीण साहित्याचा इतिहास

(कथा, कविता, कादंबरी, रंगभूमी, आत्मकथने, वैचारिक साहित्य इत्यादी)

घटक (Unit-5): वाङ्मयेतिहासाचा अभ्यास

वाङ्मयेतिहासाची संकल्पना, वाङ्मयेतिहास लेखनाचे नवे दृष्टिकोन, विविध राजवटी आणि वाङ्मय इतिहास लेखन, वाङ्मय इतिहास आणि इतर इतिहास लेखन पद्धती, वाङ्मय इतिहास (आरंभ ते २०१५)

घटक (Unit-6): वाङ्मयीन चळवळीचे स्वरूप:

मराठीतील वाङ्मयीन चळवळी, चळवळीचे समाजशास्त्र, भक्तीसाहित्याची चळवळ, भाषाशुद्धीची चळवळ, वाङ्मयशुद्धीची चळवळ, अनियतकालिकांची चळवळ, दलित साहित्याची चळवळ, ग्रामीण साहित्याची चळवळ, आदिवासी साहित्याची चळवळ, स्त्रीमुक्तीची चळवळ, शेतकरी चळवळ, चळवळीच्या प्रभावतील मराठी साहित्य, वाङ्मयीन अभिरुची (रुची-अभिरुची), अभिरुची संपर्क, अभिरुची संघर्ष, मुद्रणपूर्व अभिरुचीचे स्वरूप, आंग्लसंपर्कानंतरची अभिरुची आणि संघर्ष, सामाजिक संस्था, सत्ता, जातिसंघर्ष आणि अभिरुची.

घटक (Unit-7): साहित्य प्रवाह

साहित्यप्रवाहाचे स्वरूप, व्याप्ती व मर्यादा. साहित्यप्रवाहाच्या निर्मिती प्रेरणा, आधुनिक साहित्य, नवसाहित्य, महानगरीय साहित्य, आदिवासी साहित्य, स्त्रीवादी साहित्य, जैन साहित्य, ख्रिस्ती साहित्य, मुस्लिम साहित्य, जनवादी साहित्य, मार्क्सवादी साहित्य, विज्ञान साहित्य, अल्पसंख्यकांचे साहित्य, बालसाहित्य, कामगारांचे साहित्य इत्यादी.

घटक (Unit-8): साहित्यशास्त्र आणि भक्ती संप्रदाय

(अ) काव्यशास्त्र, काव्यलक्षण, प्रयोजन, प्रतिभाविचार, शब्दशक्ती, रीतिविचार, ध्वनिविचार, आनंद मीमांसा.

(ब) महानुभाव, नाथ, वारकरी, दत्त, रामदास, वीरशैव, सुफी संप्रदाय आणि त्यांचे साहित्य. पंडिती परंपरा, बखर वाङ्मय, शाहिरी वाङ्मय.

घटक (Unit-9): साहित्यप्रकारांचा सूक्ष्म विचार

साहित्यप्रकाराची संकल्पना, पौर्वात्य व पाश्चात्य, महाकाव्य, आख्यानकाव्य, खंडकाव्य, कविता, दीर्घ कविता, भावकविता (अभंग, ओवी, लावणी, पोवाडा)

लघुकथा, कथा, दीर्घकथा, लघुकादंबरी, कादंबरी, नाटक, एकांकिका, पथनाट्य, रिंगणनाट्य, महानाट्य,

चरित्र, आत्मचरित्र, आत्मकथा, आत्मकथन-स्वकथन, आठवणी, रोजनिशी, प्रवासवर्णन, निबंध आणि वैचारिक निबंध, ललितनिबंध, व्यक्तीचित्र.

समीक्षा व समीक्षा पद्धती.

घटक (Unit-10): निवडक साहित्यकृती

लीळाचरित्र: एकांक (शं. गो. तुळपुळे), तुकारामाची गाथा, एकनाथांची भारुडे, जनाबाईचे निवडक अभंग, मराठी गौळणी, आज्ञापत्रे, सभासद बखर, शिवाजीचा पवाडा (महात्मा फुले) स्मृतिचित्रे (लक्ष्मीबाई टिळक) बनगरवाडी (व्यंकटेश माडगूळकर), आनंद ओवरी (दि. बा. मोकाशी), तुही यत्ता कंची (नामदेव ढसाळ) जिणं आमुचं (बेबी कांबळे), गिधाडे (विजय तेंडुलकर), शोभायात्रा (शफात खान), भिजकी वही (अरुण कोलटकर), हिंदू: जगण्याची समृद्ध अडगळ (भालचंद्र नेमाडे), कोण नाही कोन्चा, वरणभात लोन्चा (जयंत पवार), पायी चालणार (प्रफुल्ल शिलेदार), आयदान (उर्मिला पवार), वळीव (शंकर पाटील), माणूस (मनोहर तल्हार), जेव्हा मी जात चोरली होती (बाबुराव बागुल), कोण म्हणतंय टक्का दिला (संजय पवार)

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SYLLABUS

Subject: English

Code No. : 03

Unit –I : Drama

Unit –II : Poetry

Unit –III : Fiction, short story

Unit –IV : Non-Fictional Prose

NOTE: The first four units must also be tested through comprehension passages to assess critical reading, critical thinking and writing skills. These four units will cover all literatures in English.

Unit –V : Language: Basic concepts, theories and pedagogy. English in Use.

Unit –VI : English in India: history, evolution and futures

Unit –VII : Cultural Studies

Unit –VIII : Literary Criticism

Unit –IX : Literary Theory post World War II

Unit –X : Research Methods and Materials in English

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SYLLABUS

Subject: ECONOMICS

Code No.: 11

Unit-1 : Micro Economics

- Theory of Consumer Behaviour
- Theory of Production and Costs
- Decision making under uncertainty Attitude towards Risk
- Game Theory – Non Cooperative games
- Market Structures, competitive and non-competitive equilibria and their efficiency properties
- Factor Pricing
- General Equilibrium Analysis
- Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization
- Welfare Economics: Fundamental Theorems , Social Welfare Function
- Asymmetric Information: Adverse Selection and Moral Hazard

Unit-2 : Macro Economics

- National Income: Concepts and Measurement
- Determination of output and employment: Classical & Keynesian Approach
- Consumption Function
- Investment Function
- Multiplier and Accelerator
- Demand for Money
- Supply of Money
- IS – LM Model Approach

- Inflation and Phillips Curve Analysis
- Business Cycles
- Monetary and Fiscal Policy
- Rational Expectation Hypothesis and its critique
-

Unit- 3 : Statistics and Econometrics

- Probability Theory: Concepts of probability, Distributions, Moments, Central Limit theorem
- Descriptive Statistics – Measures of Central tendency & dispersions, Correlation, Index Numbers
- Sampling methods & Sampling Distribution
- Statistical Inferences, Hypothesis testing
- Linear Regression Models and their properties – BLUE
- Identification Problem
- Simultaneous Equation Models – recursive and non-recursive
- Discrete choice models
- Time Series Analysis

Unit-4 : Mathematical Economics

- Sets, functions and continuity, sequence, series
- Differential Calculus and its Applications
- Linear Algebra – Matrices, Vector Spaces
- Static Optimization Problems and their applications
- Input-Output Model, Linear Programming
- Difference and Differential equations with applications

Unit-5 : International Economics

- International Trade: Basic concepts and analytical tools
- Theories of International Trade
- International Trade under imperfect competition
- Balance of Payments: Composition, Equilibrium and Disequilibrium and Adjustment Mechanisms
- Exchange Rate: Concepts and Theories
- Foreign Exchange Market and Arbitrage
- Gains from Trade, Terms of Trade, Trade Multiplier

- Tariff and Non-Tariff barriers to trade; Dumping
- GATT, WTO and Regional Trade Blocks; Trade Policy Issues
- IMF & World Bank

Unit-6 : Public Economics

- Market Failure and Remedial Measures: Asymmetric Information, Public Goods, Externality
- Regulation of Market – Collusion and Consumers' Welfare
- Public Revenue: Tax & Non-Tax Revenue, Direct & Indirect Taxes, Progressive and non-Progressive Taxation, Incidence and Effects of Taxation
- Public expenditure
- Public Debt and its management
- Public Budget and Budget Multiplier
- Fiscal Policy and its implications

Unit-7 : Money and Banking

- Components of Money Supply
- Central Bank
- Commercial Banking
- Instruments and Working of Monetary Policy
- Non-banking Financial Institutions
- Capital Market and its Regulation

Unit-8 : Growth and Development Economics

- Economic Growth and Economic Development
- Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
- Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
- Technical progress – Disembodied & embodied; endogenous growth
- Indicators of Economic Development: PQLI, HDI, SDGs
- Poverty and Inequalities – Concepts and Measurement
- Social Sector Development: Health, Education, Gender

Unit-9 : Environmental Economics and Demography

- Environment as a Public Good
- Market Failure
- Coase Theorem
- Cost-Benefit Analysis and Compensation Criteria
- Valuation of Environmental Goods
- Theories of Population
- Concepts and Measures: Fertility, Morbidity, Mortality
- Age Structure, Demographic Dividend
- Life Table
- Migration

Unit-10 : Indian Economy

- Economic Growth in India: Pattern and Structure
- Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Rural Development – Issues, Challenges & Policy Responses
- Urban Development – Issues, Challenges and Policy Responses.
- Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies
- Infrastructure Development: Physical and Social; Public-Private Partnerships
- Reforms in Land, Labour and Capital Markets
- Centre-State Financial Relations and Finance Commissions of India; FRBM
- Poverty, Inequality & Unemployment

Maharashtra State Eligibility Test for Lectureship

महाराष्ट्र राज्य व्याख्यातापदासाठी राज्यस्तरीय पात्रता चाचणी (सेट) परीक्षा

**Conducted by University of Pune
(AS THE STATE AGENCY)**

SYLLABUS

Subject : GEOGRAPHY

Code No.:(36)

Unit I - Geomorphology

Unit II - Climatology

Unit III- Oceanography

Unit IV- Geography of Environment

Unit V - Population and Settlement Geography

Unit VI- Geography of Economic Activities and Regional Development

Unit VII - Cultural, Social and Political Geography

Unit VIII - Geographic Thought

Unit IX - Geographical Techniques

Unit X- Geography of India

UNIT-I

Geomorphology

Continental Drift, Plate Tectonics, Endogenetic and Exogenetic forces. Denudation and Weathering, Geomorphic Cycle (Davis and Penck), Theories and Process of Slope Development, Earth Movements (seismicity, folding, faulting and vulcanicity), Landform Occurrence and Causes of Geomorphic Hazards (earthquakes, volcanoes, landslides and avalanches)

UNIT –II

Climatology

Composition and Structure of Atmosphere; Insolation, Heat Budget of Earth, Temperature, Pressure and Winds, Atmospheric Circulation (air-masses, fronts and upper air circulation, cyclones and anticyclones (tropical and temperate), Climatic Classification of Koppen & Thornthwaite, ENSO Events (El Nino, La Nina and Southern Oscillations), Meteorological Hazards and Disasters (Cyclones, Thunderstorms, Tornadoes, Hailstorms, Heat and Cold waves Drought and Cloudburst , Glacial Lake Outburst (GLOF), Climate Change: Evidences and Causes of Climatic Change in the past, Human impact on Global Climate.

UNIT-III

Oceanography

Relief of Oceans, Composition: Temperature, Density and Salinity, Circulation: Warm and Cold Currents, Waves, Tides, Sea Level Changes, Hazards: Tsunami and Cyclone

UNIT –IV

Geography of Environment

Components: Ecosystem (Geographic Classification) and Human Ecology, Functions: Trophic Levels, Energy Flows, Cycles (geo-chemical, carbon, nitrogen and oxygen), Food Chain, Food Web and Ecological Pyramid, Human Interaction and Impacts, Environmental Ethics and Deep Ecology, Environmental Hazards and Disasters (Global Warming, Urban Heat Island, Atmospheric Pollution, Water Pollution, Land Degradation), National Programmes and Policies: Legal Framework, Environmental Policy, International Treaties, International Programmes and Polices (Brundtland Commission, Kyoto Protocol, Agenda 21, Sustainable Development Goals, Paris Agreement)

UNIT –V

Population and Settlement Geography

Population Geography

Sources of population data (census, sample surveys and vital statistics, data reliability and errors). World Population Distribution (measures, patterns and determinants), World Population Growth (prehistoric to modern period). Demographic Transition, Theories of Population Growth (Malthus, Sadler, and Ricardo). Fertility and Mortality Analysis (indices, determinants and world patterns). Migration (types, causes and consequences and models), Population Composition and Characteristics (age, sex, rural-urban, occupational structure and educational levels), Population Policies in Developed and Developing Countries.

Settlement Geography

Rural Settlements (types, patterns and distribution), Contemporary Problems of Rural Settlements (rural-urban migration; land use changes; land acquisition and transactions), Theories of Origin of Towns (Gordon Childe, Henri Pirenne, Lewis Mumford), Characteristics and Processes of Urbanization in Developed and Developing Countries (factors of urban growth, trends of urbanisation, size, structure and functions of urban areas). Urban Systems (the law of the primate city and rank size rule) Central Place Theories (Christaller and Losch), Internal Structure of the City, Models of Urban Land Use (Burgess, Harris and Ullman , and Hoyt), Concepts of Megacities, Global Cities and Edge Cities, Changing Urban Forms (peri-urban areas, rural-urban fringe, suburban , ring and satellite towns), Social Segregation in the City, Urban Social Area Analysis, Manifestation of Poverty in the City (slums, informal sector growth, crime and social exclusion).

Unit–VI:

Geography of Economic Activities and Regional Development

Economic Geography

Factors affecting spatial organisation of economic activities (primary, secondary, tertiary and quaternary), Natural Resources (classification, distribution and associated problems), Natural Resources Management. World Energy Crises in Developed and Developing Countries.

Agricultural Geography

Land capability classification and Land Use Planning, Cropping Pattern: Methods of delineating crop combination regions (Weaver, Doi and Rafiullah), Crop diversification, Von Thunen's Model of Land Use Planning. Measurement and Determinants of Agricultural Productivity, Regional variations in Agricultural Productivity, Agricultural Systems of the World.

Industrial Geography

Classification of Industries, Factors of Industrial Location; Theories of Industrial Location (A. Weber, E. M. Hoover, August Losch, A. Pred and D. M. Smith). World Industrial Regions, Impact of Globalisation on manufacturing sector in Less Developed Countries, Tourism Industry, World distribution and growth of Information And Communication Technology (ICT) and Knowledge Production (Education and R & D) Industries.

Geography of Transport and Trade

Theories and Models of spatial interaction (Edward Ullman and M. E. Hurst) Measures and Indices of connectivity and accessibility; Spatial Flow Models: Gravity Model and its variants, World Trade Organisation, Globalisation and Liberalisation and World Trade Patterns. Problems and Prospects of Inter and Intra Regional Cooperation and Trade.

Regional Development

Typology of Regions, Formal and Fictional Regions, World Regional Disparities, Theories of Regional Development (Albert O. Hirschman, Gunnar Myrdal, John Friedman, Dependency theory of Underdevelopment, Global Economic Blocks, Regional Development and Social Movements in India

Unit – VII: Cultural, Social and Political Geography

Cultural and Social Geography

Concept of Culture, Cultural Complexes, Areas and Region, Cultural Heritage, Cultural Ecology. Cultural Convergence, Social Structure and Processes, Social Well-being and Quality of Life, Social Exclusion, Spatial distribution of social groups in India (Tribe, Caste, Religion and Language), Environment and Human Health, Diseases Ecology, Nutritional Status (etiological conditions, classification and spatial and seasonal distributional patterns with special reference to India) Health Care Planning and Policies in India, Medical Tourism in India.

Political Geography

Boundaries and Frontiers (with special reference to India), Heartland and Rimland Theories. Trends and Developments in Political Geography, Geography of Federalism, Electoral Reforms in India, Determinants of Electoral Behaviour, Geopolitics of Climate Change, Geopolitics of World Resources, Geo-politics of India Ocean, Regional Organisations of Cooperation (SAARC, ASEAN, OPEC, EU). Neopolitics of World Natural Resources.

Unit VIII: Geographic Thought

Contributions of Greek, Roman, Arab, Chinese and Indian Scholars, Contributions of Geographers (Bernhardus Varenius, Immanuel Kant, Alexander von Humboldt, Carl Ritter, Scheafer & Hartshorne), Impact of Darwinian Theory on Geographical Thought. Contemporary trends in Indian Geography: Cartography, Thematic and Methodological contributions. Major Geographic Traditions (Earth Science, man-environment relationship, area studies and spatial analysis), Dualisms in Geographic Studies (physical vs. human, regional vs. systematic, qualitative vs. quantitative, ideographic vs. nomothetic), Paradigm Shift, Perspectives in Geography (Positivism, Behaviouralism, Humanism, Structuralism, Feminism and Postmodernism).

Unit IX: Geographical Techniques

Sources of Geographic Information and Data (spatial and non-spatial), Types of Maps, Techniques of Map Making (Choropleth, Isarithmic, Dasymetric, Chorochromatic, Flow Maps) Data Representation on Maps (Pie diagrams, Bar diagrams and Line Graph, GIS Database (raster and vector data formats and attribute data formats). Functions of GIS (conversion, editing and analysis), Digital Elevation Model (DEM), Georeferencing (coordinate system and map projections and Datum), GIS Applications (thematic cartography, spatial decision support system), Basics of Remote Sensing (Electromagnetic Spectrum, Sensors and Platforms, Resolution and Types, Elements of Air Photo and Satellite Image Interpretation and Photogrammetry), Types of Aerial Photographs, Digital Image Processing: Developments in Remote Sensing Technology and Big Data Sharing and its applications in Natural Resources Management in India, GPS Components (space, ground control and receiver segments) and Applications, Applications of Measures of Central Tendency, Dispersion and Inequalities, Sampling, Sampling Procedure and Hypothesis Testing (*chi* square test, *t* test, ANOVA), Time Series Analysis, Correlation and Regression Analysis, Measurement of Indices, Making

Indicators Scale Free, Computation of Composite Index, Principal Component Analysis and Cluster Analysis, Morphometric Analysis: Ordering of Streams, Bifurcation Ratio, Drainage Density and Drainage Frequency, Basin Circularity Ratio and Form Factor, Profiles, Slope Analysis, Clinographic Curve, Hypsographic Curve and Altimetric Frequency Graph.

Unit – X: Geography of India

Major Physiographic Regions and their Characteristics; Drainage System (Himalayan and Peninsular), Climate: Seasonal Weather Characteristics, Climatic Divisions, Indian Monsoon (mechanism and characteristics), Jet Streams and Himalayan Cryosphere, Types and Distribution of Natural Resources: Soil, Vegetation, Water, Mineral and Marine Resources. Population Characteristics (spatial patterns of distribution), Growth and Composition (rural-urban, age, sex, occupational, educational, ethnic and religious), Determinants of Population, Population Policies in India, Agriculture (Production, Productivity and Yield of Major Food Crops), Major Crop Regions, Regional Variations in Agricultural Development, Environmental, Technological and Institutional Factors affecting Indian Agriculture; Agro-Climatic Zones, Green Revolution, Food Security and Right to Food. Industrial Development since Independence, Industrial Regions and their characteristics, Industrial Policies in India. Development and Patterns of Transport Networks (railways, roadways, waterways, airways and pipelines), Internal and External Trade (trend, composition and directions), Regional Development Planning in India, Globalisation and its impact on Indian Economy, Natural Disasters in India (Earthquake, Drought, Flood, Cyclone, Tsunami, Himalayan Highland Hazards and Disasters.)

Maharashtra State Eligibility Test for Lectureship

महाराष्ट्र राज्य व्याख्यातापदासाठी राज्यस्तरीय पात्रता चाचणी (सेट) परीक्षा

Conducted by University of Pune

(AS THE STATE AGENCY)

SYLLABUS AND SAMPLE QUESTIONS

Subject
Code No.

33

Subject

Chemical Sciences



UNIVERSITY OF PUNE
Ganeshkhind, Pune-411007

[33] : CHEMICAL SCIENCES

The syllabus consists of two papers, as follows :

Paper II and Paper III will be of 75 minutes and 2½ hours duration respectively. Paper II will be of 100 marks and Paper III will be of 200 marks.

PAPER II

1. Structure and Bonding : Atomic orbitals, electronic configuration of atoms (L-S coupling) and the periodic properties of elements, ionic radii, ionization potential, electron affinity, electronegativity, concept of hybridization. Molecular orbitals and electronic configuration of homonuclear and heteronuclear diatomic molecules. Shapes of polyatomic molecules. VSEPR theory. Symmetry elements and point groups for simple molecules. Bond lengths, bond angles, bond order and bond energies. Resonance. Types of chemical bond (weak and strong). Intermolecular forces. Types of solids, lattice energy.
2. Acids and Bases : Bronsted and Lewis acids and bases. pH and pKa, acid-base concept in non-aqueous media, SHAB concept, Buffer solutions.
3. Redox Reactions : Oxidation numbers, Redox potentials, Electrochemical series, Redox indicators.
4. Introductory Energetics and Dynamics of Chemical Reactions : Law of conservation of energy. Energy and enthalpy of reactions. Entropy, free energy, relationship between free energy change and equilibrium. Rates of chemical reactions (first-and second-order reactions). Arrhenius equation and Concept of transition state. Mechanisms, including S_N1 and S_N2 reactions, electron transfer reactions, catalysis Colligative properties of solutions.
5. Aspects of s, p, d, f Block Elements : General characteristics of each block. Chemical principles involved in extraction and purification of common metals. Coordination chemistry, Structural aspects, isomerism, octahedral and tetrahedral crystal-field splitting of d-orbitals. CFSE, magnetism and colour of transition metal ions. Sandwich compounds metal carbonyls and metal clusters. Rare gas compounds, non-stoichiometric oxides. Radioactivity and transmutation of elements.
6. IUPAC Nomenclature of Simple Organic and Inorganic Compounds.
7. Concept of Chirality : Recognition of symmetry elements and chiral structures, R-S nomenclature, diastereoisomerism in acyclic and cyclic-systems, E-Z isomerism. Conformational analysis of simple cyclic (chair and boat cyclohexanes) and acyclic systems, Interconversion of Fischer, Newman and Sawhorse projections.
8. Common Organic Reactions and Mechanisms : Reactive intermediates. Formation and stability of carbonium ions, carbenes, nitrenes, radicals and arynes. Nucleophilic, electrophilic, radical substitution, addition and elimination reactions. Familiar name reactions : Aldol, Perkin, Stobbe,

Dieckmann condensations ; Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangements, Reimer-Tiemann, Reformatsky and Grignard reactions. Diels-Alder reaction, Claisen rearrangement, Friedel-Crafts reaction, Wittig reaction. Routine functional group transformations and inter-conversions of simple functionalities. Hydroboration, Oppenauer oxidation, Clemmensen, Wolf-Kishner, Meerwein-Ponndorf Verley and Birch reductions.

9. Elementary principles and applications of electronic, vibrational, NMR, EPR, Mossbauer and mass spectral techniques to simple structural problems.
10. Data Analysis : Types of errors, propagation of errors, accuracy and precision, least-square analysis, average standard deviation.

PAPER III

1. Quantum Chemistry, Planck's quantum theory, wave-particle duality, Uncertainty Principle, operators and commutation relations, postulates of quantum mechanics and Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, rigid rotator and the hydrogen atom. Angular momentum including spin coupling of angular momenta including spin-orbit coupling.
2. **The variation method and perturbation theory** : Application to the helium, atom, antisymmetry and Exclusion Principle, Slater determinantal wave functions. Term symbols and spectroscopic states.
3. **Born-Oppenheimer approximation, Hydrogen molecule ion** : LCAO-MO and VB treatments of the hydrogen molecule, electron density, forces and their role in chemical binding. Hybridisation and valence MO, of H_2O , NH_3 and CH_4 . Huckel pi-electron theory and its applications to ethylene, butadiene and benzene, idea of self-consistent fields.
4. **Group theoretical representations and quantum mechanics** : Vanishing of integrals, spectroscopic selection rules for vibrational, electronic, vibronic and Raman spectroscopy. MO treatment of large molecules with symmetry.
5. **Spectroscopy** : Theoretical treatment of rotational, vibrational and electronic spectroscopy. Principles of magnetic resonance, Mossbauer and Photoelectron spectroscopy.
6. **Thermodynamics** : First law of thermodynamics, relation between C_p and C_v ; enthalpies of physical and chemical changes, temperature dependence of enthalpies. Second law of thermodynamics, entropy, Gibbs-Helmholtz equation. Third law of thermodynamics and calculation of entropy.
7. **Chemical Equilibrium** : Free energy and entropy of mixing, partial molar quantities, Gibbs-Duhem equation. Equilibrium constant, temperature dependence of equilibrium constant, phase diagram of one and two-component systems, phase rule.

8. **Ideal and Non-ideal Solutions** : Excess functions, activities, concept of hydration number, activities in electrolytic solutions, mean ionic activity coefficient. Debye-Huckel treatment of dilute electrolyte solutions.
9. **Equilibria in Electrochemical Cells** : Cell reactions, Nernst equation, application of cell EMF measurements.
10. **Surface Phenomena** : Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetic micelles and reverse micelles; solutions. Applications of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.
11. **Statistical Thermodynamic probability and entropy** : Maxwell-Boltzmann distribution of velocities, average, most probable and root-mean-square velocities. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Partition function, rotational, translational, vibrational and electronic partition functions for diatomic molecules, calculations of thermodynamic functions and equilibrium constants. Theories of specific heat for solids.
12. **Non-equilibrium Thermodynamics** : Postulates and methodologies, linear laws, Gibbs equation, Onsager reciprocal theory.
13. **Reaction Kinetics** : Methods of determining rate laws, Mechanisms of photo-chemical, chain and oscillatory reactions. Collision theory of reaction rates, steric factor, treatment of unimolecular reactions. Theory of absolute reaction rates, comparison of result with Eyring and Arrhenius equations, ionic reactions, salt effect. Homogeneous catalysis and Michaelis-Menten Kinetics; heterogeneous catalysis.
14. **Fast Reactions** : Study of kinetics by stop-flow technique, relaxation method, flash photolysis and magnetic resonance method.
15. **Macromolecules** : Number-average and weight-average molecular weights. Determination of molecular weights. Kinetics of polymerisation. Stereochemistry and mechanism of polymerisation.
16. **Solids** : Dislocations in solids, Schottky and Frenkel defects. Electrical properties. Insulators and semiconductors, band theory of solids, solid-state reactions.
17. **Nuclear Chemistry** : Radioactive decay and equilibrium. Nuclear reactions, Q value, cross-sections, types of reactions. Chemical effects of nuclear transformations, fission and fusion, fission products and fission yields. Radioactive techniques, tracer techniques, neutron activation analysis, counting techniques such as G.M., ionization and proportional counters.
18. **Chemistry of Non-transition Elements** : General discussion on the properties of the non-transition elements, special features of individual elements, synthesis, properties and structure of their halides and oxides, polymorphism of carbon, phosphorus and sulphur. Synthesis, properties and structure of boranes, carboranes, borazines, silicates, carbides, silicones, phosphazenes, sulphur, oxyacids of nitrogen, phosphorus, sulphur and halogens. Interhalogens, pseudohalides and noble gas compounds.

19. **Chemistry of Transition Elements** : Coordination chemistry of transition metal ions. Stability constants of complexes and their determination, stabilization of unusual oxidation states. Stereochemistry of coordination compounds. Ligand field theory, splitting of d-orbitals in low symmetry environments. Jahn-Teller effect, interpretation of electronic spectra including charge transfer spectra, spectrochemical series, nephelauxetic series. Dia-para-ferro and antiferromagnetism, quenching of orbital angular moments, spin orbit coupling. Inorganic reaction mechanisms, substitution reactions, trans-effect and electron transfer reactions, photochemical reactions of chromium and ruthenium complexes. Fluxional molecules. Iso and heteropolyacids, metal clusters. Spin crossover in coordination compounds.
20. **Chemistry of Lanthanides and Actinides** : Spectral and magnetic properties, use of lanthanide compounds as shift reagents.
21. **Organometallic Chemistry of Transition Elements** : Synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogeneous catalytic reactions (hydrogenation, hydroformylation, isomerisation and polymerisation), pi-metal complexes, activation of small molecules by coordination.
22. **Topics in Analytical Chemistry** : Adsorption, partition, exclusion, electrochromatography. Solvent extraction and ion exchange methods. Application of atomic and molecular absorption and emission spectroscopy in quantitative analysis. Light scattering techniques including nephelometry and Raman spectroscopy. Electroanalytical techniques, voltammetry, cyclic voltammetry, polarography, amperometry, coulometry and conductometry. Ion-selective electrodes. Anodic stripping voltammetry, TGA, DTA, DSC and on-line analysers.
23. **Bioinorganic Chemistry** : Molecular mechanism of ion transport across membranes, ionophores. Photosynthesis-PS-I, PS-II, nitrogen fixation, oxygen uptake proteins, cytochromes and ferredoxins.
24. **Aromaticity** : Huckel's rule and concept of aromaticity : annulenes and heteroannulenes, fullerenes. (C_{60})
25. **Stereochemistry and Conformational Analysis** : Newer methods of asymmetric synthesis (including enzymatic and catalytic), enantio- and diastereo selective synthesis. Effects of conformation on reactivity in acyclic compounds and cyclohexanes.
26. **Selective Organic Name Reactions** : Favorskii reaction, Stork enamine reaction, Michael addition, Mannich reaction, Sharpless asymmetric epoxidation, ene reaction, Barton reaction, Hofmann-Löffler-Freytag reaction, Shapiro reaction, Baeyer-Villiger reaction, Chichibabin reaction.
27. **Mechanisms of Organic Reactions** : Labelling and kinetic isotope effects, Hammett equation, σ - ρ (σ - ρ) relationship, non-classical carbonium ions, neighbouring group participation.

28. **Pericyclic Reactions** : Selection rules and stereochemistry of electrocyclic reactions, cycloaddition and sigmatropic shifts, Sommelet-Hauser, Cope and Claisen rearrangements.
29. **Heterocycles** : Synthesis and reactivity of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole. Skraup synthesis, Fischer indole synthesis.
30. **Reagents in Organic Synthesis** : Use of following reagents in organic synthesis and functional group transformations-Complex metal hydride. Gilman's reagent, lithium, dimethylcuprate, lithium, diisopropylamide (LDA) dicyclohexylcarbodiimide, 1, 3-dithiane (reactivity umpolung). Trimethyl silyl iodide, tri-n-butyltin hydride, Woodward and Prevost hydroxylation, osmium tetroxide, DDQ, selenium dioxide, phase transfer catalysts, crown ethers and Merrifield resin. Peterson's synthesis, Wilkinson's catalyst, Baker's yeast.
31. **Chemistry of Natural Products** : Familiarity with methods of structure elucidation and biosynthesis of alkaloids, terpenoids, steroids, carbohydrates and proteins, Conformations of proteins and nucleic acids.
32. **Bioorganic Chemistry** : Elementary structure and function of biopolymers such as proteins and nucleic acids, Genetic code, Mechanism of enzyme action.
33. **Photochemistry** : Principles of energy transfer, cis-trans isomerization, Paterno-Buchi reaction, Norrish Type I and II reactions, photoreduction of ketones, di- π -methane rearrangement, photochemistry of arenes.
34. **Spectroscopy** : Combined applications of mass, UV-VIS, IR and NMR spectroscopy for structural elucidation of compounds.

SAMPLE QUESTIONS

PAPER II

1. The total number of permitted electrons in a 4f orbital is
 (A) 10, (B) 6,
 (C) 14, (D) 2. Ans. C
2. Which one of the following is a molecular solid ?
 (A) NaCl, (B) Phosphorus,
 (C) Diamond, (D) Iron. Ans. B
3. The chiral molecules among the following are
 (i) 1, 1-Dimethylcyclopropane.
 (ii) cis-1, 2-dimethylcyclopropane.
 (iii) trans-1, 2-dimethylcyclopropane.
 (A) All three, (B) (ii) and (iii), (C) only (ii), (D) only (iii). Ans. D

PAPER III

1. The standard heat of hydrogenation of propene in the reaction
 $\text{CH}_2 = \text{CHCH}_3 (g) + \text{H}_2(g) = \text{C}_3\text{H}_8(g)$ is - 124 kJ/mol.

The standard heat of combustion of propane in the reaction
 $\text{C}_3\text{H}_8(g) + 5\text{O}_2(g) = 3\text{CO}_2(g) + 4\text{H}_2\text{O} (l)$ is - 2220 kJ/mol.

Calculate the standard heat of combustion of propane.

Given : $\{\text{H}_2(g) + 0.5\text{O}_2(g) = \text{H}_2\text{O}(l), \Delta H^\circ = -285.8\text{kJ/mol}\}$

2. Match the following Hammett σ values :

(a) m - Me (i) + 0.78

(b) p - Me (ii) - 0.27

(c) p - NO₂ (iii) + 0.12

(d) p - COCH₃ (iv) - 0.07

(e) m - OMe (v) + 0.50

(f) p - OMe (vi) - 0.17

3. (a) Predict whether the following reactions will proceed via inner, sphere or outer sphere mechanism. Give the products also.



- (b) Name the factors that determine the magnitude of crystal field splitting.
