



# मध्यप्रदेश लोक सेवा आयोग

रेसीडेन्सी क्षेत्र, इंदौर

परीक्षा तिथि 20.10.2013

विज्ञापन क्रमांक 01/परीक्षा/2013/03.06.2013

गृह विभाग, मध्यप्रदेश शासन

ऑनलाइन आवेदन करने की

अंतिम तिथि 04.07.2013

## महत्वपूर्ण

1. आवेदन पत्र केवल ऑनलाइन स्वीकार किये जायेंगे। आवेदन-पत्र दिनांक 05.06.2013 (दोपहर 12.00) से 04.07.2013 (रात्रि 12.00 बजे) तक [www.mponline.gov.in](http://www.mponline.gov.in), [www.mppsc.nic.in](http://www.mppsc.nic.in) तथा [www.mppsc.com](http://www.mppsc.com) पर भरे जा सकते हैं।
2. आवेदक ऑनलाइन आवेदन-पत्र की सावधानीपूर्वक जांच कर लें। ऑनलाइन आवेदन पत्रों में दिनांक 07.06.2013 से 06.07.2013 तक त्रुटि सुधार किया जा सकेगा। इस हेतु प्रति त्रुटि सुधार सत्र, ₹ 50/- त्रुटि सुधार शुल्क देय होगा। नियत अवधि में त्रुटि सुधार नहीं करने पर कोई पश्चातवर्ती अभ्यावेदन मान्य नहीं किया जायेगा।
3. ऑनलाइन आवेदन-पत्रों में आवेदक द्वारा भरी गयी श्रेणी/वर्ग (अनारक्षित/अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग/लिंग (महिला/पुरुष)/निःशक्तजन (अस्थिबाधित, श्रवणबाधित, दृष्टिबाधित)/शासकीय सेवक) आदि के आधार पर ही परिणाम घोषित किया जाता है। अतः त्रुटि सुधार अवधि समाप्त होने के पश्चात किसी भी प्रकार का परिवर्तन मान्य नहीं होगा तथा श्रेणी/वर्ग परिवर्तन विषयक समस्त अभ्यावेदन सरसरी तौर पर अमान्य किये जायेंगे तथा आयोग द्वारा इस संदर्भ में आवेदक से कोई पत्र व्यवहार नहीं किया जायेगा।
4. इस विज्ञापन के अंतर्गत विज्ञापित पद हेतु लिखित परीक्षा दिनांक 20.10.2013 को (प्रातः 10.00 बजे से 12.00 बजे तक) इंदौर स्थित निर्धारित परीक्षा केन्द्रों पर आयोजित होगी। परीक्षा हेतु प्रवेश पत्र दिनांक 01.10.2013 से 18.10.2013 तक [www.mponline.gov.in](http://www.mponline.gov.in), [www.mppsc.nic.in](http://www.mppsc.nic.in) तथा [www.mppsc.com](http://www.mppsc.com) पर उपलब्ध रहेंगे।
5. विज्ञापन के संदर्भ में नवीन सूचनायें आयोग की वेबसाइट [www.mppsc.nic.in](http://www.mppsc.nic.in) तथा [www.mppsc.com](http://www.mppsc.com) पर प्रसारित की जायेंगी। यद्यपि आयोग अपनी समस्त सूचनाओं को समाचार पत्रों में भी प्रकाशित करता है किंतु तत्काल सूचना हेतु आयोग की वेबसाइट पर प्रकाशित सूचना ही पर्याप्त होगी। आवेदक नवीन सूचनाओं हेतु आयोग की वेबसाइट का सतत् अवलोकन करें।

एक- भारत के नागरिकों तथा भारत के संविधान के तहत मान्य अन्य श्रेणियों के आवेदकों से मध्यप्रदेश शासन, गृह विभाग के अन्तर्गत निम्न पद हेतु आवेदन पत्र आमंत्रित किए जाते हैं :-

पद का नाम	कुल पद	रिक्तियों की वर्गवार संख्या				रिक्तियों में से वर्गवार मध्यप्रदेश की मूल निवासी महिलाओं के लिये आरक्षित पद				रिक्तियों में से निःशक्त श्रेणी हेतु आरक्षण
		अना.	अनु. जाति	अनु. जनजाति	अ.पि.व.	अना.	अनु. जाति	अनु. जनजाति	अ.पि.व.	
वैज्ञानिक अधिकारी (भौतिकी) Scientific Officer (Physics)	33	14	06	08	05	04	02	02	02	02 पद 01 अस्थिबाधित (अनारक्षित) 01 श्रवणबाधित (अनु. जाति)
वैज्ञानिक अधिकारी (रसायन) Scientific Officer (Chemistry)	42	20	07	10	05	06	02	03	02	02 पद 01 अस्थिबाधित (अनारक्षित) 01 श्रवणबाधित (अनु. जाति)
वैज्ञानिक अधिकारी (जीव विज्ञान) Scientific Officer (Biology)	44	22	08	10	04	07	02	03	01	02 पद 01 श्रवणबाधित (अनारक्षित) 01 श्रवणबाधित (अनु. जाति)

- टीप- (i) आवेदक के पास उपर्युक्त अर्हताएं ऑनलाइन आवेदन करने की अंतिम तिथि तक होना चाहिये। आवेदन करने की अंतिम तिथि के बाद किसी भी तिथि को उक्त अर्हताएं, अर्जित करने वाले आवेदक विज्ञापित पदों के लिये विचारित होने की पात्रता नहीं रखेंगे।
- (ii) शासन द्वारा पदों की संख्या का पुनरीक्षण करने पर इस पद संख्या में परिवर्तन किया जा सकता है।
- (iii) चयनित आवेदकों की नियुक्ति दो वर्ष की परीक्षा पर की जाएगी।
- (iv) किसी भी प्रवर्ग में मध्यप्रदेश की मूलनिवासी महिलाओं के लिये आरक्षित पद उपयुक्त महिला अभ्यर्थी के अभाव में उसी प्रवर्ग के पुरुष उम्मीदवारों के चयन द्वारा भरे जा सकेंगे।
- (v) वैज्ञानिक अधिकारी के पद हेतु केवल अस्थिबाधित तथा श्रवणबाधित निःशक्तता श्रेणी के 40 प्रतिशत या अधिक निःशक्त आवेदक आरक्षण एवं छूटों के पात्र हैं।

- (ब) विभाग का नाम : राज्य न्यायालयिक विज्ञान प्रयोगशाला, गृह (पुलिस) विभाग मध्यप्रदेश शासन
- (स) श्रेणी : राजपत्रित द्वितीय श्रेणी
- (द) वेतनमान : रु. 15600-39100 + ग्रेड-पे 5400/- तथा मध्यप्रदेश शासन द्वारा निर्धारित महंगाई भत्ता तथा अन्य भत्ते देय होंगे।
- (इ) अनिवार्य अर्हताएं : शैक्षणिक - रसायन शास्त्र या न्यायालयिक विज्ञान (न्यायालयिक रसायन शास्त्र या विष विज्ञान में विशेषज्ञता के साथ) में द्वितीय श्रेणी में एम.एससी. की उपाधि।  
M.Sc. Second Class in Chemistry or in Forensic Science (with specialization in Forensic Chemistry or Forensic Toxicology)
- अनुभव - किसी भी मान्यता प्राप्त शोध संस्थान/कॉलेज/ विश्वविद्यालय/प्रयोगशाला में दो वर्ष का वैज्ञानिक शोध कार्य का अनुभव।
- Two years Experience of Scientific Research

### तीन- पद का विवरण

01. (अ) पद का नाम : वैज्ञानिक अधिकारी (भौतिकी)  
Scientific Officer (Physics)
- (ब) विभाग का नाम : राज्य न्यायालयिक विज्ञान प्रयोगशाला, गृह (पुलिस) विभाग मध्यप्रदेश शासन
- (स) श्रेणी : राजपत्रित द्वितीय श्रेणी
- (द) वेतनमान : रु. 15600-39100 + ग्रेड-पे 5400/- तथा मध्यप्रदेश शासन द्वारा निर्धारित महंगाई भत्ता तथा अन्य भत्ते देय होंगे।
- (इ) अनिवार्य अर्हताएं : शैक्षणिक - भौतिक शास्त्र या कम्प्यूटर साइंस या मास्टर ऑफ कम्प्यूटर एप्लीकेशन या न्यायालयिक विज्ञान (न्यायालयिक भौतिक शास्त्र अथवा न्यायालयिक प्राक्षेपिकी में विशेषज्ञता के साथ) में द्वितीय श्रेणी में एम.एससी. की उपाधि तथा भौतिक शास्त्र एवं रसायन शास्त्र विषय बी.एससी. में होना चाहिए।  
M.Sc. Second Class in Physics or Computer Science or Master of Computer Application or in Forensic Science (with specialization in Forensic Physics or Forensic Ballistics) and should have Physics and Chemistry as subject in B.Sc.
- अनुभव - किसी भी मान्यता प्राप्त शोध संस्थान/कॉलेज/ विश्वविद्यालय/प्रयोगशाला में दो वर्ष का वैज्ञानिक शोध कार्य का अनुभव।
- Two years Experience of Scientific Research
- विशेष - उक्त अर्हतायें विज्ञापन में उल्लेखित ऑनलाइन आवेदन करने की अंतिम तिथि 04.07.2013 तक अर्जित होनी चाहिये। उक्त तिथि के बाद में अर्हता धारित करने वाले आवेदक पद हेतु अनर्ह माने जायेंगे।
- (फ) पद के कर्तव्य : विभिन्न आपराधिक प्रकरणों में प्राप्त प्रदर्शनों का विश्लेषणात्मक परीक्षण कार्य एवं परीक्षित प्रकरणों की रिपोर्ट तैयार करना तथा समय-समय पर उच्चाधिकारियों द्वारा सौंपे गये अन्य कार्य।
02. (अ) पद का नाम : वैज्ञानिक अधिकारी (रसायन)  
Scientific Officer (Chemistry)

- (फ) पद के कर्तव्य : विभिन्न आपराधिक प्रकरणों में प्राप्त प्रदर्शनों का विश्लेषणात्मक परीक्षण कार्य एवं परीक्षित प्रकरणों की रिपोर्ट तैयार करना तथा समय-समय पर उच्चाधिकारियों द्वारा सौंपे गये अन्य कार्य।
03. (अ) पद का नाम : वैज्ञानिक अधिकारी (जीव-विज्ञान)  
Scientific Officer (Biology)
- (ब) विभाग का नाम : राज्य न्यायालयिक विज्ञान प्रयोगशाला, गृह (पुलिस) विभाग मध्यप्रदेश शासन
- (स) श्रेणी : राजपत्रित द्वितीय श्रेणी
- (द) वेतनमान : रु. 15600-39100 + ग्रेड-पे 5400/- तथा मध्यप्रदेश शासन द्वारा निर्धारित महंगाई भत्ता तथा अन्य भत्ते देय होंगे।
- (इ) अनिवार्य अर्हताएं : शैक्षणिक - वनस्पति विज्ञान या प्राणि विज्ञान या जैव रसायन शास्त्र या सूक्ष्म जीव विज्ञान या जैव प्रौद्योगिकी (बायोटेक्नोलॉजी) या जेनेटिक्स (न्यायालयिक जीव विज्ञान अथवा न्यायालयिक सीरम विज्ञान में विशेषज्ञता के साथ) न्यायालयिक विज्ञान में द्वितीय श्रेणी में एम.एससी. उपाधि तथा वनस्पति विज्ञान, प्राणि विज्ञान तथा रसायन शास्त्र विषय बी.एससी. में होना चाहिए।  
M.Sc. Second Class in Botany or Zoology or Bio-Chemistry of Microbiology or Biotechnology or Genetics or in Forensic Science (with specialization in Forensic Biology or Forensic Serology) and should have Botany, Zoology and Chemistry (as) subject in B.Sc.
- अनुभव - किसी भी मान्यता प्राप्त शोध संस्थान/कॉलेज/

परिशिष्ट-1

- विश्वविद्यालय/प्रयोगशाला में दो वर्ष का वैज्ञानिक शोध कार्य का अनुभव।  
Two years Experience of Scientific Research
- विशेष** - उक्त अर्हतायें विज्ञापन में उल्लेखित ऑनलाइन आवेदन करने की अंतिम तिथि 04.07.2013 तक अर्जित होनी चाहिये। उक्त तिथि के बाद में अर्हता धारित करने वाले आवेदक पद हेतु अनर्ह माने जायेंगे।
- (फ) पद के कर्तव्य : विभिन्न आपराधिक प्रकरणों में प्राप्त प्रदर्शों का विश्लेषणात्मक परीक्षण कार्य एवं परीक्षित प्रकरणों की रिपोर्ट तैयार करना तथा समय-समय पर उच्चाधिकारियों द्वारा सौंपे गये अन्य कार्य।
- टीप** - आवेदक के पास उपर्युक्त अर्हताएं अंतिम तिथि तक होना चाहिये। आवेदन करने की अंतिम तिथि के बाद किसी भी दिनांक को उक्त अर्हताएं अर्जित करने वाले आवेदक विज्ञापित पदों के लिये विचारित होने की पात्रता नहीं रखेंगे।
- तीन** 1. अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग हेतु आरक्षित पद केवल मध्यप्रदेश के मूल निवासी अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग हेतु आरक्षित हैं। छत्तीसगढ़ सहित अन्य प्रदेशों के मूल निवासी ऐसे आवेदक जो अपने मूल निवास के राज्य में अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग के रूप में मान्य हैं, आरक्षण हेतु पात्र नहीं हैं। उन्हें अनारक्षित पदों हेतु विचारित किया जायेगा।  
2. मध्यप्रदेश के बाहर के अनुसूचित जाति, अनुसूचित जनजाति एवं अन्य पिछड़ा वर्ग के उम्मीदवार अपना वर्ग अनारक्षित लिखें।
- चार** आयु सीमा- 21 वर्ष की आयु पूर्ण कर ली हो परंतु 40 वर्ष पूर्ण न की हो।
- पाँच** आयु संगणना तिथि 01.01.2014 होगी।  
आयु सीमा में दी गई अन्य छूटों के लिये परिशिष्ट-1 देखें।  
मध्यप्रदेश शासन के स्थायी/अस्थायी तथा राज्य के निगम, मंडल, परिषद् नगर निगम, नगर पालिका आदि स्वशासी संस्थाओं में कार्यरत समस्त श्रेणी के कर्मचारी तथा नगर सैनिकों हेतु अधिकतम आयु सीमा 45 वर्ष रहेगी। उपरोक्त रियायत कार्यभारित तथा आकस्मिकता निधि से वेतन पाने वाले कर्मचारियों तथा परियोजना कार्यान्वयन समितियों में नियोजित कर्मचारियों को भी लागू होगी।
- छ:** मध्यप्रदेश सिविल सेवाएं (सेवा की सामान्य शर्तें) नियम, 1961 के अन्तर्गत अनर्हता -  
अ. कोई भी उम्मीदवार, जिसे महिलाओं के विरुद्ध किसी अपराध का सिद्ध-दोष ठहराया गया हो, किसी सेवा या पद पर नियुक्ति के लिए पात्र नहीं होगा।  
परंतु जहां किसी उम्मीदवार के विरुद्ध न्यायालय में ऐसे मामले, लंबित हों तो उसकी नियुक्ति का मामला आपराधिक मामले का अंतिम विनिश्चय होने तक लंबित रखा जायेगा।  
ब. कोई भी उम्मीदवार जिसकी दो से अधिक जीवित संतान हैं, जिनमें से एक का जन्म 26 जनवरी 2001 को या उसके पश्चात् हो, किसी सेवा या पद पर नियुक्ति के लिये पात्र नहीं होगा।  
परंतु कोई भी उम्मीदवार जिसकी पहले से एक जीवित संतान है तथा आगामी प्रसव 26 जनवरी, 2001 को या उसके पश्चात् हो, जिसमें दो या दो से अधिक संतान का जन्म होता है, किसी सेवा या पद पर नियुक्ति के लिये निरर्हता नहीं होगा।
- सात** महत्वपूर्ण-यह सुनिश्चित करने की जिम्मेदारी स्वयं आवेदक की होगी कि, वे आवेदित पद के लिए निर्धारित समस्त अर्हताओं और शर्तों को पूरा करते हैं। अतः आवेदन करने के पहले आवेदक अपनी अर्हता की जाँच स्वयं कर लें और अर्हता की समस्त शर्तों को पूरा करने पर ही आवेदन पत्र भेजें। लिखित परीक्षा में सम्मिलित किये जाने या साक्षात्कार के लिये आमंत्रित करने का अर्थ यह कदापि नहीं होगा कि आवेदक को अर्ह मान लिया गया है। चयन के किसी भी स्तर पर आवेदक के अनर्ह पाये जाने पर आवेदन पत्र निरस्त कर आवेदक की उम्मीदवारी समाप्त की जायेगी।
- आठ** अधिवार्षिकी आयु- 60 वर्ष
- नौ** चयन प्रक्रिया- उपरोक्त पदों पर अंतिम चयन लिखित परीक्षा तथा साक्षात्कार में प्राप्तियों के आधार पर होगा। लिखित परीक्षा में प्राप्तियों के आधार पर गुणानुक्रम में प्रत्येक श्रेणी के आवेदकों को पदों की संख्या के 3 गुणा के अनुपात में साक्षात्कार हेतु आमंत्रित किया जाएगा। लिखित परीक्षा में सफल होने के लिये प्रत्याशियों को कम से कम 40 प्रतिशत अंक अर्जित करना अनिवार्य होगा। मध्यप्रदेश के अनुसूचित जाति/अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग के प्रत्याशियों के अंकों में दस प्रतिशत की छूट दी जायेगी। इस प्रकार उनके लिये लिखित परीक्षा में कम से कम 30 प्रतिशत अंक प्राप्त करना आवश्यक होगा। साक्षात्कार में अनुपस्थित रहने वाले आवेदकों को चयन के लिये अनर्ह माना जायेगा। साक्षात्कार के लिये आवेदकों को बुलाने के संबंध में आयोग का निर्णय अंतिम होगा। अर्हताधारी आवेदकों को व्यक्तिगत रूप से साधारण डाक द्वारा पत्र भेजकर सूचित किया जायेगा। आयोग की परीक्षा प्रणाली में पुनर्मूल्यांकन/पुनर्गणना का कोई प्रावधान नहीं है। इस विषय में प्राप्त अभ्यावेदनों पर कोई कार्यवाही नहीं की जायेगी। चयन परिणाम प्रकाशित होने के बाद भी यदि कोई कम्प्यूटर त्रुटि/लिपिकीय त्रुटि ध्यान में आती है तो आयोग को चयन परिणाम को सुधारने का अधिकार सुरक्षित है। परीक्षा योजना एवं पाठ्यक्रम हेतु परिशिष्ट-3 देखें।
- दस-** परीक्षा की तिथि- लिखित परीक्षा दिनांक 20.10.2013 को प्रातः 10.00 बजे से दोपहर 12.00 बजे तक आयोजित की जायेगी।  
प्रश्न पत्र में किसी भी प्रकार की त्रुटि के संदर्भ में आवेदक परीक्षा तिथि के 15 दिवस पश्चात् तक अभ्यावेदन प्रस्तुत कर सकेंगे। उक्त अवधि के बाद प्राप्त अभ्यावेदनों पर कोई कार्यवाही नहीं की जायेगी।
- ग्यारह-** परीक्षा केंद्र- लिखित परीक्षा इंदौर स्थित परीक्षा केंद्रों पर आयोजित की जायेगी।
- बारह-** आवेदन प्रक्रिया - उक्त पद हेतु आवेदन पत्र मात्र इन्टरनेट के माध्यम से ऑनलाइन जमा किए जा सकेंगे। ऑनलाइन आवेदन पत्र भरने की प्रक्रिया की विस्तृत जानकारी हेतु परिशिष्ट-2 का अवलोकन करें।
- तेरह-** प्रवेश पत्र प्राप्ति प्रक्रिया- परीक्षा हेतु प्रवेश पत्र दिनांक 01.10.2013 (दोपहर 12.00 बजे) से 18.10.2013 (रात्रि 12.00 बजे) तक [www.mponline.gov.in](http://www.mponline.gov.in), [www.mppsc.nic.in](http://www.mppsc.nic.in) तथा [www.mppsc.com](http://www.mppsc.com) पर उपलब्ध रहेंगे। अर्हताधारी आवेदक अपने प्रवेश-पत्र उक्त वेबसाइटों से डाउनलोड कर सकेंगे, पृथक से प्रवेश पत्र नहीं भेजे जायेंगे। प्रवेश पत्र डाउनलोड करने हेतु आवेदक को वेबसाइट में विहित स्थान पर उसके आवेदन-पत्र क्रमांक तथा जन्मतिथि की प्रविष्टि करनी होगी। एम.पी. ऑनलाइन के अधिकृत कियोस्क के माध्यम से प्रवेश पत्र प्राप्ति हेतु 5 रुपये पोर्टल शुल्क देय होगा।
- चौदह-** आवेदक द्वारा आवेदन पत्र में अंकित वर्तमान पते पर ही आयोग द्वारा समस्त पत्र-व्यवहार किया जायेगा। यदि आवेदक का पता परिवर्तन होता है तो ऐसी स्थिति में आवेदक को चाहिये कि वह अविलंब नये पते की सूचना आयोग को लिखित में प्रस्तुत करें ताकि आयोग नये पते पर पत्र-व्यवहार कर सके। आवेदक द्वारा पता परिवर्तन की स्थिति में नये पते की सूचना न देने पर समस्त पत्र-व्यवहार पुराने पते पर ही किया जावेगा जिसके फलस्वरूप आवेदक को पत्रादि प्राप्त न होने की स्थिति हेतु आवेदक स्वयं जिम्मेदार होगा तथा इस संदर्भ में आवेदक का कोई अभ्यावेदन मान्य नहीं होगा।
- पंद्रह-** आवेदक विस्तृत जानकारी हेतु निम्न परिशिष्ट देखें -  
(i) आयु सीमा की छूटें परिशिष्ट-1  
(ii) आवेदन पत्र भरने तथा अन्य निर्देश एवं जानकारी परिशिष्ट-2  
(iii) परीक्षा योजना एवं पाठ्यक्रम परिशिष्ट-3

(एक) उच्चतम आयु सीमा में वर्ग विशेष को देय छूटें

- (1) सामान्य प्रशासन विभाग, मध्यप्रदेश शासन के परिपत्र क्रमांक सी 3-11/12/1/3, दिनांक 03.11.2012 एवं परिपत्र क्रमांक सी 3-11/2012/3/एक, दिनांक 20.11.2012 द्वारा राज्य शासन की सेवाओं में सीधी भर्ती से भरे जाने वाले पदों पर नियुक्ति के लिये निर्धारित 35 वर्ष की अधिकतम आयु सीमा को बढ़ाकर 40 वर्ष नियत करते हुये निम्नानुसार छूट की गणना अधिसूचित की गयी है :-

1. पुरुष आवेदक (अनारक्षित वर्ग)	40 वर्ष
2. पुरुष आवेदक (शासकीय/निगम/मंडल/स्वशासी संस्था के कर्मचारी तथा नगर सैनिक)	45 वर्ष
3. पुरुष आवेदक (आरक्षित वर्ग - अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग)	45 वर्ष
4. पुरुष आवेदक (आरक्षित वर्ग - शासकीय/निगम/मंडल/स्वशासी संस्था के कर्मचारी तथा नगर सैनिक)	45 वर्ष
5. महिला आवेदक (अनारक्षित वर्ग)	45 वर्ष
6. महिला आवेदक (शासकीय/निगम/मंडल/स्वशासी संस्था के कर्मचारी तथा नगर सैनिक) (विधवा/परित्यक्ता/तलाकशुदा)	45 वर्ष
7. महिला आवेदक (आरक्षित वर्ग - अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग)	45 वर्ष

**विशेष :- सभी प्रकार की छूट को शामिल करते हुये किसी भी स्थिति में किसी भी प्रवर्ग के लिये अधिकतम आयु सीमा 45 वर्ष से अधिक नहीं होगी।**

- (2) निःशक्त आवेदकों को अधिकतम आयु सीमा में 05 वर्ष छूट देय होगी। वैज्ञानिक अधिकारी (भौतिकी, रसायन, जीव विज्ञान) के पद हेतु केवल 40 प्रतिशत या अधिक अस्थिबाधित एवं श्रवणबाधित निःशक्त आवेदक आरक्षण तथा छूटों के पात्र होंगे। निःशक्त आवेदकों के चिकित्सा मंडल द्वारा जारी नवीनतम निःशक्तता प्रमाण-पत्र जिसमें 40 प्रतिशत या अधिक निःशक्तता प्रमाणित हो, ही मान्य किये जायेंगे।  
(3) ऐसा अभ्यर्थी, जो छंटनी किया गया सरकारी सेवक हो अपनी आयु में से उसके द्वारा पहले की गई संपूर्ण अस्थायी सेवा की अधिक से अधिक 7 वर्ष तक की कालावधि (भले ही वह कालावधि एक से अधिक बार की गई सेवा का योग हो) कम कराने के लिये अनुज्ञात किया जायेगा, परंतु इसके परिणामस्वरूप उसकी आयु निर्धारित आयु सीमा से तीन वर्ष से अधिक नहीं होना चाहिये।

**स्पष्टीकरण-**

- छंटनी किये गये सरकारी सेवक से तात्पर्य है ऐसा व्यक्ति जो इस राज्य या किसी भी संगठक इकाई की अस्थायी सरकारी सेवा में लगातार कम से कम छः मास तक रहा हो तथा जिसे रोजगार कार्यालय में अपना नाम रजिस्ट्रीकृत कराने या सरकारी सेवा में नियोजन हेतु अन्यथा आवेदन देने की तारीख से अधिक से अधिक तीन वर्ष पूर्व स्थापना में कमी किये जाने के कारण सेवामुक्त किया गया हो।  
(4) ऐसा अभ्यर्थी जो भूतपूर्व सैनिक हो, उसे अपनी आयु में से उसके द्वारा पहले की गई संपूर्ण प्रतिरक्षा सेवा की अवधि कम करने के लिये अनुज्ञात किया जायेगा, किंतु उसके परिणामस्वरूप जो आयु निकले वह उच्चतम आयु सीमा से तीन वर्ष से अधिक नहीं होना चाहिये।

**स्पष्टीकरण-**

- मध्यप्रदेश भूतपूर्व सैनिक (राज्य की सिविल सेवाओं तथा पदों, तृतीय श्रेणी तथा चतुर्थ श्रेणी में रिक्तियों का आरक्षण) नियम 1985 के नियम 2 (ग) के अनुसार  
“2 (ग) भूतपूर्व सैनिकों से अभिप्रेत है ऐसा व्यक्ति जिसने संघ के सशस्त्र बलों में जिसमें भूतपूर्व भारतीय रियासतों के संयुक्त सशस्त्र बल भी सम्मिलित है, किसी भी रैंक (लड़ाकू या गैर लड़ाकू) में कम से कम लगातार छः मास की कालावधि तक सेवा की हो और  
(एक) जिसे स्वयं के निवेदन पर या अवचार या अक्षमता के कारण पदच्युत या सेवोन्मुक्त किये जाने से अन्यथा निर्मुक्त किया गया हो या ऐसी निर्मुक्ति के लंबित रहने तक रिजर्व में अंतरित किया गया हो, या  
(दो) जिसे उपरोक्तानुसार निर्मुक्त या अंतरित किये जाने का हकदार होने के लिये अपेक्षित सेवा की कालावधि पूरी करने हेतु छः मास से अनधिक अवधि के लिये सेवा करनी पड़ी हो।  
(तीन) जिसे संघ के सशस्त्र बल में पाँच वर्ष की सेवा पूरी करने के पश्चात् स्वयं के निवेदन पर निर्मुक्त किया गया हो।”  
**टीप-** भूतपूर्व सैनिक की उक्त परिभाषा “मध्यप्रदेश के भूतपूर्व सैनिक (तृतीय तथा चतुर्थ श्रेणी पदों पर आरक्षण) नियम 1985” के संशोधनों के अधधीन रहेगी।

(दो) प्रोत्साहनस्वरूप दी गई छूटें

- (1) परिवार कल्याण कार्यक्रम के अन्तर्गत ग्रीनकार्डधारी आवेदकों को सामान्य प्रशासन विभाग के ज्ञाप क्रमांक सी-3-40/आ/84/(3) 1, दिनांक 11 जनवरी, 1985 के संदर्भ में अधिकतम आयु सीमा में दो वर्ष की छूट दी जायेगी।  
(2) अनुसूचित जाति, अनुसूचित जनजाति एवं पिछड़ा वर्ग कल्याण विभाग की अन्तर्जातीय विवाह योजना के अन्तर्गत पुरस्कृत दंपतियों के सर्वर्ण सहभागी को सामान्य प्रशासन विभाग के ज्ञापन क्रमांक सी-3/10/85/3/1, दिनांक 29.6.1985 के संदर्भ में अधिकतम आयु सीमा में पाँच वर्ष की छूट दी जायेगी।  
(3) विक्रम पुरस्कार से सम्मानित खिलाड़ियों को सामान्य प्रशासन विभाग के ज्ञापन क्रमांक सी-3/18/85/3/1, दिनांक 03.09.1985 के संदर्भ में अधिकतम आयु सीमा में पाँच वर्ष की छूट दी जायेगी।

**टीप-**

- (1) परिशिष्ट-1 (दो) के अन्तर्गत प्रोत्साहनस्वरूप अधिकतम आयु सीमा में विभिन्न कार्यों/योजनाओं के अन्तर्गत दी गई छूटों में से यदि कोई आवेदक एक से अधिक छूटों का आधार रखता है तो उसे आयु सीमा में अधिकतम लाभ वाले किसी एक आधार (प्रोत्साहन वाले) के लिये देय छूट मिलेगी।  
(2) समस्त आरक्षण तथा उससे जुड़ी आयु सीमा की छूट मध्यप्रदेश राज्य के संदर्भ में है अतः अनुसूचित जाति, अनुसूचित जनजाति, अन्य पिछड़ा वर्ग तथा महिला आवेदकों को देय आरक्षण एवं आयु सीमा की छूट केवल मध्यप्रदेश के मूल निवासियों को ही देय होगी। अन्य प्रदेशों के उक्त श्रेणी के आवेदक अनारक्षित मान्य होंगे।  
(सामान्य प्रशासन विभाग मध्यप्रदेश शासन के पत्र क्रमांक 969/1197/2012/आ.प्र./एक, दिनांक 06.08.2012 में निहित व्यवस्था के अनुसार)

- नोट-** (1) उपरोक्त परिशिष्ट-1 (एक) (1 से 4) परिशिष्ट-1 (दो) (1 से 3) में उल्लेखित उच्चतम आयु सीमा में छूट की पात्रता तत्संबंधी सक्षम अधिकारी द्वारा जारी प्रमाण-पत्र प्रस्तुत करने पर ही देय होगी।  
(2) आवेदकों को उपरोक्त सभी छूटें देय होंगी किन्तु समस्त छूटों को शामिल करते हुये भी अधिकतम आयु सीमा 45 वर्ष से अधिक नहीं होगी। अर्थात् जिन आवेदकों की आयु 45 वर्ष से अधिक है वे आवेदक आवेदन करने हेतु पात्र नहीं होंगे।

परिशिष्ट-2

ऑनलाइन आवेदन करने के संबंध में निर्देश एवं अन्य जानकारी

1. वैज्ञानिक अधिकारी (भौतिकी, रसायन, जीव विज्ञान) (Scientific Officer (Physics, Chemistry, Biology) के पदों के लिये ऑनलाइन आवेदन करने के संदर्भ में आवश्यक अनुदेश निम्नानुसार हैं :-

- उपरोक्त पदों हेतु आवेदन पत्र निम्न वेबसाइटों पर भरे जा सकेंगे-
  - www.mponline.gov.in
  - www.mppsc.com
  - www.mppsc.nic.in
- आवेदक mponline के स्थापित अधिकृत कियोस्कों के माध्यम से ऑनलाइन फार्म भरकर कियोस्क पर ही परीक्षा शुल्क का नगद भुगतान कर रसीद प्राप्त कर सकते हैं। mponline के अधिकृत कियोस्कों की सूची www.mponline.gov.in, www.mppsc.com, www.mppsc.nic.in पर पता एवं फोन नंबर सहित उपलब्ध है।
- आवेदक अपने घर पर या इंटरनेट कैफे के माध्यम से भी ऑनलाइन फार्म भरकर परीक्षा शुल्क का भुगतान क्रेडिट कार्ड या डेबिट कार्ड के माध्यम से कर सकते हैं। इसके अतिरिक्त स्टेट बैंक ऑफ इंडिया तथा यूनियन बैंक के नेट बैंकिंग सुविधाधारक आवेदक नेट बैंकिंग द्वारा भी शुल्क का भुगतान कर सकते हैं।
- आवेदक फार्म भरने के पूर्व अपने अद्यतन फोटोग्राफ की पासपोर्ट साइज की तथा हस्ताक्षर की स्कैन फाइल तैयार रखें जिसे उन्हें ऑनलाइन फार्म भरते समय संलग्न करना होगा। एम.पी. ऑनलाइन अधिकृत KIOSK पर स्कैनिंग की सुविधा निःशुल्क उपलब्ध है जिसका उपयोग किया जा सकता है। आवेदक यह सुनिश्चित कर लें की आवेदन पत्र में उनके फोटो एवं हस्ताक्षर स्पष्ट हैं।
- ऑनलाइन आवेदन पत्र भरते समय ध्यान रखना चाहिए कि, वह उक्त वेबसाइट पर दिये गये ऑनलाइन आवेदन पत्र की प्रत्येक जानकारी अच्छी तरह समझकर सावधानीपूर्वक सही रूप में जिस प्रकार चाहा गया है उसी प्रकार जानकारी भरें।
- ऑनलाइन आवेदन पत्र भरते समय ध्यान रखना चाहिए कि शैक्षणिक योग्यता संबंधी जानकारी में दिये गये निर्धारित स्थान पर सही पूर्णांक, प्राप्तांक, श्रेणी, उत्तीर्ण करने का वर्ष, औसत प्रतिशत एवं अन्य जानकारी जो ऑनलाइन आवेदन पत्र में दी गई है, को सही रूप से अंकित करें।
- आयोग द्वारा ऑनलाइन आवेदन भरने की प्रक्रिया में यह समझ लिया गया है कि, आवेदक द्वारा जो जानकारी ऑनलाइन फार्म में अंकित की जा रही है वही प्रमाणिक जानकारी है अतः ऑनलाइन आवेदन पत्र Submit करने के पूर्व आवेदक अपना आवेदन पत्र सावधानीपूर्वक भलीभाँति पढ़ें एवं समझकर तथा भरी गई जानकारी से स्वयं को संतुष्ट करने के पश्चात् ही आवेदन Submit करें।
- आवेदन पत्र Submit करने के बाद खुलने वाले Pop up Window में आवेदक को उसके आवेदन के सफलतापूर्वक जमा होने की सूचना मिलेगी जिसमें उसके आवेदन पत्र क्रमांक का भी उल्लेख होगा। आवेदक उक्त सूचना को प्रिंट कर अपने पास रखें तथा भविष्य में आयोग से किए जाने वाले पत्र व्यवहार में आवेदन पत्र क्रमांक का उल्लेख करें।

9. **त्रुटि सुधार सुविधा-** आवेदक अपना आवेदन सावधानीपूर्वक भरें। आवेदन-पत्र में कोई त्रुटि होने पर दिनांक 07.06.2013 से 06.07.2013 तक प्रति त्रुटि सुधार सत्र, ₹ 50/- त्रुटि सुधार शुल्क का भुगतान कर ऑनलाइन आवेदन पत्र में सुधार किया जा सकेगा। यह सुधार आवेदक स्वयं अथवा कियोस्क के माध्यम से ऑनलाइन ही कर सकेगा। **नियत अवधि में त्रुटि सुधार नहीं करने पर कोई पश्चातवर्ती अभ्यावेदन मान्य नहीं किया जायेगा।** आवेदन पत्रों में त्रुटि सुधार हेतु प्राप्त लिखित अभ्यावेदन मान्य नहीं किये जायेंगे तथा उन्हें सरसरी तौर पर नस्तीबद्ध किया जायेगा। एक से अधिक आवेदन पत्र की स्थिति में अतिरिक्त आवेदन-पत्रों हेतु जमा शुल्क किसी भी स्थिति में वापस नहीं किया जायेगा।

ऑनलाइन आवेदन-पत्रों में आवेदक द्वारा भरी गयी श्रेणी/वर्ग (अनारक्षित/अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग/लिंग (महिला/पुरुष)/निःशक्तजन/शासकीय सेवक) आदि के आधार पर ही परिणाम घोषित किया जाता है। अतः त्रुटि सुधार अवधि समाप्त होने के पश्चात किसी भी प्रकार का परिवर्तन मान्य नहीं होगा तथा श्रेणी/वर्ग परिवर्तन विषयक समस्त अभ्यावेदन सरसरी तौर पर अमान्य किये जायेंगे तथा आयोग द्वारा इस संदर्भ में आवेदक से कोई पत्र व्यवहार नहीं किया जायेगा।

10. आवेदक यह सुनिश्चित करें कि उसके द्वारा आवेदन-पत्र में दर्ज हस्ताक्षर ही वह परीक्षा हाल की उपस्थिति सूची, साक्षात्कार की उपस्थिति सूची तथा आयोग के समस्त पत्र व्यवहार में करें। विभिन्न अभिलेखों के हस्ताक्षरों में समानता न होने पर आवेदक की उम्मीदवारी निरस्त की जा सकेगी।

- परीक्षा एवं आवेदन शुल्क**
  - मध्यप्रदेश के ऐसे मूल निवासी आवेदक जो मध्यप्रदेश के लिए अधिसूचित अनुसूचित जाति, अनुसूचित जनजाति एवं अन्य पिछड़ा वर्ग की श्रेणी में आते हैं, के लिए तथा निःशक्त श्रेणी के आवेदकों के लिये आवेदन शुल्क ₹ 30/- तथा परीक्षा शुल्क ₹ 60/- कुल ₹ 90/- देय होगा।
  - शेष सभी श्रेणी के एवं मध्यप्रदेश के बाहर के निवासी आवेदकों के लिए आवेदन शुल्क ₹ 60/- तथा परीक्षा शुल्क ₹ 120/- कुल ₹ 180/- देय होंगे।

मध्यप्रदेश के मूल निवासी अनुसूचित जाति, अनुसूचित जनजाति, अन्य पिछड़ा वर्ग तथा निःशक्त श्रेणी के आवेदकों के लिए आवेदन शुल्क	शेष सभी श्रेणी तथा मध्यप्रदेश के बाहर के निवासी आवेदकों के लिए कुल शुल्क
₹ 90/-	₹ 180/-

उपरोक्त शुल्क के अतिरिक्त पोर्टल शुल्क ₹ 40/- (सेवा कर सहित) अतिरिक्त देय होगा।

आवेदन शुल्क तथा पोर्टल शुल्क के अतिरिक्त किसी भी रूप में अन्य कोई राशि का भुगतान नहीं करना है। यदि कियोस्कधारक द्वारा अतिरिक्त राशि की मांग की जाती है तो एम.पी.ऑनलाइन से निम्न दूरभाष पर संपर्क कर शिकायत दर्ज करा सकते हैं।

फोन (0755) दूरभाष क्रमांक (0755) 4019401-4019406, काल सेंटर-155343 (टोल फ्री) तकनीकी समस्या के लिए : विनोय एम. जॉर्ज (0755) 4019410

टीप:- आयोग को प्राप्त शुल्क केवल निम्नानुसार परिस्थितियों में ही आवेदक को वापस किया जायेगा :-

- आयोग द्वारा विज्ञापित विज्ञापन निरस्त हो जाये अथवा
- किसी कारण से चयन की कार्यवाही निरस्त कर दी जाये।

नोट:- यदि आपको ऑनलाइन फार्म भरने में कोई समस्या आती है तो नीचे दर्शाये गये दूरभाष नंबरों पर तत्काल संपर्क करें :-

मध्यप्रदेश लोक सेवा आयोग, रेसीडेंसी क्षेत्र, इंदौर (0731) 2701624, 2701983  
एम.पी. ऑनलाइन लिमिटेड, निरूपम शॉपिंग माल, द्वितीय तल, अहमदपुर, होशंगाबाद रोड, भोपाल-422026  
फोन (0755) दूरभाष क्रमांक (0755) 4019401-4019406, काल सेंटर-155343 (टोल फ्री) तकनीकी समस्या के लिए : विनोय एम. जॉर्ज (0755) 4019410

- आवेदन की अंतिम तिथि**  
ऑनलाइन आवेदन पत्र जमा करने की अंतिम तिथि 04.07.2013 है। अंतिम तिथि को रात्रि 12.00 बजे के बाद आवेदन पत्र जमा करने की सुविधा बंद कर दी जायेगी।

- आवेदक को ऑनलाइन आवेदन-पत्र के साथ कोई प्रमाण पत्र लगाने की आवश्यकता नहीं है। साक्षात्कार के पूर्व अनुप्रमाण पत्र के साथ निम्न प्रमाण-पत्र आयोग द्वारा निर्धारित समयावधि में आवश्यक रूप से प्रस्तुत करना होगा। निर्धारित अवधि में अनुप्रमाण फार्म/प्रमाण-पत्र प्रस्तुत न करने पर आवेदक की उम्मीदवारी समाप्त की जा सकेगी।

**आयु संबंधी प्रमाण के लिये-** केवल हाईस्कूल/हायर सेकेण्डरी अथवा मैट्रिक्यूलेशन की अंकसूची/प्रमाण-पत्र जिनमें जन्मतिथि का स्पष्ट उल्लेख हो।

**शैक्षणिक अर्हताओं के प्रमाण पत्र-** हाईस्कूल/हायर सेकेण्डरी तथा उसके बाद की उन समस्त परीक्षाओं

की जिन्हें आवेदक ने उत्तीर्ण किया है। समस्त वर्षों/सेमेस्टर्स की अंकसूचियाँ।  
**अनुभव के प्रमाण पत्र :** उक्त पदों की अनिवार्य अर्हताओं में मान्यता प्राप्त महाविद्यालय/विश्वविद्यालय/शोध संस्थान/प्रयोगशाला का वैज्ञानिक शोध कार्य का दो वर्ष का अनुभव आवश्यक है। अनुभव प्रमाण पत्र उक्त संस्था के प्रमुख द्वारा किया जाना चाहिये। अनुभव प्रमाण-पत्र में धारित पद, सेवा अवधि तथा कार्य के स्वरूप का स्पष्ट रूप से उल्लेख होना चाहिये। रिसर्च स्कालर तथा पीएच.डी. उपाधि धारक आवेदक के प्रमाण-पत्र संबंधित विश्वविद्यालय के रजिस्ट्रार द्वारा अथवा शोध संस्थान के प्रमुख द्वारा जारी किया जाना चाहिए जिसमें शोध के विषयवस्तु का स्पष्ट उल्लेख होना आवश्यक है। महाविद्यालय/विश्वविद्यालय/शोध संस्थान/प्रयोगशाला का शासन से मान्यता प्राप्त होना आवश्यक है। अतः मान्यता विषयक प्रमाणन अभिलेख, प्रमाण-पत्र के साथ संलग्न किया जाना आवश्यक है। **वैज्ञानिक अधिकारी** के पद हेतु अनुभव प्रमाण पत्र निम्न प्रारूप में प्रस्तुत करना आवश्यक होगा :-

**अनुभव प्रमाण पत्र**  
(मध्यप्रदेश लोक सेवा आयोग द्वारा वैज्ञानिक अधिकारी के पदों की पूर्ति हेतु जारी विज्ञापन क्रमांक 01/परीक्षा/2013, दिनांक ..... के संदर्भ में जारी)

क्रमांक ..... दिनांक .....

प्रमाणित किया जाता है कि श्री/श्रीमती/कु.....(आवेदक का नाम) हमारे विश्वविद्यालय/महाविद्यालय/शोध संस्थान/प्रयोगशाला (जो न लागू हों उसे काट दें) में ..... (पद का नाम) में दिनांक.....से दिनांक.....तक कार्यरत रहे हैं। यह भी प्रमाणित किया जाता है कि आवेदक द्वारा संपादित कार्य भौतिकी/रसायन शास्त्र/जीव विज्ञान (जो न लागू हों उसे काट दें) विषय से संबंधित वैज्ञानिक शोध कार्य है।

**अथवा**

प्रमाणित किया जाता है कि श्री/श्रीमती/कु. .... (आवेदक का नाम) हमारे विश्वविद्यालय/महाविद्यालय/शोध संस्थान/प्रयोगशाला (जो न लागू हों उसे काट दें) में वैज्ञानिक शोध कार्य हेतु शोधार्थी के रूप में/पीएच.डी. हेतु दिनांक ..... से दिनांक ..... तक शोधरत रहे हैं। उनके शोध कार्य का विवरण निम्नानुसार है :-

रिसर्च स्कालर/पीएच.डी. हेतु स्वीकृति क्रमांक ..... दिनांक .....

गाइड का नाम एवं पद .....

रिसर्च प्रमाण पत्र/पीएच.डी. उपाधि क्रमांक ..... दिनांक ...../शोध कार्य जारी

रिसर्च स्कालर/पीएच.डी. का विषय (टाॅपिक सहित) :- .....

हमारी संस्था ..... विश्वविद्यालय/केंद्र सरकार/राज्य सरकार (जो न लागू हों उसे काट दें) द्वारा मान्यता प्राप्त है जिससे संबंधित अभिलेख इस प्रमाण-पत्र के अनुलग्नक के रूप में संलग्न है।

जारीकर्ता के हस्ताक्षर .....

जारीकर्ता का नाम .....

पद नाम .....

संस्था की सील .....

संलग्न : संस्था के मान्यता विषयक अभिलेख :-

(1) .....

(2) .....

(3) .....

(विश्वविद्यालय/महाविद्यालय/शोध संस्थान/प्रयोगशाला के मूल लेटरहेड पर जारी किया जाये तथा नियुक्ति प्राधिकारी/संस्था प्रमुख द्वारा हस्ताक्षरित किया जाये)

**जाति के प्रमाण पत्र-**

अनुसूचित जाति/अनुसूचित जनजाति/अन्य पिछड़ा वर्ग का स्थायी जाति प्रमाण-पत्र अनुविभागीय अधिकारी (राजस्व) द्वारा जो कि मध्यप्रदेश शासन द्वारा जाति प्रमाण पत्र देने के लिए अधिकृत है द्वारा जारी किया गया हो आवेदन पत्र के साथ संलग्न करें। यदि आवेदन पत्र के साथ वैध प्रावधिक जाति प्रमाण (जो कि आवेदन की अंतिम तिथि को छः माह के भीतर की अवधि में जारी हुआ हो) संलग्न किया जाता है तो साक्षात्कार के समय स्थायी जाति प्रमाण पत्र प्रस्तुत करना अनिवार्य है। यदि आवेदक साक्षात्कार के समय स्थायी प्रमाण पत्र प्रस्तुत नहीं करता है तो उसकी उम्मीदवारी रद्द की जायेगी जिसके लिए आवेदक स्वयं जिम्मेदार होगा। इस संबंध में आवेदक का कोई वचन पत्र अथवा अभ्यावेदन मान्य नहीं करते हुए उसे नस्तीबद्ध किया जायेगा एवं आयोग इस संबंध में कोई पत्र व्यवहार नहीं करेगा। विवाहित महिलाओं का अपने नाम के साथ पिता के नाम उल्लेखित जाति प्रमाण पत्र ही मान्य किया जायेगा। (प्रमाण पत्र की फोटोप्रति संलग्न करें)। अन्य पिछड़ा वर्ग में क्रीमीलेयर में न आने का प्रमाण पत्र भी आवश्यक है अर्थात् जिन प्रमाण पत्रों में आय संबंधी कड़िका कटी होगी या नहीं होगी वे मान्य नहीं होंगे। विवाहित महिलाएँ विवाहोपरांत नाम/उपनाम परिवर्तन (पिता/पति) का शपथ पत्र संलग्न करें।

**निःशक्तता प्रमाण पत्र-**

निःशक्त श्रेणी के आवेदकों को आवेदन पत्र के साथ लोक स्वास्थ्य एवं परिवार कल्याण मंत्रालय की अधिसूचना क्रमांक एफ-8-01-सत्रह-मैडि-2, दिनांक 9.1.2009 द्वारा गठित जिला चिकित्सा मंडल से प्राप्त नवीनतम (Latest) प्रमाण पत्र संलग्न करना आवश्यक है। आवेदक लिफाफे पर "निःशक्तजन" भी लिखें। वैज्ञानिक अधिकारी (भौतिकी, रसायन, जीव विज्ञान) Scientific Officer (Physics, Chemistry, Biology) के पद हेतु अस्थिबाधित तथा श्रवणबाधित निःशक्तता का प्रतिशत 40 प्रतिशत या अधिक होने पर ही निःशक्त श्रेणी के आवेदकों को देय आरक्षण तथा छूटों का लाभ प्राप्त होगा।

**निःशक्त आवेदकों को देय सहलेखक सुविधा -**

ऐसे परीक्षार्थी जिनके दोनों हाथ नहीं हैं या अपने दाएं बाएं हाथों का उपयोग नहीं कर सकते हैं उन्हें केवल सहायक लेखक की सुविधा दी जायेगी, समय में किसी प्रकार की रियायत नहीं दी जायेगी। सहायक लेखक की शैक्षणिक योग्यता हाईस्कूल अथवा हायर सेकेण्डरी से अधिक नहीं होना चाहिए। सह लेखक की व्यवस्था आवेदक को स्वयं करनी होगी। सह लेखक हेतु अनुमति केन्द्राध्यक्ष द्वारा ही प्रदान की जायेगी। इस हेतु आवेदक केन्द्राध्यक्ष से पर्याप्त समय पूर्व संपर्क करें। केन्द्राध्यक्ष द्वारा अनुमति दी जा सकेगी।

**नोट-** निःशक्त आवेदकों के लिये सी.एम.ओ. (मुख्य स्वास्थ्य अधिकारी) मेडिकल बोर्ड या सिविल सर्जन का प्रमाण-पत्र प्रस्तुत करना होगा। प्रायवेट डॉक्टर का प्रमाण-पत्र मान्य नहीं होगा। अन्य नियम यथावत रहेंगे।

**तदर्थ रूप से शासन की सेवा में कार्यरत आवेदकों को तत्संबंधी प्रमाण-पत्र आवेदन-पत्र के साथ संलग्न करना आवश्यक है।**

**विधवा, परित्यक्ता तथा तलाकशुदा महिला** आवेदकों द्वारा सब डिवीजनल मजिस्ट्रेट अथवा जिला मजिस्ट्रेट का प्रमाण पत्र।

**कार्यरत/छूटनी किये गये शासकीय सेवकों हेतु :-** नियुक्ता अधिकारी/सक्षम अधिकारी का प्रमाण पत्र।

**परिशिष्ट-1 की कड़िका-(दो-1)** के अन्तर्गत उच्चतम आयु सीमा में छूट के लिये ग्रीनकार्ड।

**परिशिष्ट-1 की कड़िका-(दो-2)** के अन्तर्गत आयु सीमा में छूट के लिये शासन द्वारा प्राधिकृत अधिकारी का प्रमाण पत्र।

**परिशिष्ट-1 की कड़िका-(दो-3)** के अन्तर्गत आयु सीमा में छूट के लिये विक्रम पुरस्कार प्राप्त होने का

- प्रमाण पत्र।
5. जो व्यक्ति पहले से सरकारी नौकरी में स्थायी या अस्थायी हैसियत से काम कर रहा हो या किसी काम के लिये विशिष्ट रूप से नियुक्त कर्मचारी हो, जिसमें आकस्मिक या दैनिक दर पर नियुक्त कर्मचारी हो, अथवा जो लोक सेवा उद्यमों के अधीन कार्यरत हो, उनको यह परिवचन (Undertaking) प्रस्तुत करना होगा कि, उन्होंने लिखित रूप से अपने कार्यालय/विभाग के अध्यक्ष को सूचित कर दिया है कि, उन्होंने इस परीक्षा के लिये आवेदन किया है। उम्मीदवारों को ध्यान रखना चाहिए कि यदि आयोग को उनके नियुक्ता से उनके उक्त परीक्षा के लिये आवेदन करने/परीक्षा में बैठने के संबंध में अनुमति रोकते हुये कोई पत्र मिलता है तो उनका आवेदन पत्र अस्वीकृत कर उनकी उम्मीदवारी रद्द कर दी जायेगी।
6. **अनुशासनिक निर्देश -**  
ऐसे आवेदक को अपराधिक अभियोजन के लिये दोषी ठहराया जायेगा जिसे आयोग से निम्नलिखित के लिये दोषी पाया गया हो -
- जिसने अपनी उम्मीदवारी के लिए लिखित परीक्षा या साक्षात्कार में किसी भी तरीके से समर्थन अभिप्राप्त किया हो; या
  - प्रतिरूपण किया हो; या
  - किसी व्यक्ति से प्रतिरूपण कराया हो; या
  - कूटचित्त अभिलेख या ऐसे अभिलेख प्रस्तुत किये हों, जिनमें फेरबदल किया गया हो; या
  - ऐसे कथन दिए हों जो गलत और झूठे हों या जिनमें चयन के किसी भी प्रक्रम पर सारभूत जानकारी छिपायी हो; या
  - परीक्षा में प्रवेश पाने के लिये कोई अन्य अनियमित या अनुचित साधन अपनाया हो; या
  - परीक्षा कक्ष में अनुचित साधनों का उपयोग किया हो या करने का प्रयास किया हो; या
  - परीक्षा संचालन में लगे कर्मचारीवृंद को परेशान किया हो या धमकाया हो या शारीरिक क्षति पहुंचाई हो; या
  - उनके द्वारा प्रवेश पत्र में उम्मीदवारों के लिये दिये गये किसी भी अनुदेशों या अन्य निर्देशों जिनमें परीक्षा संचालन में लगे केंद्र पर्यवेक्षक या अन्य कर्मचारीवृंद द्वारा मौखिक रूप से दिये गये अनुदेश सम्मिलित हैं, अतिक्रमण किया हो; या
  - परीक्षा कक्ष में या साक्षात्कार में किसी अन्य तरीके से किया गया दुर्व्यवहार,
  - परीक्षा कक्ष में परीक्षा हेतु प्राप्त उत्तर पुस्तिका परीक्षा के समाप्त होने पर परीक्षा कक्ष के वीक्षक/परीक्षक को जमा न कराते हुये अपने साथ ले गया हो।
- अपराधिक अभियोजन के लिए उसे उत्तरदायी ठहराने के अलावा -**
- (क) आयोग द्वारा उसे उस परीक्षा के लिए, जिसके लिए वह उम्मीदवार है, निरह ठहराया जाने का दायी हो सकेगा और/या
- (ख) उसे या तो स्थाई रूप से या विनिर्दिष्ट कालावधि के लिए-
- (एक) आयोग द्वारा, ली गई किसी परीक्षा से या उनके द्वारा किये जाने वाले चयन से;
- (दो) राज्य शासन द्वारा उसके अधीन नियोजन से विवर्जित किया जा सकेगा; और
- (ग) यदि वह शासन के अधीन पहले से ही सेवा में हो तो उपर्युक्त नियमों के अधीन उस पर अनुशासनिक कार्रवाई की जा सकेगी किन्तु इस नियम के अधीन कोई शास्ति तब तक अधिरोपित नहीं की जाएगी जब तक कि -
- (एक) उम्मीदवार को, लिखित में ऐसा अभ्यावेदन जो वह इस संबंध में देना चाहे, प्रस्तुत करने का अवसर नहीं दिया गया हो, और
- (दो) उम्मीदवार द्वारा उसे अनुज्ञप्त की गई कालावधि के भीतर प्रस्तुत किये गये अभ्यावेदन, यदि कोई हो, पर विचार न किया गया हो।
7. **अनर्हताएँ -**  
ऐसे आवेदकों के आवेदन पत्र निरस्त किए जाएंगे जिन्हें किसी परीक्षा अथवा चयन से उपरोक्त दर्शित

- प्रावधानों के तहत विवर्जित किया गया है।
8. **प्रवेश पत्र**
- किसी भी उम्मीदवार को लिखित परीक्षा में तब तक प्रवेश नहीं दिया जायेगा, जब तक कि उसके पास आयोग द्वारा जारी किया गया प्रवेश पत्र न हो।
  - अर्हताधारी आवेदक अपने प्रवेश पत्र [www.mponline.gov.in](http://www.mponline.gov.in) अथवा [www.mppsc.com](http://www.mppsc.com) या [www.mppsc.nic.in](http://www.mppsc.nic.in) से डाउनलोड कर सकेंगे, पृथक से प्रवेश पत्र नहीं भेजे जायेंगे। परीक्षा हेतु प्रवेश पत्र दिनांक **01.10.2013 से 18.10.2013 तक** [www.mponline.gov.in](http://www.mponline.gov.in), [www.mppsc.in](http://www.mppsc.in) तथा [www.mppsc.com](http://www.mppsc.com) पर उपलब्ध रहेंगे। प्रवेश पत्र डाउनलोड करने हेतु आवेदक को वेबसाइट में विहित स्थान पर उसके आवेदन-पत्र क्रमांक तथा जन्मतिथि की प्रविष्टि करनी होगी। **एम.पी. ऑनलाइन के अधिकृत क्रियोस्क के माध्यम से प्रवेश पत्र प्राप्ति हेतु 5 रुपये पोर्टल शुल्क देय होगा।**
  - यदि प्रवेश पत्र प्राप्त करने में कोई समस्या आती है तो आयोग से निम्न पते पर संपर्क करें-  
**मध्यप्रदेश लोक सेवा आयोग, रेसीडेंसी क्षेत्र, इंदौर**  
**Ph. (0731) 2701624, 2701983**  
**एम.पी. ऑनलाइन लिमिटेड, निरूपम शॉपिंग माल, द्वितीय तल, अहमदपुर, होशंगाबाद रोड, भोपाल-422026**  
**फोन (0755) दूरभाष क्रमांक (0755) 4019401-4019406, काल सेंटर-155343 (टोल फ्री)**  
**तकनीकी समस्या के लिए : विनोय एम. जॉर्ज (0755) 4019410**
9. **लिखित परीक्षा की पश्चातवर्ती प्रक्रिया के संदर्भ में आवश्यक निर्देश**
- परीक्षा का परिणाम केवल "रोज़गार और निर्माण" समाचार पत्र तथा आयोग की वेबसाइट [www.mppsc.nic.in](http://www.mppsc.nic.in), [www.mppsc.com](http://www.mppsc.com) पर प्रकाशित किया जायेगा आवेदक को उसके परीक्षा परिणाम की सूचना अन्य किसी भी रीति से नहीं दी जायेगी तथा न ही इस संदर्भ में कोई अभ्यावेदन मान्य किया जायेगा।
  - परीक्षा परिणाम के साथ ही साक्षात्कार के संदर्भ में समस्त आवश्यक सूचनायें प्रकाशित की जायेंगी। अतः सफल आवेदक उनके परीक्षा परिणाम के साथ ही साक्षात्कार से संबंधित समस्त सूचनाओं का ध्यानपूर्वक अध्ययन कर उसमें प्रदत्त अनुदेशों के अनुरूप आयोग की वेबसाइट [www.mppsc.nic.in](http://www.mppsc.nic.in), [www.mppsc.com](http://www.mppsc.com) पर उपलब्ध कराये गये अनुप्रमाण पत्रक, व्यक्तिगत विवरण पत्रक एवं उपस्थिति पत्रक डाउनलोड करके आवश्यक पूर्तियों के पश्चात् एवं सभी आवश्यक अभिलेख संलग्न कर, परीक्षा परिणाम में उल्लेखित साक्षात्कार हेतु अभिलेख जमा करने हेतु निर्धारित अंतिम तिथि तक जमा करें।
  - साक्षात्कार हेतु अभिलेख जमा करने हेतु निर्धारित अंतिम तिथि तक अभिलेख जमा न करने पर आवेदक को उम्मीदवारी स्वयंमेव समाप्त हो जायेगी तथा आयोग द्वारा इस संदर्भ में आवेदक को पृथक से कोई सूचना नहीं दी जायेगी तथा इस संदर्भ में प्राप्त अभ्यावेदनों को बिना विचार किये नस्तीबद्ध किया जायेगा।
10. **यात्रा व्यय का भुगतान -**
- मध्यप्रदेश के मूल निवासी तथा मध्यप्रदेश हेतु अधिसूचित अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग के ऐसे आवेदकों को जो कहीं सेवारत न हों, मध्यप्रदेश शासन के प्रचलित नियमों के अधीन यात्रा व्यय का नगद भुगतान वापसी यात्रा के पूर्व परीक्षा केंद्र पर केंद्राध्यक्ष द्वारा किया जायेगा। आवेदकों को इसके लिये केन्द्राध्यक्ष को वांछित घोषणा पत्र भरकर देना होगा तथा यात्रा भत्ते की पात्रता से संबंधित निम्न अभिलेख प्रस्तुत करना होंगे-  
(1) अनुसूचित जाति/अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग के प्रमाण हेतु अनुविभागीय अधिकारी (राजस्व) द्वारा जारी स्थायी जाति प्रमाण-पत्र की स्वप्रमाणित प्रति।  
(2) यात्रा टिकट जिसमें यात्रा की तिथि, कहां से कहां तक यात्रा की तथा किराये की राशि स्पष्ट उल्लेख हो।
  - साक्षात्कार हेतु उपस्थित होने वाले आवेदकों को यात्रा व्यय उपरोक्त नियमानुसार आयोग कार्यालय द्वारा दिया जायेगा।

सचिव

## वैज्ञानिक अधिकारी-भौतिक शास्त्र, रसायन शास्त्र एवं जीव विज्ञान लिखित परीक्षा-2010

### परीक्षा योजना

वैज्ञानिक अधिकारी भौतिक शास्त्र, रसायन शास्त्र एवं जीव विज्ञान के पदों के लिए आयोजित लिखित परीक्षा में आवेदकों को बहुविकल्पीय (A, B, C, D) वस्तुनिष्ठ प्रकार के केवल एक प्रश्न पत्र की परीक्षा देनी होगी। किस पद के लिए कौन सा कोई एक प्रश्न पत्र लिया जा सकता है इसकी सूची निम्नानुसार है :-

स. क्र.	पद जिसके लिए कोई एक प्रश्न पत्र लिया जा सकता है।	प्रश्न पत्र संकेतांक	प्रश्न पत्र का नाम
1.	वैज्ञानिक अधिकारी भौतिक शास्त्र	01	भौतिकी (Physics)
		02	कम्प्यूटर साइंस (Computer Science)
		03	कम्प्यूटर एप्लीकेशन (Computer Application)
		04	न्यायालयिक विज्ञान एवं न्यायालयिक भौतिक शास्त्र (Forensic Science & Forensic Physics)
		05	न्यायालयिक विज्ञान एवं न्यायालयिक प्राक्षेपिकी (Forensic Science & Forensic Ballistics)
2.	वैज्ञानिक अधिकारी रसायन शास्त्र	06	रसायन शास्त्र (Chemistry)
		07	न्यायालयिक विज्ञान एवं न्यायालयिक रसायन (Forensic Science & Forensic Chemistry)
		08	न्यायालयिक विज्ञान एवं न्यायालयिक विष विज्ञान (Forensic Science & Forensic Toxicology)
3.	वैज्ञानिक अधिकारी जीव विज्ञान	09	वनस्पति शास्त्र (Botany)
		10	प्राणी विज्ञान (Zoology)
		11	जैव रसायन विज्ञान (Biochemistry)
		12	सूक्ष्म जीव विज्ञान (Microbiology)
		13	जैव प्रौद्योगिकी (Biotechnology)
		14	जेनेटिक्स (Genetics)
		15	न्यायालयिक विज्ञान एवं न्यायालयिक जीव विज्ञान (Forensic Science & Forensic Biology)
		16	न्यायालयिक विज्ञान एवं न्यायालयिक सीरम विज्ञान (Forensic Science & Forensic Serology)

उपरोक्त सूची में प्रश्न पत्र का नाम, प्रश्न पत्र का संकेतांक तथा पद का नाम जिसके लिए यह प्रश्न पत्र लिया जा सकता है दर्शाये हैं।

- प्रत्येक प्रश्न पत्र में 2-2 अंकों के वस्तुनिष्ठ/बहुविकल्पीय (A, B, C, D) 150 प्रश्न होंगे। प्रश्न पत्र कुल 300 अंक का होगा। प्रश्न पत्र की कुल अवधि 2 घंटे होगी तथा प्रश्न पत्र केवल अंग्रेजी भाषा में ही होगा। पूरा प्रश्न पत्र कुल 300 अंकों का होगा।
- न्यायालयिक विज्ञान एवं न्यायालयिक भौतिक शास्त्र, न्यायालयिक विज्ञान एवं न्यायालयिक प्राक्षेपिकी, न्यायालयिक विज्ञान एवं न्यायालयिक रसायन, न्यायालयिक विज्ञान एवं न्यायालयिक विष विज्ञान, न्यायालयिक विज्ञान एवं न्यायालयिक जीव विज्ञान, न्यायालयिक विज्ञान एवं न्यायालयिक सीरम विज्ञान, इन विषयों में खंड- (अ) एवं खंड-(ब) है। प्रत्येक खंड से 75-75 प्रश्न पूछे जायेंगे। कुल 150 प्रश्न होंगे पूरा प्रश्न पत्र कुल- 300 अंकों का होगा।
- रसायन शास्त्र के पठ्यक्रम में 4 खंड होंगे। भौतिक रसायन में से 40 प्रश्न कार्बनिक रसायन, में से 40 प्रश्न अकार्बनिक रसायन में से 40 प्रश्न एवं रसायन के इन्टरडीसीप्लीनरी टॉपिक्स में से 30 प्रश्न होंगे। इस प्रकार कुल 150 प्रश्न होंगे एवं प्रश्न पत्र कुल 300 अंकों का होगा।
- प्रति प्रश्न गलत उत्तर होने पर 01 अंक काटा जाएगा।
- लिखित परीक्षा उत्तीर्णता :-**  
लिखित परीक्षा में उत्तीर्ण होने हेतु अनारक्षित आवेदकों को प्रत्येक प्रश्न पत्र में 40% अंक प्राप्त करना अनिवार्य होगा। मध्यप्रदेश के अधिसूचित अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग श्रेणी एवं निःशक्त के आवेदकों को लिखित परीक्षा में उत्तीर्ण होने हेतु न्यूनतम 30% अंक प्राप्त करना अनिवार्य होगा। इस छूट का लाभ केवल मध्यप्रदेश के मूल निवासी को ही मिलेगा। लिखित परीक्षा में प्राप्त अंकों के आधार पर गुणानुक्रम में विभिन्न प्रवर्गों से भरी जाने वाली कुल रिक्तियों की संख्या के तीन गुना तथा समान अंक प्राप्त करने वाले आवेदक साक्षात्कार हेतु आमंत्रित किये जायेंगे।
- चयन प्रक्रिया :-**  
अंतिम चयनफल लिखित परीक्षा तथा साक्षात्कार में कुल प्राप्त अंकों के गुणानुक्रम के आधार पर घोषित किया जायेगा।
- साक्षात्कार हेतु कुल 35 अंक निर्धारित हैं।
- परीक्षा केन्द्र :-**  
लिखित परीक्षा मध्यप्रदेश के दो संभागीय मुख्यालयों में आयोजित की जायेंगी :-  
(1) इंदौर, (2) भोपाल,  
परीक्षार्थियों की संख्या तथा प्रशासनिक सुविधा की दृष्टि से परीक्षा केन्द्रों की संख्या कम की जा सकती है।

**SYLLABUS FOR RECRUITMENT OF SCIENTIFIC OFFICER****Syllabus of Physics (01)****I. Mathematical Methods of Physics**

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigenvalue problems; Linear differential equations; Special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis: Laurent series-poles, residues and evaluation of integrals; Elementary ideas about tensors; Introductory group theory, SU(2), O(3); Elements of computational techniques; roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method; Finite difference methods; Elementary probability theory, random variables, binomial, Poisson and normal distributions.

**II. Classical Mechanics**

Newton's laws; Phase space dynamics, stability analysis; Central-force motion; Two-body collisions, scattering in laboratory and centre-of-mass frames; Rigid body dynamics, moment of inertia tensor, non-inertial frames and pseudoforces; Variational principle, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations; Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, small oscillations and normal modes; Special theory of relativity, Lorentz transformations, relativistic kinematics and mass-energy equivalence.

**III. Electromagnetic Theory**

Electrostatics: Gauss's Law and its applications; Laplace and Poisson equations, boundary value problems; Magnetostatics; Biot-Savart law, Ampere's theorem, electromagnetic induction; Maxwell's equations in free space and linear isotropic media; boundary conditions on fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; Dynamics of charged particles in static and uniform electromagnetic fields; Radiation from moving charges, dipoles and retarded potentials.

**IV. Quantum Mechanics**

Wave-particle duality; Wave functions in coordinate and momentum representations; Commutators and Heisenberg's uncertainty principle; Matrix representation; Dirac's bra and ket notation; Schrodinger equation (time-dependent and time-independent); Eigenvalue problems such as particle-in-a-box, harmonic oscillator, etc.; Tunneling through a barrier; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, fine structure; Time-independent perturbation theory and applications; Variational method; WKB approximation; Time dependent perturbation theory and Fermi's Golden Rule: Selection rules; Semi-classical theory of radiation; Elementary theory of scattering, phase shifts, partial waves, Born approximation; Identical particles, Pauli's exclusion principle, spin-statistics connection; Relativistic quantum mechanics; Klein Gordon and Dirac equations.

**V. Thermodynamic and Statistical Physics**

Laws of thermodynamics and their consequences; Thermodynamic potentials, Maxwell relations; Chemical potential, phase equilibria; Phase space, micro-and macrostates; Microcanonical, canonical and grand-canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; First- and second-order phase transitions; Classical and quantum statistics, ideal Fermi and Bose gases; Principle of detailed balance; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Random walk and Brownian motion; Introduction to nonequilibrium processes; Diffusion equation.

**VI. Electronics**

Semiconductor device physics, including diodes, junctions, transistors, field effect devices, homo and heterojunction devices, device structure, device characteristics, frequency dependence and applications; Optoelectronic devices, including solar cells, photodetectors, and LEDs; High-frequency devices, including generators and detectors; Operational amplifiers and their applications; Digital techniques and applications (registers, counters, comparators and similar circuits); A/D and D/A converters; Microprocessor and microcontroller basics.

**VII. Experimental Techniques and data analysis**

Data interpretation and analysis; Precision and accuracy; error analysis, propagation of errors, least squares fitting, linear and nonlinear curve fitting, chi-square test; Transducers (temperature, pressure/vacuum, magnetic field, vibration, optical, and particle detectors), measurement and control; Signal conditioning and recovery, impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding; Fourier transforms; lock-in detector, box-car integrator, modulation techniques.

Applications of the above experimental and analytical techniques to typical undergraduate and graduate level laboratory experiments.

**VIII. Atomic & Molecular Physics**

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shift; Rotational, vibrational, electronic, and Raman spectra of diatomic molecules; Frank-Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Lasers, optical pumping, population inversion, rate equation; Models of resonators and coherence length.

**IX. Condensed Matter Physics**

Bravais lattices; Reciprocal lattice, diffraction and the structure factor; Bonding of solids; Elastic properties, phonons, lattice specific heat; Free electron theory and electronic specific heat; Response and relaxation phenomena; Drude model of electrical and thermal conductivity; Hall effect and thermoelectric power; Diamagnetism, paramagnetism, and ferromagnetism; Electron motion in a periodic

potential, band theory of metals, insulators and semiconductors; Superconductivity, type-I and type-II superconductors, Josephson Junctions; Defects and dislocations; Ordered phases of matter, translational and orientational order, kinds of liquid crystalline order; Conducting polymers; Quasicrystals.

**X. Nuclear and Particle Physics**

Basic nuclear properties; size, shape, charge distribution, spin and parity; Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; Nature of the nuclear force, form of nucleon-nucleon potential; Charge-independence and charge-symmetry or nuclear forces; Isospin; Deuteron problem; Evidence of shell structure, single-particle shell model, its validity and limitations; Rotational spectra; Elementary ideas of alpha, beta and gamma decays and their selection rules; Nuclear reactions, reaction mechanisms, compound nuclei and direct reactions; Classification of fundamental forces; Elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Relativistic kinematics.

**Syllabus for Computer Science (02)****Computer Organisation and Architecture**

Computer Organization: Digital and Analog computers, CPU, Hardware, Software and Firmware. Number Systems: Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements; Signed Binary Numbers, Binary Codes: BCD code, Gray Code, ASCII code, Excess 3 Code, Error detecting Code.

Computer Arithmetic, Logic gates, Integrated Circuits, K-Map, AND, OR, NAND and NOR implementations, Exclusive-OR function.

Combinational Logic: Combinational Circuits, Binary adder, subtracter, multiplier, Decoders, Encoders, Multiplexes, and Demultiplexers.

Sequential circuits, Latches, Flip Flops: SR, D, JK, T. Master Slave JK Flip flop. Characteristic equations and Excitation tables of flip-flops. Shift Registers, Counters.

Computer organization: The memory unit, the input and output subsystem, the bus structures, ALU. Program development tools: Compiler, interpreter, and assembler. 8085 micro processor architecture, Instruction set of 8085 processor, Integer division. BCD arithmetic, Design of ALU.

Memory address and addressing modes. RISC and CISC processors. Instruction pipelining, Parallel processing and pipelining, pipelining in RISC and CISC processors. Super scalar processors. VLIW processors. Cache memory and its types. Input Output organization, accessing I/O devices, Interrupts. Memory mapped I/O and I/O mapped I/O. Programmed I/O.

**II****Operating System**

Operating system concepts, Processor Management: Concepts, Algorithms for batch processing Memory Management, Concurrent Processes: mutual exclusion and synchronization, Techniques of inter process communication, Deadlock handling.

File Management: Operations on a file, structure of a file system.

Free block list, directory structure, sharing and protection of files, file system Reliability, Unix file system.

Device Management: Goals of input/output software design, Structure of device hardware and software. Layers of I/O software, structure of device drivers, Disk driver, disk arm scheduling algorithms, terminal driver, clock driver etc.

I/O devices. Introduction to network and distributed operating systems Case Studies: Unix/Linux, Windows operating system, Unix/Linux commands.

File system and process management commands, Shell, Pattern matching, Navigating the File Systems. Unix Editor: VI editor, Creating new files. Shell programming: Features of shell. Shell variables. Control statements. Unix system administration: Adding and removing users. User accounting. Adding and removing hardware. Performing backups and restore. Disk space management.

Introduction To Embedded Systems : Definition and Classification - Overview of Processors and hardware units in an embedded system - Software embedded into the system- Exemplary Embedded Systems- Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Serial Devices - Examples of Internal Serial- Communication Devices- UART- Parallel Port Devices - '12C', 'USB', 'CAN'.

Real Time Operating Systems:

Definitions of process, tasks and threads - RTOS Services- RTOS :- Kernel, Process Management, Memory Management, Device Management, File System Organisation, I/O Subsystems, Interrupt Routines Handling. Inter Process Communications, Study of Micro C/OS-II and Vx Works, Memory Allocation Related Functions, Semaphore Related Functions, Mailbox Related Functions, Queue Related Functions, Windows CE.

**III****Computer Networks**

Computer Network, Goals and Applications, Reference models- OSI and TCP/IP. A LAN, MAN and WAN and topologies, LAN components- File server, Workstations, Network Adapter Cards. Connection Oriented and Connection less services, Switching Techniques- Circuit Switching, Packet Switching. Transmission media, Data Link Layer: Design Issues, Framing, Error Detection: Parity Check, Check Sum and Cyclic Redundancy Check (CRC); Correction Technique: hamming code. Flow Control: Elementary Data Link Protocols, Data link layer in the Internet: SLIP and PPP.

Aloha, CSMA Protocols; Collision-Free Protocols; IEEE MAC Sublayer protocols: 802.3, 802.4, 802.5 and their management. High speed LANs- Fast Ethernet, FDDI, Wireless LANs

Network Layer: Routing Algorithms, Internet addressing and Internet Control protocols Transport Layer : Connection Establishment, Connection Release, Multiplexing, UDP, TCP.

Application layer : Client Server Architecture, DNS, WWW and HTTP, Cookies, Proxy Server.

E-mail Protocols. Network Security: Cryptography, Symmetric- key Algorithms, Public-key Algorithms, Digital Signatures.

Characteristic of Cellular Systems, Mobility support in cellular telephone networks,

Personal Communications Systems/Personal Communications Networks, Mobile applications, Limitations, Health Concerns, Cordless phone.

Wireless Personal Area Network, Wireless Local Area Network and Internet Access. Mobility management, Security. Cellular telephony, Mobile communication, Satellite Systems, Mobile IP, goals, assumptions requirements, entities & terminology, IP packet delivery, tunneling and encapsulation, Feature & format IPv6, DHCP, TCP over Wireless. Ad Hoc networks, CODA, WML, XML application for wireless handheld devices. UWB systems Characteristics, Signal propagation, technology, Mobility management for integrated systems, Current approaches for security. Network management in Unix.

#### IV

##### Programming Languages

Classification of programming languages, Programming Environment {Assemblers, compilers, interpreters, linkers, and loaders}.

Programming Concepts with Flowcharting and algorithms, Developing and debugging flowcharts for Programming Problem.

Introduction to C: Data types, Constants and Variables, Expressions and Operators and Decision Control Structures in C. Loop Control Structures, Case Control Structures. One dimensional and multidimensional array. Pointers and their Applications, String Handling.

Functions : Standard and User defined Function, Parameter passing, Scope Rule. Recursion. Structures and Union, Arguments to main, Enumerations and bit fields. Pre-Processors: {def, include, macro's, ifdef etc.}, File Handling.

Introduction to C++ : Structures, Variables in C++, References, Functions, Function Overloading, Default Values for Formal Arguments of Functions, Inline Functions.

Class and Objects : Introduction to Classes and Objects

Constructors, destructors, friend function, dynamic memory allocation, Inheritance, Overloading, Polymorphism, Templates.

Introduction to Java : Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables, Memory concepts, decision making operators, Naming Conventions.

Introduction to Class, Objects, Methods and Instance Variables, Primitive type Vs Reference Type, Initializing Objects with Constructors.

Static Methods, static field, String Handling in JAVA, Arrays, Using Command-line Arguments, final Instance Variables, this reference, static import, overloaded Constructors, Garbage collection and method finalize, Overloading methods, Parameter passing.

Inheritance, Polymorphism, Packages and Interfaces, Exception Handling, Streams and Files, Multithreading, GUI in JAVA, Applets, Generic and Collection API, Database connectivity : JDBC

Programming Concepts And Embedded Programming in C, C++ : Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions- Use of Pointers- NULL Pointers- Use of Function Calls- Multiple function calls in a Cyclic Order in the Main Function Pointers.

Concepts of EMBEDDED PROGRAMMING in C++ - Object Oriented Programming- Embedded Programming in Java.

#### V

##### Database Technologies

Various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator & user, data dictionary, database architectures. ER model, Reduction of ER Schema to tables, candidate, primary, alternate & foreign keys, attributes, relationships, degree, unary, binary, ternary, n-ary, cardinalities constraints, ER modeling examples.

Enhanced ER modeling : supertype, subtypes, specialization, generalization, specifying constraints in EER models, Disjointness, discriminators, defining super/sub type hierarchies

Relational Algebra, SQL: DDL, DML, DCL Queries, Relational Database, Programming concepts of PL/SQL, Stored procedure, Database connectivity with ODBC/JDBC. SQL Extensions. Functional dependencies, Normalization, basic normal forms, definition of first, second, third normal form and removing anomalies from the relations. De-normalization and merging relations. Database Integrity, Transaction Management, Concurrency & Recovery, Query processing, Query optimization, File Organization : File organization, Organization records in files, basic concept of Indexing, ordered indices : B+ tree & B tree index files. RAID, Distributed Databases, Data Warehouse, Warehouse Schema, Data Warehouse Architecture, Data Warehouse Server, Data Warehouse Implementation, Metadata, OLAP operations. Object Oriented Databases, Spatial Databases. Fundamentals of data mining Data Mining applications.

#### VI

##### Software Engineering

Introduction to Software Engineering & Software Process, Software development process: Linear Sequential model, Prototyping model, Iterative Enhancement model, Spiral model, Time boxing model, RAD model, Component based development. The people, product, process and project, Phases of project management process, Project life cycle, SDLC,

Project Planning : Metrics and measurements, Project estimation (Size & Cost), Project Scheduling, Staffing and personnel planning, Software configuration management plans, Quality assurance plans, Project monitoring plans, Risk management. Software requirements, Functional & Non functional requirements, Problem analysis (Structured analysis and Object Oriented analysis, Prototyping approach). Software Requirements specifications (SRS)

UML, Class diagrams- relationships, association, generalization, dependence, constraints

Use case diagrams, Object diagrams State Machine view, Activity view- activity diagram, Interaction view- collaboration, Interaction, sequence diagrams, Best practices of software engineering Rational Unified Process.

Software Design principles, functional independency, Cohesion, Coupling. Structured design methodology. Software Quality Assurance, Software reliability, Capability

Maturity Model (CMM), ISO 9000, Six sigma, SQA plan. Software Testing techniques and strategies.

#### VII

##### Data Structures and Algorithms

Data Structures : Definition, Arrays, Stacks, Queues, Dequeues, Linked Lists, Singly and Doubly linked list., Trees : Definition, Tree types and their and Implementation. Preorder, post order, inorder traversal, Graphs : Definition and implementation Hashing, Hash function, Collision Resolution Techniques, Hashing Applications Time Complexity, Big-Oh notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity. Straight Sequential Search, Array implementations, Linked implementation, Binary Search, Interpolation Search.

Sorting : Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Efficiency of above algorithms, Merge sort, Quick sort Algorithm, Heap sort, Heap Construction, Heap sort, Radix sort, Standard Template Libraries.

Order Analysis : Objectives of time analysis of algorithms; Big-oh and Theta notations. Master Theorem and its proof, solution of divide and conquer recurrence relations Dynamic Programming : methodology and examples. Graph Algorithms : Basics of graphs and their representations. BFS, DFS. Topological sorting.

Minimum spanning trees (Kruskal and Prim's algorithms and brief discussions of disjoint set and Fibonacci heap data structures). Shortest Paths (Dijkstra, Bellman-Ford, Floyd-Warshall).

Hard problems and approximation algorithms. Problem classes P, NP, NP-hard and NP-complete, deterministic and nondeterministic polynomial-time algorithms. Approximation algorithms for some NP-complete problems. Backtracking, Branch and Bound technique, String Matching, Knave algorithm, KMP algorithm, Parallel Algorithms.

Artificial Intelligence and its Applications. The Eight Puzzle, Travelling Salesman Problem, Breadth-First Search & Depth First Search; Heuristic Search Techniques, Neural Network Computing, Expert Systems, Building an expert system using LISP/ PROLOG. Knowledge Management, Embedded Systems.

#### VIII

##### Theory of Computation and Compiler Design

String, Alphabets and Languages, Finite Automata, Finite State Machine, Basic Definition. Description of a Finite Automata, Deterministic Finite Accepters- Transition Graphs, Languages, Non-Deterministic Finite Accepters- Definition, Finite Automata with e-moves Mealy and Moore models, Conversion of NDFA to DFA Removal of e transition from e-NDFA. The Myhill-Nerode theorem and Minimization of Finite Automata Regular Sets: Pumping lemma for regular set, Closure, Properties of regular set. Formal Language, Regular Grammars, Context-Free Grammars, Pushdown Automata, Turing Machine.

Compiler, Translator, Interpreter definition, Phase of compiler introduction to one pass & Multi pass compilers. Analysis of source program.

Review of Finite automata lexical analyzer, Input, buffering, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling.

Introduction to parsing. Bottom up parsing Top down parsing techniques. Shift reduce parsing, Operator precedence parsing, Recursive descent parsing predictive parsers. LL grammars & parsers error handling of LL parser. LR parsers, Construction of SLR. Conical LR & LALR parsing tables, parsing with ambiguous grammar. Syntax directed definitions; Construction of syntax trees, L-attributed definitions, Top down translation.

Intermediate code forms using postfix notation and three address code. Representing TAC using triples and quadruples, Translation of assignment statement. Boolean expression and control structures. Definition of basic block control flow graphs, DAG representation of basic block. Advantages of DAG, Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Issues in design of code generator, A simple code generator, Code generation from DAG. Code Optimization.

#### IX

##### Computer Graphics and Multimedia

Introduction to Computer Graphics, Application of Graphics, Display Devices : Refresh Cathode-Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Flat Panel Displays. Video cards/display cards.

Input Devices : Mouse, Trackball, Space ball, Data Glove, Joystick, Light pen, Scanner, Digital Camera, Touch Panels, Voice Systems. Hardcopy Devices : Printers and Plotters.

Line Generation Algorithms : DDA algorithm, Bresenham's algorithm. Circle Generation Algorithms : Midpoint Circle algorithm, Bresenham's circle generation algorithm. Ellipse Generation algorithm. Graphics Primitives : Polygon filling Algorithms, Inside-Outside Tests, Boundary-Fill algorithm, Flood-Fill algorithm. Fundamentals of aliasing and Antialiasing Technique.

Clipping operations, Point clipping, Line clipping : Cohen Sutherland Algorithm, Liang Barsky Algorithm, Nicholl-Lee-Nicholl Algorithm.

Polygon clipping: Sutherland-Hodgeman Algorithm, Weiler Atherton Algorithm. Text clipping, Exterior clipping. Two dimensional Transformations : Translation, Scaling, Rotation, Reflection, Shear, Homogeneous coordinate system, composite transformations, raster method of transformation Two Dimensional Viewing : Window to Viewport coordinate transformation, Three Dimensional : 3D Geometry, 3D display techniques, transformations. projections : Parallel Projection, Perspective Projection. Color Models and Color Application Advancements in the technology in Computer Graphics.

#### X

##### Web Technology

Internet, ISPs, Types of internet connection, Internet connection configuration-sub netting, Firewalls, Internet phone, Chatting, Search Engines.

WWW an introduction, Web site and Web page, Web server, Publishing and maintaining a web site. Web technologies : HTML, DHTML and CSS, Java Script. DOM, CGI, XML and ASP. Java Servlet, Servlet Development Process, Deployment

Descriptors, The Generic Servlet Lifecycle, Servlet Packages, Classes, Interfaces, and Methods, Handling Forms with Servlets. Session Handling Java Database Connectivity.

Connection of JSP and Servlet with different database viz. Oracle, MS-SQL Server, MySQL java.sql Package. Accessing metadata from the database.

Type of Statement, Connection pooling : multiple users and need of connection pooling.

JSP Basics : JSP lifecycle, Directives, scripting elements, standard actions, implicit objects. Writing JSPs. Building and using Java Bean. Expression Language (EL), Separating Business, Logic and Presentation Logic, Session handling in JSP, Types of errors and exceptions handling, Standard Tag Library in JSP, Building Custom Tag Library, JSP Tag Library, MVC Design pattern, Advances in J2EE and Other Web technology.

#### Syllabus for Computer Application (03)

##### Computer Organisation and Architecture

Computer Organization : Digital and Analog computers, CPU, Hardware, Software and Firmware. Number Systems : Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes : BCD code, Gray Code, ASCH code, Excess 3 Code, Error detecting Code.

Computer Arithmetic, Logic gates, Integrated Circuits, K-Map, AND, OR, NAND and NOR implementations, Exclusive-OR function.

Combinational Logic : Combinational Circuits, Binary adder, subtracter, multiplier, Decoders, Encoders, Multiplexes, and Demultiplexers.

Sequential circuits, Latches, Flip Flops : SR, D, JK, T. Master Slave JK Flip flop. Characteristic equations and Excitation tables of flip-flops. Shift Registers, Counters.

Computer organization : The memory unit, the input and output subsystem, the bus structures, ALU. Program development tools : Compiler, interpreter, and assembler. 8086/86 micro processor architecture, Instruction set. Integer division. BDC arithmetic, Design of ALU.

Memory address and addressing modes. RISC and CISC processors. Instruction pipelining, Parallel processing and pipelining, pipelining in RISC and CISC processors. Super scalar processors. VLIW processors. Cache memory and its types. Input Output organization, accessing I/O devices, Interrupts. Memory mapped I/O and I/O mapped I/O. Programmed I/O.

#### II

##### Operating System

Evolution of operating systems, operating system concepts, Process Management : Concepts, Algorithms. Memory Management : Concepts, single user memory management. Partition memory allocation, Virtual memory management using paging and segmentation techniques. Concurrent Processes : Mutual exclusion and synchronization, Techniques of inter process communication, Deadlock handling.

File Management : Operations on a file, structure of a file system, Free block list, keeping track of blocks allocated to a file, directory structure, sharing and protection of files, file system Reliability, Unix file system.

Device Management : Goals of input/output software design, Structure of device hardware and software, Layers of I/O software, structure of device drivers, Disk driver, disk arm scheduling algorithms, terminal driver, clock driver etc.

Introduction to network and distributed operating systems Case Studies : Unix/Linux, Windows operating system, Unix/Linux commands.

Mobile operating System : file system, Process, Task, Thread, ISR and IST.

#### III

##### Computer Networks

Computer Network, Goals and Applications, Reference models- OSI and TCP/IP, LAN, MAN and WAN and topologies, LAN components- File server, Workstations, Network Adapter Cards. Connection Oriented and Connection less services, Switching Techniques- Circuit Switching, Packet Switching, Transmission media.

Data Link Layer : Design Issues, Framing, Error Detection : Parity Check, Check Sum and Cyclic Redundancy Check (CRC); Correction Technique : Hamming code. Flow Control : Elementary Data Link Protocols, Data link layer in the Interest : SLIP and PPP.

Aloha CSMA Protocols; Collision-Free Protocols; IEEE MAC Sublayer protocols : 802.3 802.4, 802.5 and their management. High speed LANs- Fast Ethernet, FDDI, Wireless LANs Network Layer : Routing Algorithms, Internet addressing and Internet Control protocols Transport Layer : Connection Establishment, Connection Release, Multiplexing, UDP, TCP. Application layer : L Client Server Architecture, DNS, WWW and HTTP, Cookies, Proxy Server. E-mail Protocols. Network Security : Cryptography, Symmetric- key Algorithms, Public-key Algorithms, Digital Signatures.

Characteristic of Cellular Systems, Mobility support in cellular telephone networks, Personal Communications Systems/Personal Communications Networks, Mobile applications, Limitations, Health Concerns, Cordless phone.

Wireless Personal Area Network, Wireless Local Area Network and Internet Access. Mobility management, Security. Cellular telephony, Mobile communication, Satellite Systems, Mobile IP, goals, assumptions requirements, entities & terminology, IP packet delivery, tunnelling and encapsulation, Feature & format IPv6, DHCP, TCP over Wireless. Ad Hoc networks, CODA, HTTP versus HTML, WML, XML application for wireless handheld devices. UWB systems Characteristics, Signal propagations, technology, Mobility management for integrated systems, Current approaches for security.

#### IV

##### Programming Languages

Classification of programming languages, Programming Environment [Assemblers, compilers, interpreters, linkers, and loaders].

Programming Concepts with Flowcharting and algorithms, Developing and debugging flowcharts for Programming Problem.

**Introduction to C :** Data types, Constants and Variables, Expressions and Operators and Decision Control Structures in C. Loop Control Structures, Case Control Structures. One dimensional and multidimensional array. Pointers and their applications, String Handling Functions : Standard and User defined Function, Parameter passing, Scope Rule. Recursion, Structures and Union, Arguments to

main, Enumerations and bit fields.

Pre-Processors : {def, include, macro's, ifdef etc.}, File Handling.

**Introduction to C++ :** Structures, Variables in C++, References, Functions, Function Overloading, Default Values for Formal Arguments of Functions, Inline Functions. Class and Objects : Introduction to Classes and Objects

Constructors, destructors, friend function, dynamic memory allocation, Inheritance, Overloading, Polymorphism, Templates.

**Introduction to Java :** Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables, Memory concepts, decision making operators, Naming Conventions.

Introduction to Class, Objects, Methods and Instance Variables, Primitive type Vs Reference Type, Initializing Objects with Constructors.

Static Method, static field, String Handling in JAVA, Arrays, Using Command-line Arguments, final Instance Variables, this reference, static import, overloaded Constructors, Garbage collection and method finalize, Overloading methods, Parameter passing.

Inheritance, Polymorphism, Packages and Interfaces, Exception Handling, Streams and Files, Multithreading, GUI in JAVA, Applets, Generic and Collection API, Database connectivity : JDBC.

#### V

##### Database Technologies

Various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator & user, data dictionary, database architectures. ER model, Reduction of ER Schema to tables, candidate, primary, alternate & foreign keys. EER model, Relational Algebra, SQL : DDL, DML, DCL Queries, Relational Database, Programming concepts of PL/SQL, Stored procedure, Database connectivity with ODBC/JDBC. SQL Extensions. Functional dependencies, Normalization, Database Integrity, Transaction Management, Concurrency & Recovery, Query processing, Query optimization, File Organization : File organization, Organization of records in files, basic concept of Indexing, ordered indices : B+ tree & B tree index files. RAID. Data Warehouse, Warehouse Schema, Data Warehouse Architecture, Data Warehouse Server, Data Warehouse Implementation, Metadata, OLAP operations. Object Oriented Databases, Spatial Databases.

#### VI

##### Software Engineering and Project Management

System development life cycle, Introduction to Software Engineering & Software Processes, Software development processes : Linear Sequential model, Prototyping model, Iterative Enhancement model, Spiral model, Time boxing model, RAD model, Component based development. Project life cycle,

Project Planning : Metrics and measurements, Project estimation (Size & Cost), Project Scheduling, Staffing and personnel planning, Software configuration management plans, Quality assurance plans, Project monitoring plans, Risk management. Software requirements, Functional & Non functional requirements, Problem analysis (Structured analysis and Object Oriented analysis, Prototyping approach). Software Requirements specifications (SRS)

UML, Class diagrams - relationships, association, generalization, dependence, constraints, Use case diagrams, Object diagrams State Machine view, Activity view-activity diagram, Interaction view- collaboration, Interaction, sequence diagrams, Best practices of software engineering Rational Unified Process.

Software Design principles, functional independency, Cohesion, Coupling. Structured design methodology. Software Quality Assurance, Software reliability, Capability Maturity Model (CMM), ISO 9000, Six sigma, SQA plan. Software Testing techniques and strategies.

Introduction to project management, Project Quality Management Project Human Resource Management Project Risk Management, Project Procurement Management.

#### VII

##### Data Structures and Algorithms

Data Structures : Definition, Arrays, Stacks, Queues, Dequeues, Linked Lists, Singly and Doubly linked list., **Trees** : Definition, Tree types and their Implementation. Preorder, post order, in order traversal, Graphs : Definition and implementation.

Hashing, Hash function, Collision Resolution Techniques, Hashing Applications, Standard Template Libraries.

Time Complexity, Big-Oh-notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity.

Straight Sequential Search, Binary Search, Interpolation Search.

Sorting : Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Efficiency of above algorithms, Merge sort, Quick sort Algorithm, Heap sort, Radix sort,

Order Analysis : Objectives of time analysis of algorithms ; Big-oh and Theta notations, Master Theorem and its proof, solution of divide and conquer recurrence relations, Dynamic Programming : methodology and examples. Graph Algorithms : Basics of graphs and their representations, BFD, DFS, Topological sorting.

Minimum spanning trees (Kruskal and Prim's algorithms and brief discussions of disjoint set and Fibonacci heap data structures). Shortest Paths (Dijkstra, Bellman-Ford, Floyd-Warshall).

Hard problems and approximation algorithms. Problem classes P, NP. NP-hard and NP-complete, deterministic and nondeterministic polynomial-time algorithms. Approximation algorithms for some NP-complete problems. Backtracking, Branch and Bound technique, String Matching, Knave algorithm, KMP algorithm, Parallel Algorithms.

#### VIII

##### Theory of Computation and Compiler Design

String, Alphabets and Languages, Finite Automata, Finite State Machine, Basic Definition, Description of a Finite Automation, Deterministic Finite Accepters- Transition Graphs, Languages, Non-Deterministic Finite Accepters- Definition, Finite Automata with e-moves Mealy and Moore models, Conversion of N DFA to DFA Removal of e-transition from e-N DFA. The Myhill-Nerode theorem and Minimization

of Finite Automata Regular Sets : Pumping lemma for regular set, Closure, Properties of regular set. Formal Language, Regular Grammars, Context-Free Grammars, Pushdown Automata, Turing Machine.

Compiler, Translator, Interpreter definition, Phase of compiler introduction to one pass & Multi pass compilers. Analysis of source program.

Review of Finite automata lexical analyzer, Input, buffering, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling.

#### IX

##### Intelligent Systems

Artificial Intelligence and its Applications. Knowledge Representation Techniques : Symbolic Approaches, Representation of knowledge using propositional logic (PL), First Order Predicate Logic (FOPL) Conversion to casual form, Inference Rules, The Resolution principle, non-deductive inference methods.

Associative networks and Frame Structures. Conceptual Dependencies and Scripts. Introduction to LISP and PROLOG. Search and Control Strategies : Introduction, Classical AI problems :

The Eight Puzzle, Travelling Salesman Problem, Breadth-First Search & Depth First Search; Heuristic Search Techniques, Neural Network Computing, Activation and synaptic dynamics, learning methods, stability and convergence in ANN, Functional units of an ANN for pattern recognition. Expert System, Building an expert system using LISP/PROLOG. Embedded Systems.

Fundamentals of data mining, Data Mining Query Languages, Data Mining applications, Association Rule, clustering, classification, Genetic Algorithm. Web Mining, Web content mining, Web Structure mining, Text mining, Temporal Data Mining, Spatial Data Mining.

#### X

##### Web Technology

Internet, ISPs, Types of internet connection, Internet connection configuration-sub netting, Firewalls, Internet phone, Chatting, Search Engines

W3 an introduction, Web site and Web page, Web server, Web cache, Principles of web designing planning a web site. Principles and patterns of Good design.

Publishing and maintaining a web site. Web technologies : HTML, DHTML and CSS, Java Script, DOM, CGI, XML and ASP. Java Servlet, Servlet Development Process, Deployment Descriptors, The Generic Servlet Lifecycle. Servlet Development Process, Deployment Descriptors, The Generic Servlet Lifecycle. Servlet Packages, Classes, Interfaces, and Methods, Handling Forms with Servlets. Session Handling Java Database Connectivity.

Connection of JSP and Servlet with different database viz., Oracle, MS-SQL Server, MySQL. Java.sql Package. Accessing metadata from the database.

Type of Statement, Connection pooling : multiple users and need of connection pooling.

JSP Basics : JSP lifecycle, Directives, scripting elements, standard actions, implicit objects. Writing JSPs. Building and using JavaBean. Expression Language (EL), Separating Business Logic and Presentation Logic, Session handling in JSP, Types of errors and exceptions handling, Standard Tag Library in JSP, Building Custom Tag Library, JSP Tag Library, MVC Design pattern, Advances in J2EE and Other Web technology.

#### Forensic Science & Forensic Physics (04)

##### Section-A

Forensic Science- Definition and scope. Historical development of Forensic Science. Basic Principles of Forensic Science.

Crime Scene Management and investigation- Searching methods' at scene of crime, sketching and Photography.

Collection, Preservation, Packing and Forwarding of Physical evidence to the Forensic Science Laboratory.

Reconstruction of Crime Scene.

Physical Evidences - Types and Importance.

Legal and Court Procedure pertaining to Expert Testimony. Organization and Management of Forensic Science Laboratory. Quality control Accreditation and Creditability in Forensic Science Laboratory.

Role of Forensic Scientist.

**Microscopy** : Microscope and its parts, Function, Application in Forensic Science.

**Types off Microscopes-** Simple, Compound, Polarizing, Phase Contrast, Comparison, Stereo, Fluorescence, Election- TEM and SEM.

**Spectrophotometry** -Principles, Techniques and Application in Forensic science-U.V., Visible, I.R. FTIR.

Atomic Absorption Spectroscopy.

Mass Spectrometry.

Raman Spectroscopy.

Neutron Activation. Analysis

N.M.R.

X-Ray Analysis

X-Ray Diffraction Analysis.

X-Ray Fluorescence Analysis.

Thermal Techniques- TGM and D.T.A.

Chromatography- Theory and Techniques- Column, Paper, TLC, Ion-Exchange, GC, HPLC, HPTLC, CG-MS and LC-MS.

**Electrophoresis** - Theory and Principles.

High and Low Voltage Electrophoresis.

Gel Electrophoresis.

Immune Electrophoresis.

Iso Electrophoresis.

**Forensic statistics** : Type of Data, Measure of Central Tendency, Dispersion of Data, Correlation, Probability and Proof.

**Psychological Techniques in Forensic science** - Polygraph, Narco Analysis, Brain Mapping, Hypnosis and their legal status.

**Wild Life Forensics** : Wild Life species identification methods.

Significance of pug Marks in wild life identification.

Importance of DNA Technique in poaching cases.

Wild Life DNA Data Bank and its utility.

**Computer Forensics** : Introduction to Computer and Cyber Crimes- Hacking, Virus, Phising, Pornography, Software Piracy, Program manipulation, ATM Frauds. Role of Forensic Scientist in Computer Crime investigation and prevention.

#### FORENSIC SCIENCE

##### SECTION-B (FORENSIC PHYSICS)

**Forensic Physics** - Definition and Scope.

**Fiber** - Types, Classification, Laboratory examination of fibers.

Examination of Rope, Cord, String, Metal fragments, Dust and Debris.

Examination of and Mortar, Determination of adulteration in Cement.

Glass - Definition and Nature. Various types of glass, their composition and properties.

Examination of Glass in the laboratory.

Glass Fractures- Types and Characteristics.

Forensic importance of glass fractures.

**Soil-** Nature and importance, Composition of different soils.

Collection and Preservation of soil sample for laboratory examination.

Examination of soil in the laboratory.

**Paper-** Composition, Types of papers, Examination of Paper in laboratory.

**Paint** - Forensic importance, Nature and main constituents of paint, Types of paints, Examination of Paint in the laboratory.

**Foot Print, Shoe Print and Tyre Marks-** Nature and importance in Forensic Science and their different types.

Preservation methods of these impression.

Comparison of these impressions.

**Tool Marks** : Nature and Importance in Forensic Science,

Types of Tool Marks : Factors influencing Tool Marks. Standard for comparison.

Comparison of Tool Marks in laboratory.

Casting of Tool marks.

**Voice Analysis-** Voice production theory, Acoustics of speech.

Methods of Voice Identification.

Voice Spectrograph.

Speech recognition and Speaker Identification.

**Counterfeit coins and Currency Notes** - Features of genuine Currency Note.

Examination of counterfeit coins, Currency notes and Security Stamps.

Restoration of Erased marks on Metal and Wood.

**Document-** Preliminary examination of Document.

Exemplers for comparison of Handwriting.

Examination of Handwriting.

Erasure, Obiteration and Addition.

Secret Writing.

Decipherment of Charred Document.

Forgery and Forged signature.

Indented Writing.

Photography of Questioned Document.

#### Forensic Science & Forensic Ballistics (05)

##### Section-A

**Forensic Science** - Definition and scope. Historical development of Forensic Science. Basic Principles of Forensic Science.

Crime Scene Management and investigation- Searching methods at scene of crime, sketching and Photography.

Collection, Preservation, Packing and Forwarding of Physical evidence to the Forensic Science Laboratory.

Reconstruction of Crime Scene.

**Physical Evidences** - Types and Importance.

Legal and Court Procedure pertaining to Expert Testimony.

Organization and Management of Forensic Science Laboratory.

Quality control Accreditation and Creditability of Forensic Science Laboratory.

Role of Forensic Scientist.

**Microscopy** : Microscope and its parts, Function, Application in Forensic Science.

**Types off Microscopes-** Simple, Compound, Polarizing, Phase Contrast, Comparison, Stereo, Fluorescence, Election- TEM and SEM.

**Spectrophotometry** - Principles, Techniques and Application in Forensic science-U.V., Visible, I.R. FTIR.

Atomic Absorption Spectroscopy.

Mass Spectrometry.

Raman Spectroscopy.

Neutron Activation. Analysis

N.M.R.

X-Ray Analysis

X-Ray Diffraction Analysis.

X-Ray Fluorescence Analysis.

Thermal Techniques- TGM and D.T.A.

**Chromatography-** Theory and Techniques- Column, Paper, TLC, Ion-Exchange, GC, HPLC, HPTLC, CG-MS and LC-MS.

**Electrophoresis** - Theory and Principles.

High and Low Voltage Electrophoresis.

Gel Electrophoresis.

Immune Electrophoresis.

Iso Electrophoresis.

**Forensic statistics** : Type of Data, Measure of Central Tendency, Dispersion of Data, Correlation, Probability and Proof.

**Psychological Techniques in Forensic science** - Polygraph, Narco Analysis, Brain Mapping, Hypnosis and their legal status.

**Wild Life Forensics** : Wild Life species identification methods.

Significance of pug Marks in wild life identification.

Importance of DNA Technique in poaching cases.

Wild Life DNA Data Bank and its utility.

**Computer Forensics** : Introduction to Computer and Cyber Crimes- Hacking, Virus, Phising, Pornography, Software Piracy, Program manipulation, ATM Frauds. Role of



Forensic Scientist in Computer Crime investigation and prevention.

### FORENSIC SCIENCE

#### SECTION-B (FORENSIC BALLISTICS)

**Forensic Ballistics-** Definition and Scope.

Historical development of Fire arms and Ammunition.

Definition of Fire arm and Ammunition as per Indian Arms Act.

Fire arm and its main parts.

Classification of Fire arms.

Ammunition and its composition.

Classification of Cartridges.

Propellant- Types and properties.

Projectile- Shots, Bullets, their types and composition.

Air Gun, Muzzle loaders, Improvised Gun.

**Interior Ballistics-** Theory of burning of Propellant, Pressure Curve inside barrel, Twist, Muzzle Velocity, Barrel length and Velocity, Propellant and Velocity, Recoil.

**Exterior Ballistics-** Trajectory of Projectile, Effect of Air resistant, Drift, Drag, Tumbling of bullet, Bullet drop, Bullet range.

Dispersion of pellets, Ballistics coefficient, Ballistics Tables.

Yaw, stability of bullet.

**Terminal Ballistics-** Effect of Projectile on hitting the target, Striking Velocity, Stopping Power, Recochet.

**Wound Ballistics-** Elements of mechanics of Wounding, Threshold velocity for Penetration in human body.

Use of Gel block for study of wound ballistics, Casualty Criteria.

Nature of Temporary and Permanent cavity formation in wound.

Entry and Exit wound in firearm injury.

Determination of suicidal, homicidal, Accidental firing.

Post mortem and Ante mortem firearm wound.

Examination of Firearm, Fired Cartridge and Bullet in the laboratory.

Analysis of G.S.R.

Determination of Range of firing.

Identification of Shooter.

Accidental Discharge.

Restoration of erased stamped serial number on firearm.

Photography and Reconstruction of crime scene in firearm case.

IBIS (Integrated Ballistics Identification System)

**Explosive-** Chemicals used as explosives, Classification of explosives,

Low and High Explosives, IED (Improvised Explosive Device)

Examination of Explosive and Bomb, Dynamite.

Examination of Black gun powder and Smokeless powder.

Examination of Explosive Debris.

Diffusing of live Bomb.

Photography and Crime Scene inspection in explosion cases.

#### Syllabus of Chemistry (06)

##### Physical Chemistry :

1. Basic principles and applications of quantum mechanics- hydrogen atom, angular momentum.
2. Variational and perturbational methods.
3. Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra.
4. Theoretical treatment of atomic structures and chemical bonding.
5. Chemical applications of group theory.
6. Basic principles and application of spectroscopy- rotational, vibrational, electronic, Raman, ESR, NMR.
7. Chemical thermodynamics.
8. Phase equilibria.
9. Statistical thermodynamics.
10. Chemical equilibria.
11. Electrochemistry- Nernst equation, electrode kinetics, electrical double layer, Debye-Huckel theory.
12. Chemical kinetics- empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques for fast reactions.
13. Concepts of catalysis.
14. Polymer chemistry. Molecular weights and their determinations. Kinetics of chain polymerization.
15. Solids- structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties
16. Collids and surface phenomena.
17. Data analysis.

##### Inorganic Chemistry :

1. Chemical periodicity.
2. Structure and bonding in homo-and heteronuclear molecules, including shapes of molecules.
3. Concepts of acids and bases.
4. Chemistry of the main group elements and their compounds. Allotropy, synthesis, bonding and structure.
5. Chemistry of transition elements and coordination compounds- bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements- spectral and magnetic properties, analytical applications.
7. Organometallic compounds- synthesis, bonding and structure and reactivity, Organometallics in homogenous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation techniques. Spectroscopic electro- and thermoanalytical methods.
10. Bioinorganic chemistry- photosystems, porphyrines, metalloenzymes, oxygen transport, electron- transfer reactions, nitrogen fixation.
11. Physical characterization of inorganic compounds by IR, Raman, NMR, EPR,

Mossbauer, UV-, NOR, MS, electron spectroscopy and microscopic techniques.

12. Nuclear chemistry- nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

##### Organic Chemistry

1. IUPAC nomenclature of organic compounds.
2. Principles of stereochemistry, conformational analysis, isomerism and chirality.
3. Reactive intermediates and organic reaction mechanisms.
4. Concepts of aromaticity.
5. Pericyclic reactions.
6. Named reactions.
7. Transformations and rearrangements.
8. Principles and applications of organic photochemistry, Free radical reactions.
9. Reactions involving nucleophilic carbon intermediates.
10. Oxidation and reduction of functional groups.
11. Common reagents (organic, inorganic and organometallic) in organic synthesis.
12. Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids.
13. Selective organic transformations- chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity, Protecting groups.
14. Chemistry of aromatic and aliphatic heterocyclic compounds.
15. Physical characterisation of organic compounds by IR, UV-, MS, and NMR.

##### Interdisciplinary topics

1. Chemistry in nanoscience and technology.
2. Catalysis and green chemistry.
3. Medicinal chemistry.
4. Supramolecular chemistry.
5. Environmental chemistry.

#### FORENSIC SCIENCE & FORENSIC CHEMISTRY (07)

##### SECTION-A

**Forensic Science-** Definition and Scope.

Historical development of Forensic Science. Basic Principles of Forensic Science.

Crime Scene Management and investigation- Searching methods at scene of crime, sketching and Photography.

Collection, Preservation, Packing and Forwarding of Physical evidence to the Forensic Science Laboratory.

Reconstruction of Crime Scene.

**Physical Evidences-** Types and Importance.

Legal and Court Procedure pertaining to Expert Testimony.

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Quality control Accreditation and Creditability in Forensic Science Laboratory.

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**Microscopy :** Microscope and its parts, Function, Application in Forensic Science.

**Types of Microscopes-** Simple, Compound, Polarizing, Phase Contrast, Comparison, Stereo, Fluorescence, Election- TEM and SEM.

**Spectrophotometry -** Principles, Techniques and Application in Forensic science- U.V., Visible, I.R. FTIR.

Atomic Absorption Spectroscopy.

Mass Spectrometry.

Raman Spectroscopy.

Neutron Activation, Analysis

N.M.R.

X-Ray Analysis

X-Ray Diffraction Analysis.

X-Ray Fluorescence Analysis.

Thermal Techniques- TGM and D.T.A.

**Chromatography-** Theory and Techniques- Column, Paper, TLC, Ion-Exchange, GC, HPLC, HPTLC, CG-MS and LC-MS.

**Electrophoresis -** Theory and Principles.

High and Low Voltage Electrophoresis.

Gel Electrophoresis.

Immune Electrophoresis.

Iso Electrophoresis.

**Forensic statistics :** Type of Data, Measure of Central Tendency, Dispersion of Data, Correlation, Probability and Proof.

**Psychological Techniques in Forensic science -** Polygraph, Narco Analysis, Brain Mapping, Hypnosis and their legal status.

Wild Life Forensics : Wild Life species identification methods.

Significance of pug Marks in wild life identification.

Importance of DNA Technique in poaching cases.

Wild Life DNA Data Bank and its utility.

**Computer Forensics :** Introduction to Computer and Cyber Crimes- Hacking, Virus, Phising, Pornography, Software Piracy, Program manipulation, ATM Frauds. Role of Forensic Scientist in Computer Crime investigation and prevention.

##### FORENSIC SCIENCE

#### SECTION-B (FORENSIC CHEMISTRY)

**Forensic Chemistry -** Definition and Scope.

Preliminary Screening Methods for some chemical constituents- spot test and crystal test.

Analysis of Toxic Anions- Nitric, Nitrate, Sulphide, Sulphate, Halides, Cyanide,

Analysis of CO<sub>2</sub> and CO.

Analysis of some Metallic poisons- As, Sb, Pb, Ba, Cu, Hg, Zn, Thallium.

Analysis of Methanol, Ethanol, Denatured Spirit, Illicit liquor.

Methanol Poisoning.

Analysis of Ethyl alcohol in breath, blood and urine.

Analysis of Dyes and Pigments.

Determination of Adulteration in Edible oils, Food commodities, Fertilizers, Cement, Ornaments.

**Alkaloid-** Definition, Classification, Isolation and General Properties.

Examination of Morphine, Codeine, Brucine, Strychnine, Atropine, Heroin, Cocaine, Alkaloids from Opium, Cannabis Sativa and Dhatura.

**Fire and Arson Investigation** - Nature and Chemistry of Fire. Types of Arson cases. Detailed Examination of scene of crime. Collection and Preservation of evidences in a arson case.

Analysis of Incendiary material from debris.

Analysis of Incendiary material from debris.

Analysis of Petroleum products for adulteration.

Trap cases- Analysis of Dyes used in Trap cases.

**Explosive**- Nature, Classification and Composition, Ignition, combustion and Detonation.

Examination of Explosive, Bomb and LED (Improved Explosive Device)

Reconstruction of explosive cases.

Diffusing of Live Bomb.

Analysis of cement and Mortar

Analysis of Detergent and Soap.

#### FORENSIC SCIENCE & FORENSIC TOXICOLOGY (08)

##### SECTION-A

**Forensic Science**- Definition and Scope.

Historical development of Forensic Science. Basic Principles of Forensic Science.

Crime Scene Management and investigation- Searching methods at scene of crime, sketching and Photography.

Collection, Preservation, Packing and Forwarding of Physical evidence to the Forensic Science Laboratory.

Reconstruction of Crime Scene.

**Physical Evidences**- Types and Importance.

Legal and Court Procedure pertaining to Expert Testimony.

Organization and Management of Forensic Science Laboratory.

Quality control Accreditation and Credibility in Forensic Science Laboratory.

Role of Forensic Scientist.

**Microscopy** : Microscope and its parts, Function, Application in Forensic Science.

**Types of Microscopes**- Simple, Compound, Polarizing, Phase Contrast, Comparison, Stereo, Fluorescence, Electron- TEM and SEM.

**Spectrophotometry** - Principles, Techniques and Application in Forensic science- U.V., Visible, I.R. FTIR.

Atomic Absorption Spectroscopy.

Mass Spectrometry.

Raman Spectroscopy.

Neutron Activation, Analysis

N.M.R.

X-Ray Analysis

X-Ray Diffraction Analysis.

X-Ray Fluorescence Analysis.

Thermal Techniques- TGM and D.T.A.

**Chromatography**- Theory and Techniques- Column, Paper, TLC, Ion-Exchange, GC, HPLC, HPTLC, CG-MS and LC-MS.

**Electrophoresis** - Theory and Principles.

High and Low Voltage Electrophoresis.

Gel Electrophoresis.

Immune Electrophoresis.

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**Computer Forensics** : Introduction to Computer and Cyber Crimes- Hacking, Virus, Phishing, Pornography, Software Piracy, Program manipulation, ATM Frauds. Role of Forensic Scientist in Computer Crime investigation and prevention.

#### FORENSIC SCIENCE

##### SECTION-B (FORENSIC TOXICOLOGY)

**Forensic Toxicology** - Definition and Scope.

**Poison** - Definition, Classification, Mode of action, Factors modifying mode of action of poison.

Methods of Poison administration, Toxicological exhibits in poisoning cases, their collection and preservation.

Extraction and Isolation of Poison from Viscera and other Biological specimen.

Analysis of Corrosive and Irritant poisons.

**Metallic Poisons**- As, Sb, Pb, Hg, Cu, Ba, Zn, Th and their examination in laboratory.

**Analysis of Toxic anions** - Nitrite, Nitrate, Sulphide, Sulphate, Halides, Phosphide, Cyanide.

Estimation of liquor in breath, blood and urine.

Analysis of Methanol, Ethanol, Acetone, Chloroform, Ether.

Denatured spirit and Methanol Poisoning.

Analysis of CO<sub>2</sub>, CO and other Poisonous gases.

**Insecticide and Pesticide**- Organochloro, Organophosphorus and carbamates and their analysis.

**Alkaloids** - Definition, classification, Isolation and General Properties Analysis of Morphine, Codeine, Brucine, Strychnine, Nicotine, Atropine, Hyosyamine. Cocaine.

**Plant Poisons and their examination** - Dhatura, Papaver Somniferum, Atropa Belladonna, Marking nut, Nux-Vomica, Oleander, Aconite, Abrus, Cannabis Sativa, Coca, Croton.

Snake venom and Canthridine.

Analysis of Barbiturates, Chloral hydrate, tranquilizers.

Examination of Heroine, Methaqualone, Meprobamate, Mescaline, Mandrax, LSD,

Amphetamine, Benzodiazepines.

Abusive Drugs used in Sports.

Food Poisoning- Botulism, Ptomaine poisoning.

#### SYLLABUS- BOTANY (09)

##### 1. Molecules and their Interaction relevant to Biology :

A. Composition structure and functions of biomolecules (carbohydrates, lipids, proteins and nucleic acids)

B. Bioenergetics : Glycolysis oxidative phosphorylation coupled reaction, group transfer biological energy transducers.

C. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.

D. Conformation of proteins and nucleic acids [A, B, Z-DNA, t, micro-RNA] stability of protein and nucleic acid structures.

E. Structure of carbohydrates, lipids aminoacids nucleotides and vitamins.

##### 2. Cellular organization :

A. Membrane structure and function : Structure of model membrane, lipid bilayer and membrane protein, diffusion osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membrane.

B. Structural organization and function of intracellular organelles : Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, chloroplast, vacuoles.

C. Organization of genes and chromosomes : Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

D. Cell division and cell cycle : Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle.

##### 3. Fundamental Processes:

A. DNA replication, repair and recombination : Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, DNA damage and repair mechanisms extra chromosomal replicons.

B. RNA Synthesis and processing : Transcription factors, machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

C. Protein synthesis and processing : Ribosome, formation of initiation complex, initiation factor and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA identity, aminoacyl tRNA synthetase, translational proof reading, translational inhibitors, post-translational modification of proteins.

D. Control of gene expression of transcription and translation level : Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

##### 4. Developmental Biology (Embryology):

A. Gametogenesis, fertilization and ovary development : Microsporogenesis, microgametogenesis, megasporogenesis, embryonic development, double fertilization, endosperm and embryo development, seed formation and germination, Pollination, incompatibility.

B. Morphogenesis and organogenesis in plants : Organization of root and shoot, apical meristem, root and shoot development, leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.

##### 5. System Physiology : Plants

A. Photosynthesis : Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO<sub>2</sub> fixation-C<sub>3</sub>, C<sub>4</sub> and CAM pathways.

B. Respiration and photorespiration : Citric acid cycle, plant mitochondrial electron transport and ATP synthesis, Alternate oxides photo respiratory pathway.

C. Nitrogen metabolism : Nitrate and ammonium assimilation; aminoacid biosynthesis.

D. Plant hormones : Biosynthesis, storage, breakdown and transport; physiological effects and mechanism of action, aging and senescence.

E. Sensory photobiology : Structure functions and mechanism of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

F. Solute transport and photoassimilate translocation : Update transport and translocation of water, ions, solutes and macromolecules from soil, through cells across membranes, through xylem and phloem, transpiration, mechanism of loading and unloading of photoassimilates.

G. Secondary metabolites, Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

H. Stress physiology Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stress, mechanism of resistance to biotic stress and tolerance to biotic stress.

##### 6. Biology and Diversity of Viruses Bacteria Fungi Algae :

A. Virology General account of viruses, characteristics, ultrastructure, chemical nature, replication, transmission.

B. Bacteriology General account of bacteria, ultrastructure, nutrition, reproduction, economic importance, Cyanobacteria salient features and biological importance.

C. Mycology : General characters and classification of fungi, cellular organization, cell wall composition, nutrition, reproduction, Heterothallism and parasexuality, General account of mostigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Fungi in industry, medicine and as food. Mycorrhiza, Fungal diseases in plants. Host-parasite relationships, mycotoxins.

D. Phycology : Habitat, thallus organization, cell ultrastructure, reproduction of Algae, criteria for classification. General account of Protochlorophyta, chlorophyta, charophyta, xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta. Algal bloom, Algal biofertilizer, Algae as food, industrial uses of algae.

**7. Biology and Diversity of Embryophyta (Bryophyta, Pteridophyta, Gymnosperm):**

- A. Bryophyta : Distribution, general characters and reproduction of bryophytes, General account of marchantiales, jungermanniales anothocerotales, sphagnales, funariales and palytrichales, Ecological and economic importance of bryophytes.
- B. Pteridophyta : Morphology anatomy reproduction and life history of pteridophyta. Evolution of stele, heterospory and origin of seed habit. General account of Psilopsida, Lycopsida, Sphenopsida and pteropsida.
- C. Gymnosperms Evolution, Characters, Classification and economic importance of Gymnosperms. General account of Pteridospermales, Cycadeoidales cordaitales cycadales ginkgoales, coniferales ephedrales welwitschiales and Gnetales.

**8. Morphology and Taxonomy of Angiosperms :**

- A. Origin of angiosperms.
- B. Morphology of stamen and carpel, their evolution.
- C. Morphology and anatomy of plant parts. Tissue system, secondary Growth & Anomalous structure.
- D. Concept of species and hierarchical taxa, Salient features of international code of Botanical Nomenclature. Taxonomic tools : herbaria, flora, Botanical Garden and keys.
- E. Systems of angiosperm classification, their relative merits and demerits.
- F. Endemism and Hot spots.
- G. Ethnobotanical studies Economic botany.

**9. Ecological Principles :**

- A. The Environment : Physical environment, biotic environment, biotic and biotic interactions.
- B. Habitat and Niche : Concept of habitat and niche, niche width and overlap; fundamental and realized niche; resource partitioning character displacement.
- C. Population Ecology : Characteristics of a population; population growth curves, population regulation; life history strategies (r and k selection)
- D. Species interactions : Types of interactions interspecific competition, herbivory, carnivory, pollination, symbiosis.
- E. Community ecology : Nature of communities, community structure and attributes; levels of species diversity and its measurement; edge and ecotone.
- F. Ecological succession : Types, mechanisms, changes involved in succession, concept of climax.
- G. Ecosystem : Structure and function; energy flow and mineral cycling (C, N, P), primary production and decomposition Structure and function of some Indian ecosystems, terrestrial (forest grassland) and aquatic (freshwater, marine, estuarine) wetlands.

**10. Biogeography**

- A. Major terrestrial biomes, Phytogeographical zones of India.
- B. Applied Ecology : Environmental pollution; global environmental change, biodiversity status, monitoring and documentation major drivers of biodiversity change, biodiversity management approaches.
- C. Conservation biology : Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (soil conservation & watersheds management, Biosphere reserve).

**11. Evolution**

- A. Emergence of evolutionary thoughts : Lamarck, Darwin, concepts of variation, adaptation, struggle, fitness and natural selection. Mendelism, spontaneity of mutations, the evolutionary synthesis.
- B. Origin of cells and unicellular evolution : Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers, concept of oparin and Haldance; Experiments of Miller (1953), the first cell; evolution of prokaryotes, origin of eukaryotic cells, evolution of unicellular eukaryotes; anaerobic metabolism; photosynthesis and aerobic metabolism.
- C. Paleobotany and evolutionary history : The evolutionary time scale, eras, periods, epochs, major events in the evolutionary time scale Origin of unicellular and multicellular organisms major groups of plants.
- D. Fossils types & formation.

**12. Applied Biology :**

- A. Microbial fermentation and production of small and macro molecules.
- B. Tissue and cell culture methods for plants.
- C. Transgenic plants
- D. Phytoremediation

**13. Methods in Biology :**

- A. Molecular biology and recombinant DNA methods : Isolation and purification of RNA, DNA (Genomic and plasmid) and proteins, different separation methods, analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels;
- B. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems, expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences; generation of genomic and C-DNA libraries in plasmid, phage, cosmid, BAC and YAC vectors;
- C. In vitro mutagenesis and deletion techniques, geneknock out in bacterial and eukaryotic organisms; protein sequencing methods, detection of post translation modification of proteins; DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis such as micro array based techniques; isolation, separation and analysis of carbohydrate and lipid molecules, RFLP, RAPD and AFLP techniques.
- D. Histochemical and immunotechniques : Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluorimetry, and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH, GISH.

- E. BIOPHYSICAL METHODS : Analysis of biomolecules using UV; visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determining using X-Ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
- F. Microscopic techniques, Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, Freeze-etching and freeze fracture methods for EM, image processing methods in microscopy.

**Syllabus of Zoology (10)****1. Molecules and Their Interaction**

- A. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
- B. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- C. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.
- D. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.
- E. Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds).
- F. Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA).
- G. Stability of protein and nucleic acid structures.
- H. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

**2. Cellular Organization**

- A. **Membrane structure and function** : Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intercellular transport, electrical properties of membranes.
- B. **Structural organization and function of Intracellular organelles** : Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.
- C. **Organization of genes and chromosomes** : Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.
- D. **Cell division and cell cycle** : Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.
- E. **Microbial Physiology** : Growth, yield and characteristics, strategies of cell division, stress response.

**3. Fundamental Process**

- A. **DNA replication, repair and recombination** : Unit of replication, enzymes involved replication, origin and replication fork, extrachromosomal replicons, DNA damage and repair mechanisms.
- B. **RNA synthesis and processing** : Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.
- C. **Protein synthesis and processing** : Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post-translational modification of proteins.
- D. **Control of gene expression at transcription and translation level** : Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

**4. Cell Communication and Cell Signaling**

- A. **Host parasite interaction** : Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.
- B. **Cell signaling** : Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.
- C. **Cellular communication** : Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.
- D. **Cancer** : Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

- E. **Innate and adaptive immune system** : Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

**5. Developmental Biology**

- A. **Basic concepts of development** : Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell

- fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.
- B. Gametogenesis, fertilization and early development :** Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.
- C. Morphogenesis and organogenesis in animals:** Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis - vulva formation in *Caenorhabditis elegans*; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.
- D. Programmed cell death, aging and senescence.**
- 6. Structure and Function of Invertebrates :**
- A. Origin of metazoan, organization of coelom (Acocelomates, Pseudocoelomates and coelomates).
- B. Locomotion- Amoeboid, flagellar and ciliary movement in protozoa, Hydrostatic movement in coelenterate, Annelids and Echinodermata.
- C. Nutrition & Digestion- Patterns of feeding and digestion in lower metazoa, Mollusca, Echinodermata, Fitter, feeding in Polychaeta.
- D. Respiration- Organs of respiration : Gills, lungs and trachea, respiratory pigments, mechanism of respiration.
- E. Excretion - Excretion in lower and higher invertebrates.
- F. Mechanism of Osmoregulation.
- G. Nervous system- primitive and advanced nervous system.
- H. Larval forms and their evolutionary significance in helminthes, Arthropodes, Molluscs and Echinodermates.
- I. Structure, affinities and life history of - Rotifera, Entoprocta, Phoronida and Ectoprocta.
- 7. Structure and functions of Lower & Higher Vertebrates -**
- A. **Blood and circulation :** Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
- B. **Cardiovascular System :** Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG- its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.
- C. **Respiratory system :** Comparison of respiration of different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.
- D. **Nervous system :** Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.
- E. **Sense organs :** Vision, hearing and tactile response.
- F. **Excretory system :** Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
- G. **Thermoregulation :** Comfort zone, body temperature- physical, chemical, neural regulation, acclimatization.
- H. **Stress and adaptation**
- I. **Digestive system :** Digestion, absorption, energy balance, BMR.
- J. **Endocrinology and reproduction :** Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.  
Embryology : Principle, Development & Functions.
- 8. Inheritance Biology**
- A. **Mendelian principles :** Dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- B. **Concept of gene :** Allele, multiple alleles, pseudoallele, complementation tests.
- C. **Extensions of Mendelian principles :** Codominance, Incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.
- D. **Gene mapping methods :** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
- E. **Extra chromosomal inheritance :** Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
- F. **Microbial genetics :** Methods of genetic transfers- transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.
- G. **Human genetics :** Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.
- H. **Quantitative genetics :** Polygenic inheritance, heritability and its measurements, QTL mapping.
- I. **Mutation :** Types, causes and detection, mutant types - lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.
- J. **Structural and numerical alterations of chromosomes :** Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- K. **Recombination:** Homologous and non-homologous recombination, including transposition, site-specific recombination.
- 9. Diversity of life forms**
- A. **Principles and methods of taxonomy :** Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants, animals and microorganisms.
- B. **Levels of structural organization :** Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy.
- C. **Outline classification of plants, animals and microorganisms :** Important criteria used for classification in each taxon; classification of plants, animals and microorganisms; evolutionary relationships among taxa.
- D. **Natural history of Indian subcontinent :** Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of the subcontinent.
- E. **Organisms of health and agricultural importance :** Common parasites and pathogens of humans, domestic animals and crops.
- 10. Ecological Principles**
- A. **The Environment :** Physical environment; biotic environment; biotic and abiotic interactions.
- B. **Habit, Habitat and niche :** Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
- C. **Population ecology :** Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation- demes and dispersal, interdemec extinctions, age structured populations.
- D. **Species interactions :** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.
- E. **Community ecology :** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.
- F. **Ecological succession :** Types; mechanisms; changes involved in succession concept of climax.
- G. **Ecosystem :** Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems; terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Food Chain.
- H. **Biogeography :** Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
- I. **Applied ecology :** Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches, Remote sensing.
- J. **Conservation biology :** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves). Life Conservation of Forest.
- 11. Evolution and Behaviour**
- A. **Emergence of evolutionary thoughts :** Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis.
- B. **Origin of cells and unicellular evolution :** Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.
- C. **Paleontology and evolutionary history :** The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.
- D. **Molecular Evolution :** Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.
- E. **The Mechanisms :** Population genetics- populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.
- F. **Brain, Behavior and Evolution :** Approaches and methods in study of behavior; proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism; neural basis of learning, memory, cognition, sleep and arousal; biological clocks; development of behavior; social communication; social dominance; use of space and territoriality; mating systems, parental investment and reproductive success; parental care; aggressive behavior; habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes.
- 12. Applied Biology**
- A. Microbial fermentation and production of small and macro molecules.
- B. Application of immunological principles (vaccines, diagnostics), tissue and cell culture methods for plants and animals.
- C. Transgenic animals and plants, molecular approaches to diagnosis and strain identification.
- D. Genomics and its application to health and agriculture, including gene therapy.
- E. Bioresource and uses of biodiversity.
- F. Breeding in plants and animals, including marker- assisted selection.
- G. Bioremediation and phytoremediation.
- H. Biosensors.
- 13. Methods in Biology**
- A. **Molecular biology and recombinant DNA methods :** Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods; analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels; molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences; generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; in vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms; protein sequencing methods,

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detection of post-translation modification of proteins; DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as micro array based techniques; isolation, separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques.

- B. **Histochemical and immunotechniques** : Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.
- C. **Biophysical methods** : Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
- D. **Statistical Methods** : Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance;  $\chi^2$  test; basic introduction to Multivariate statistics, etc.
- E. **Radiolabeling techniques** : Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.
- F. **Microscopic techniques** : Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.
- G. **Electrophysiological methods** : Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.
- H. **Methods in field biology** : Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization-ground and remote sensing methods.
- I. **Computational methods** : Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

**Subject-Biochemistry (11)****1. Biomolecules-**

- Classification, Structure, Properties and Biological importance of Carbohydrates, Proteins, Lipids and Nucleic acids.
- Water Soluble and Fat Soluble Vitamins.
- Hormones and their functions.
- Enzymes - Classification and Nomenclature of enzymes. Enzyme kinetics. Effect of PH, Temperature, Substrate Concentration on enzyme catalyzed reactions. Michaelis-Menten equation. Enzyme inhibition. Enzyme specificity and Active site factors affecting catalytic efficiency. Polymorphic enzymes, PGM-GLO as etc.
- Mechanism of Enzyme action.
- Enzyme regulation- Allosteric and Covalent modification.

**2. Biochemical Techniques**

- Principles of Adsorption, Partition and Ion exchange Chromatography.
- Gel Filtration.
- Affinity and High performance liquid chromatography
- Gel Electrophoresis.
- Isoelectric Focusing Technique,
- Ultracentrifugation.
- Radioactivity- Detection and measurement of radioisotopes and their Biochemical applications.
- Spectroscopic analysis- General Principle, Instrumentation and Biochemical applications of UV- Vis spectrophotometry.
- Atomic absorption spectrophotometry and NMR Spectroscopy
- X-Ray Diffraction and Electron Microscopy.

**3. Physiology and Nutrition**

- Ultrastructure of cell, Plasma membrane. Structure & Functions of various Cell organelles. Composition of Blood. Formed elements of Blood. Plasma Proteins, Hemoglobin. Blood Coagulation, Blood groups.
- $O_2$ ,  $CO_2$  Transport.
- Structure of Nephron. Mechanism of urine formation, Acid-Base Balance.
- Digestion and Absorption of Carbohydrates, Lipids and Proteins.
- Structure of Muscle, Mechanism of Muscle Contraction.
- Structure of Neuron. Transmission of nerve impulse.
- Proximate Principles of Nutrition. Balanced diets. Biological Value of Proteins. Nutritional Deficiency disorders. Basal metabolic rate & its Determination.

**4. Metabolism**

- Enzymes of Biological Oxidation.
- Redox Potential
- Mitochondria and Oxidative Phosphorylation. Chloroplast and Photo-phosphorylation. Carbohydrate metabolism- Glycolysis, Glycogenolysis. Glycogenesis, Gluconeogenesis, HMP Pathway. Lipid metabolism- Biosynthesis and Degradation of Fatty acids, Cholesterol Metabolism. General reactions of Proteins metabolism.

Catabolism of Aminoacids.  
Catabolism & Biosynthesis of Purines & Pyrimidines.  
Regulation of Carbohydrate and Lipid Metabolism.  
Biological Nitrogen Fixation.  
Biological role of minerals.

**5. Clinical Biochemistry-**

- Biochemistry of Detoxication.
  - Antibiotics- mechanism of action and applications.
  - Enzymes in Clinical Diagnosis.
  - Organ function tests- Liver, Kidney.
  - Bile pigments & their clinical importance.
  - Joundice, Fatty livers.
  - Carcinogenesis, Anticancerdrugs.
  - Fluid and Electrolyte Balance.
  - Types of Immunity. Cell mediated and humoral. Antibody mediated immune response. Immunoglobulins. Antigen antibody reaction. RIA and ELISA. Monoclonal antibodies- technique of production and applications. Hyper sensitivity, AIDS.
- 6. Molecular Biology & Biotechnology**
- DNA as genetic material
  - Chromosomes.
  - Replication of DNA, Transcription, Translation, Genetic Code. Post translational changes.
  - Regulation of Gene Expression. Operation Concept.
  - Principles of Recombinant DNA technology.
  - Restriction enzymes.
  - Gene cloning, DNA Sequencing.
  - Applications of Genetic engineering.
  - Production of transgenic plant and animals.
  - Northern and Southern blotting, PCR.
  - Enzyme technology- Technology of enzyme production.
  - Enzyme Immobilization and applications of Immobilized enzymes.

**Subject- Microbiology (12)****1. General Microbiology -**

- Classification of Micro organisms.
- Morphology and ultra structure of bacteria.
- Cultivation of bacteria- Aerobic & Anaerobic Cultivation, Nutritional types of bacteria.
- Bacterial growth- culture media, growth curve.
- Control of bacteria- Physical, Chemical agents, thermal death constant, Economic importance of bacteria, algae and fungi.
- General Characters of viruses, their morphology and ultra structure.
- Bacteriophages- organization, life cycle brief details of T-Phages and Lambda phage.

**2. Microbial Physiology & Biochemistry**

- Bacterial Photosynthesis.
- Respiration Metabolism.
- Biochemistry of Methanogens.
- Extremophiles- Mechanism of adaptation, types and their applications.
- Structure, Identification and importance of Mono, oligosaccharides.
- Structure of Polysaccharides e.g. blood groups.
- Aminoacids- Structure, Classification and properties.
- Enzymes as biocatalysts- Classification, mechanism of enzyme action, coenzymes and co-factors.

**3. Molecular Biology and Genetic Engineering**

- Fine Structure of prokaryotic and eukaryotic genome.
- DNA Structure.
- DNA replication
- Gene transfer mechanisms- Transformation, conjugation and transduction.
- Bacteriophages- Lytic and lysogenic cycles.
- Core techniques and essential enzymes used in recombination DNA technology. Restriction digestion, ligation and transformation.
- Cloning vectors- Plasmids, phages and cosmids.
- DNA Sequencing methods.
- Applications of r-DNA technology.

**4. Environmental and Industrial Microbiology**

- Microbiology of water and sewage.
- Methods of purification of water.
- Treatment of domestic and Industrial wastes.
- Microbial spoilage of food materials, preservation of food.
- Diseases caused by spoiled food, mycotoxins, food poisoning.
- Air microbiology- Micro-organisms in air, air borne human and plant diseases.
- Scope of industrial microbiology.
- Biotechnology in Pharmaceuticals.
- Micro-organism in production of vitamins and beverages.
- Importance of microbes in dairy industry.

**5. Immuno and Medical Microbiology**

- Structure, composition and types of cells and organs involved in immune system. Innate and acquired immunity.
- Immunization- Modern methods of Producing vaccines, Humoral and cell mediated immune responses.
- Antigens- Structure properties, types.
- Immunoglobulins - Structure and types.
- Complement - Structure, components, properties and functions.
- Antigen- Antibody interaction- In vitro and vivo methods.
- Classification of medically important micro-organisms, Normal microbial flora of

human body.

- Mode of spread of infections.
- Classification of Pathogenic bacteria.
- Fungal infections- some important types.
- Viral infections- Important examples.
- 6. Fermentation Technology & Instrumentation-**
- Isolation and screening of industrially important micro organisms.
- Inoculum development for industrial fermentation.
- Industrial sterilization process for media.
- Batch and continuous Sterilization and fermentation.
- Optimization and Scale up fermentation.
- Detection, analysis and quality control of fermentation products & raw materials.
- Microbial Limit test.
- Theoretical considerations and instrumentation of light. Types of Microscopes.
- Chromatography- Paper, thin layer, column, gel exclusion & gas chromatography.
- Spectrophotometry- Types & applications.
- Types of Fermentors.

#### Syllabus of Biotechnology (13)

- Cell theory, Structure of Prokaryotic and Eukaryotic cells- Isolation and growth of cells.
- Cellular organelles- Plasma membrane, cell wall, their structural organization; Mitochondria, Chloroplast; Nucleus and other organelles and their organization.
- Transport of nutrients, ions and macromolecules across membranes.
- Cellular energy transactions- role of mitochondria and chloroplast.
- Cell cycle- molecular events and model systems.
- Cellular responses to environmental signals in plants and animals- mechanisms of signal transduction. Biology of cancer.
- Metabolite pathways and their regulation.
- Biosynthesis of proteins in Eukaryotic cell, Co- and post-translational modification intracellular protein traffic.
- Development in Drosophila and Arabidopsis; Spatial and temporal regulation of Gene Expression.
- Brief introduction to the Life Cycle and Molecular Biology of some important pathogen of AIDS, Malaria, Hepatitis, Tuberculosis, Filariasis, Kala-azar.
- Chemical foundations of Biology- pH, pK, acids, bases, buffers, weak bonds, covalent bonds.
- Amino acids and peptides- classification, chemical reactions and physical properties.
- Sugars- classification and reactions.
- Heterocyclic compounds and secondary metabolites in living systems- nucleotides, pigments, isoprenoids.
- Lipids- classification, structure and functions.
- Proteins - classification and separation, purification and criteria of homogeneity, end group analysis, hierarchy in structure, Ramachandran map.
- Polysaccharides- types, structural features, methods for compositional analysis.
- Analytical techniques in biochemistry and biophysics for small molecules and macro-molecules for quantitation.
- Measures of central tendency and dispersion : mean, median, mode, range, standard deviation, variance. Idea of two types of errors and level of significance, tests of significance (F&t test); chi-square tests, standard deviation; t-test, correlation coefficient.
- Basic energy concepts- Intensive and extensive properties, enthalpy, general energy balance equations, enthalpy change in non-reactive processes, enthalpy change due to reaction, heat of combustion, heat of reaction at non-standard conditions, thermodynamics of microbial growth, energy balance equation for cell culture, unsteady state energy balance equations.
- Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Repair. Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing. 5'-Cap formation, Transcription termination.
- 3'-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA, mRNA stability. Nuclear Splicing, spliceosomes and small nuclear RNAs, group I and Group II introns, Cis and trans-splicing reactions, tRNA splicing, alternate splicing.
- Prokaryotic and eukaryotic translation : Synthesis of aminoacyl tRNA, aminoacyl synthetases, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co- and post-translational modifications of proteins.
- Viral and cellular oncogenes, tumor suppressor genes from humans, Structure function and mechanism of action of pRB and p53 tumor suppressor proteins.
- Holliday junction, gene targeting, gene disruption, FLP/FRT and Cre/Lox recombination RecA and other recombinases.
- RFLP, RAPD and AFLP analysis, Molecular markers linked to disease resistance genes.
- Epigenetic regulation of DNA and its role in gene expression levels. Therapeutic approaches based on modulation of epigenetic changes.
- Alternative Strategies of Gene Cloning.
- Nucleic acid microarray arrays and serial analysis of gene expression (SAGE).
- Site-directed Mutagenesis and Protein Engineering. Gene and protein pollution and the possible strategies to minimize them.
- Molecular Marker-aided Breeding : RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), AFLP, QTL, map based cloning, molecular marker assisted selection. Molecular Tools and Their Applications: Restriction enzymes, modification enzymes, DNA, and RNA markers, cDNA Synthesis and Cloning : mRNA enrichment, reverse transcription, DNA primers, Linkers, adaptors and their chemical synthesis, Library construction and screening. Alternative Strategies of Gene Cloning: Cloning interacting genes- Two- and three hybrid systems, cloning differentially expressed genes. Nucleic acid microarray arrays, Serial analysis of gene expression (SAGE)
- Site-directed Mutagenesis and Protein Engineering. Expression Strategies for Heterologous Genes: Vector engineering and codon optimization, host engineering, In vitro transcription and translation, expression in bacteria, expression in Yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants.
- Processing of Recombinant Proteins : Purification and refolding, characterization of recombinant proteins, stabilization of proteins, Gene Therapy : Vector engineering, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.
- Physical techniques in protein, nucleic acids and polysaccharide structural analysis (UV, IR, NMR, LASER Raman Spectroscopy, MASS Spectroscopy, Fluorescence Spectroscopy). Differential colorimetry, X-ray Crystallography, Ultra centrifugation, Confocal and Electron microscopy techniques; autoradiography.
- Methods in biophysical analysis : CD, ORD and fluorescence spectroscopy, Raman spectroscopy, Various types of Chromatography TLC.
- Column chromatography (partition chromatography, Adsorption Chromatography, Ion-exchange chromatography, Gel filtration chromatography, affinity chromatography, reverse phase chromatography, HPLC, Microscopy, phase contrast, fluorescence microscopy, Electron microscopy and scanning tunneling microscopy.
- Radio isotope technique : Detection and measurement of radio activity Geiger Muller counters, scintillation counting, auto radiography and RIA Application of isotopes in biological studies.
- Sequencing of proteins and nucleic acids.
- Computer aided drug designing, Computational techniques in structural analysis; Nanoparticles.
- UV and chemical mutagens; Types of mutation; Ames test for mutagenesis; Methods of genetic analysis.
- Plasmids and Transposons. Bacterial genetics map with reference to *E. Coli*.
- **Bacteria** : Purple and green bacteria; Cyanobacteria; Homoacetogenic bacteria; Acetic acid bacteria; Budding and appendaged bacteria; Spirilla; Spirochaetes; Gliding and sheathed bacteria; Pseudomonads: Lactic and propionic acid bacteria; Endospore forming rods and cocci; Mycobacteria; Rickettsias, Chlamydia and Mycoplasmas.
- **Archaea: Archaea as earliest Life forms**; Halophiles; Methanogens; Hyperthermophilic archaea; Thermoplasma.
- **Eukarya** : Algae, Fungi, Slime molds and Protozoa.
- **Viruses** : Bacterial, Plant, Animal and Tumor viruses. Discovery, classification and structure of viruses; Lysogeny; DNA viruses; Positive strand, Negative strand and double standard RNA viruses; Replication; Examples of Herpes, Pox, Adenoviruses, Retroviruses, Viroids and Prions. Antimicrobial agents, Sulfa drugs; Antibiotics : Penicillins, and Cephalosporins; Broad spectrum antibiotics; Antibiotics from prokaryotes, Antifungal antibiotics; Mode of action; Resistance to antibiotics.
- Initiation and maintenance of callus and suspension culture; single cell clones.
- **Organogenesis** : somatic embryogenesis : transfer and establishment of whole plants in soil. Embryo culture and embryo rescue. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids. Cryopreservation, slow growth and DNA banking for germ plasm conservation.
- **Plant Transformation technology** : basis of tumor formation, hairy root, features of TI and RI plasmids, mechanisms of DNA transfer, role of virulence genes, use of TI and RI as vectors, binary vectors, use of 35S and other promoters, genetic markers, use of reporter genes, reporter gene with introns, use of scaffold attachment regions, methods of nuclear transformation.
- Innate and acquired immunity, Clonal nature of immune response antigens and super antigens, antibody structure and function, Antigen-antibody interactions. Major histocompatibility complex, T-lymphocytes, Macrophages, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast-Cells.
- Regulation of immune response, Antigen processing and presentation, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes Hypersensitivity, Autoimmunity, Transplantation. Immunity to infectious agents.
- Hybridoma Technology and Monoclonal antibodies, Primary and established cell line cultures Cell synchronization. Cell cloning and micromanipulation. Cell transformation.
- Application of animal cell culture. Stem cell cultures, isolation, selection markers cryo preservation, banking and stem cell based therapies. Cell culture based vaccines.
- Isolation, Preservation and Maintenance of Industrial Microorganisms.
- Types of fermentation processes : Analysis of batch, Fed-batch and continuous bioreactions, analysis of mixed microbial populations.
- Microbiology of Waste Water Treatments, Aerobic Process : Activated sludge, Oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds. Microbiology of degradation of Xenobiotics in Environment. Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides.
- Bioremediation of contaminated soils and waste land.
- Biopesticides in integrated pest management. Global Environmental Problems : Ozone depletion, UV-B, green-house effect and acid rain, their impact and biotechnological approaches for management.
- Downstream Processing : Introduction.
- Discovery, classifications and nomenclature of enzymes.

- Allosterism, Structure and activity of the enzymes Mechanism of action of chymotrypsin, glyceraldehyde 3 Phosphate dehydrogenase, lysoenzyme, carboxy peptidase, ribonuclease, aldolase etc.
  - Isolation of enzymes, DNA sequencing, synthesis and mutation, detection and separation, cloning, gene expression. Cloning and patenting of life forms. Genetic engineering guidelines. Molecular Tools and Their Applications, cDNA Synthesis and Cloning, mRNA enrichment, reverse transcription, DNA primers, Linkers, adaptors and their chemical synthesis, Library construction and screening. Lipid Metabolism : Beta Oxidation of Fatty acids, fatty acid biosynthesis, Biosynthesis of simple fat, phospholipids, cholesterol, sulfolipids and their possible regulation.
  - Classification of fluids, Reynolds number, hydrodynamic boundary layers, momentum transfer, viscosity, non-newtonian fluids, Rheological properties of fermentation broths, mixing equipments, flow patterns in agitated tanks, Radial and axial flow impellers, Mechanism of mixing, scale up of mixing systems, power requirement for mixing, ungasged Newtonian fluids, gasged fluids, improving mixing in fermenters, effect of rheological properties on mixing, role of shear in stirred fermenters, interactions between cells and turbulent eddies, operating conditions for turbulent shear damage, bubble shear.
  - Removal of microbial cells and solid matter, foam reparation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, Membrane process, Drying and Crystallization.
  - Industrial Production of Chemicals : Alcohol (ethanol), Acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), Antibiotics penicillin, streptomycin.
  - Secondary metabolites, various pathways for secondary metabolites viz., Alkaloids, Phenolics, Lignins, Terpenoids Flavonoids, Porphyrins, Importance of secondary metabolites in medicine and agriculture.
  - Rare metabolic conversions, mass balances, rates and experiments, models for growth and product formation.
  - Bacterial transcriptional regulation of metabolism.
  - Modeling tools for metabolic engineering; Metabolic flux analysis, control analysis, multi scale modeling of metabolic regulation.
  - Anaerobic Processes : Anaerobic digestion, anaerobic filters.
  - Upflow anaerobic sludge blanket reactors.
  - Number systems : Binary, decimal, octal, hexadecimal.
  - Introduction to Programming : Development of Algorithms and flow charts, Low level and high-level programming languages, C, C++, Java and SQL.
  - Probability, Concept of Probability Theory, Events, Trials, Mutually exclusive events, favourable events, exhaustive events, Bayesian theorem of Probability, Addition theorem, Multiplication theorem, Binomial distribution, Normal distribution.
  - Design of experiments, ANOVA (one-way and two-way), F-test.
  - Simple regression and correlation.
  - Bioethics : Legality, morality and ethics, the principles of bioethics : autonomy, human rights, beneficence, privacy, justice, equity etc. Biosafety in the laboratory institution : Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/institution.
  - Biosafety regulations in the handling of recombinant DNA process and products in institutions and industries, biosafety assessment procedures in India and abroad. Bioethics & Animal Experimentation, Bioethics & Human Person, General Introduction : Patent claims, the legal decision- making process, ownership of tangible and intellectual property, Patent litigation.
  - Basic Requirements of Patentability : Patentable subject matter, novelty and the public domain, non obviousness.
  - Special issues in Biotechnology Patents : Disclosure requirements, Collaborative research, Competitive research.
- Syllabus of Genetics (14)**
- Concepts of Genetics : Mendelian inheritance, History, Mendel's Law, Law of Segregation and the Law of Independent Assortment. Mendelian trait.
  - Sickle-cell anemia, Tay-Sachs disease, cystic fibrosis and xeroderma pigmentosa, single gene contrasts with a multi-factorial disease, like arthritis.
  - Non-Mendelian inheritance, Dominance relationship, Heritability, Particulate inheritance, Mendelian error, Punnett square.
  - Single Locus Genetics and Monohybrids. Double Loci Genetics and Dihybrids.
  - Deductive Genetics and Test Crosses. Sex Determination, Chromosomes and Mosaicism.
  - Incomplete Dominance & Codominance, Pleiotropy and Multialleles, Epistasis, Polygenes, Penetrance, Expressivity and Cytoplasmic Inheritance.
  - Patterns of Single Gene Inheritance, Relatedness and Pedigree.
  - DNA Replication and the Flow of Genomic Information, Prokaryotic Genetics, Prokaryotic Gene Expression, Eukaryotic Genetics, Eukaryotic Gene Expression.
  - Clinical genetic services, Genetic assessment, Genetic counseling, Chromosomal analysis, Common chromosomal disorders, Mendelian inheritance.
  - Unusual inheritance mechanisms, Estimation of risk in mendelian disorders.
  - Detection of carriers, Genetics of cancer, Genetics of common disorders.
  - Dysmorphology and teratogenesis.
  - Prenatal diagnosis.
  - DNA structure and gene expression, Gene mapping and molecular pathology.
  - Techniques of DNA analysis, Molecular analysis of mendelian disorders.
  - Treatment of genetic disorders, The internet and human genetics.
  - Biostatistics and Computer Application.
  - Population genetics.
  - Mutation, Repair and Recombination.
  - Cytogenetic : Karyotype, G- Banded chromosomes, other cytogenetic banding techniques, as well as molecular cytogenetics such as fluorescent in situ hybridization (FISH) and comparative genomic hybridization (CGH), McClintock's work on maize.
  - Human abnormalities and medical applications : as Down's syndrome, trisomy, Abnormalities arising from nondysjunction, aneuploid, Patau's Syndrome and Edward's Syndrome.
  - Advent of banding techniques.
  - Other numerical abnormalities discovered include sex chromosome abnormalities. An individual with only one sex chromosome (the X) has Turner syndrome, an additional X chromosome in a male, resulting in 47 total chromosomes, has Klinefelter's Syndrome.
  - Gene function, genetic variation.
  - Holliday junction, gene targeting, gene disruption, FLP/FRT and Cre/Lox recombination RecA and other recombinases.
  - Epigenetic regulation of DNA and its role in gene expression levels. Therapeutic approaches based on modulation of epigenetic changes.
  - Alternative Strategies of Gene Cloning.
  - Nucleic acid microarray arrays and serial analysis of gene expression (SAGE).
  - Site-directed Mutagenesis and Protein Engineering. Gene and protein pollution and the possible strategies to minimize them.
  - Processing of Recombinant Proteins : Purification and refolding, characterization of recombinant proteins, stabilization of proteins, Gene Therapy : Vector engineering, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.
  - Regulation of Gene Expression and Development.
  - Advanced Microbial Genetics : The Beginning of Microbiology, Bacterial Genetic System, Transformation, Conjugation, Transduction, Recombination, Plasmids and Transposons. Bacterial genetics map with reference to *E. Coli*.
  - Virus and Their Genetic System, Phage I and its life cycle; RNA phages; RNA Viruses; Retroviruses.
  - Genetic Systems of Yeast and Neurospora.
  - Plant Breeding and biotechnology.
  - Recombinant DNA Technology, Molecular biology research and viral therapy.
  - Genetics of Crop Improvement.
  - Quantitative and Evolutionary Genetics, Genetic variation and Genetic toxicology.
  - Proteomics : Post-translational modifications, Phosphorylation, Ubiquitination, methylation, acetylation, glycosylation, oxidation and nitrosylation.
  - Limitations to genomic study.
  - Development in Drosophila and Arabidopsos; Spatial and temporal regulation of Gene Expression.
  - Brief introduction to the Life Cycle and Molecular Biology of some important pathogen of AIDS, Malaria, Hepatitis, Tuberculosis, Filaria, Kalazar.
  - Concepts of Biochemistry; Chemical foundations of Biology- pH, pK, acids, bases, buffers, weak bonds, covalent bonds.
  - Principles of thermodynamics.
  - Classes of organic compounds and functional groups- atomic and molecular dimensions, space filling and ball and stick models.
  - Methods of studying proteins; "two-dimensional gel electrophoresis".
  - PROTOMAP SDS-PAGE shotgun proteomics, ELISAs, matrix-assisted laser desorption/ionization (MALDI) electrospray ionization (ESI).
  - Practical applications of proteomics.
  - Protein Engineering.
  - Virology : Virus structure and classification, Viral diseases and host defenses common cold, influenza, rabies, measles, hepatitis, yellow fever, polio, smallpox, AIDS and Herpes simplex.
  - Biophysical Chemistry and Instrumentation : electron microscopy, X-ray crystallography, NMR spectroscopy and atomic force microscopy (AFM), dual polarization interferometry and circular dichroism . RFLP, RAPD and AFLP analysis, Molecular markers linked to disease resistance genes.
  - Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing, 5'-Cap formation, Transcription termination.
  - 3-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA, mRNA stability. Nuclear Splicing, spliceosomes and small nuclear RNAs, group I and group II introns, Cis and trans-splicing reactions, tRNA splicing, alternate splicing.
  - Prokaryotic and eukaryotic translation : Synthesis of aminoacyl tRNA, amino acyl synthetases, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co- and post-translational modifications of proteins.
  - Cell theory. Structure of Prokaryotic and Eukaryotic cells- Isolation and growth of cells.
  - Cellula organelles- Plasma membrane, cell wall, their structural organization; Mitochondria, Chloroplast; Nucleus and other organelles and their organization.
  - Transport of nutrients, ions and macromolecules across membranes.
  - Cellular energy transactions - role of mitochondria and chloroplast.
  - Cell cycle- molecular events and model systems.
  - Cellular responses to environmental signals in plants and animals- mechanisms of signal transduction. Biology of cancer.
  - Metabolic pathways and their regulation.
  - Biosynthesis of proteins in Eukaryotic cell, Co- and post-translational modification intracellular protein traffic.
  - Amino acids and peptides - classification, chemical reactions and physical properties.
  - Sugars- classification and reactions.
  - Heterocyclic compounds and secondary metabolises in living systems- nucleotides, pigments, isoprenoids.
  - Lipids - classification, structure and functions.
  - Proteins- classification and separation, purification and criteria of homogeneity,

end group analysis, hierarchy in structure, Ramachandran map.

- Polysaccharides - types, structural features, methods for compositional analysis.
- Analytical techniques in biochemistry and biophysics for small molecules and macro-molecules for quantitation.
- Measures of central tendency and dispersion : mean, median, mode, range, standard deviation, variance. Idea of two types of errors and level of significance, tests of significance (F&t test); chisquare tests, standard deviation; t-test, correlation coefficient.
- Viral and cellular oncogenes, tumor suppressor genes from humans, Structure, function and mechanism of action of pRB and p53 tumor suppressor proteins.
- Immunology : Overview of immune system, cells and organs of immune system, antigens, immunoglobulins, organization and expression of immunoglobulin genes, antigen-antibody reaction, major histo compatibility, T cell receptors, cytokines, complement system, hypersensitivity reaction, Immune response to infectious diseases, Vaccines, AIDS, Autoimmunity, Transplant immunology, cancer.
- Basic energy concepts - Intensive and extensive properties, enthalpy, general energy balance equations, enthalpy change in non-reactive processes, enthalpy change due to reaction, heat of combustion, heat of reaction at non-standard conditions, thermodynamics of microbial growth, energy balance equation for cell culture, unsteady state energy balance equations.

#### Forensic Science & Forensic Biology (15)

##### Section-A

**Forensic Science** - Definition and scope. Historical development of Forensic Science. Basic Principles of Forensic Science.

Crime Scene Management and investigation- Searching methods' at scene of crime, sketching and Photography.

Collection, Preservation, Packing and Forwarding of Physical evidence to the Forensic Science Laboratory.

Reconstruction of Crime Scene.

**Physical Evidences** - Types and Importance.

Legal and Court Procedure pertaining to Expert Testimony.

Organization and Management of Forensic Science Laboratory.

Quality control Accreditation and Creditability in Forensic Science Laboratory.

Role of Forensic Scientist.

**Microscopy** : Microscope and its parts, Function, Application in Forensic Science.

**Types off Microscopes**- Simple, Compound, Polarizing, Phase Contrast, Comparison, Stereo, Fluorescence, Election- TEM and SEM.

**Spectrophotometry**- Principles, Techniques and Application in Forensic science- U.V., Visible, I.R. FTIR.

Atomic Absorption Spectroscopy.

Mass Spectrometry.

Raman Spectroscopy.

Neutron Activation. Analysis

N.M.R.

X-Ray Analysis

X-Ray Diffraction Analysis.

X-Ray Fluorescence Analysis.

Thermal Techniques- TGM and D.T.A.

**Chromatography**- Theory and Techniques- Column, Paper, TLC, Ion-Exchange, GC, HPLC, HPTLC, CG-MS and LC-MS.

**Electrophoresis** - Theory and Principles.

High and Low Voltage Electrophoresis.

Gel Electrophoresis.

Immune Electrophoresis.

Iso Electrophoresis.

**Forensic statistics** Type of Data, Measure of Central Tendency, Dispersion of Data, Correlation, Probability and Proof.

**Psychological Techniques in Forensic science** - Polygraph, Narco Analysis, Brain Mapping, Hypnosis and their legal status.

**Wild Life Forensics** : Wild Life species identification methods.

Significance of pug Marks in wild life identification.

Importance of DNA Technique in poaching cases.

Wild Life DNA Data Bank and its utility.

**Computer Forensics** : Introduction to Computer and Cyber Crimes- Hacking, Virus, Phising, Pornography, Software Piracy, Program manipulation, ATM Frauds. Role of Forensic Scientist in Computer Crime investigation and prevention.

#### Forensic Science

##### Section-B (Forensic Biology)

**Forensic Biology** - Definition and Scope

Collection and Preservation of Biological Evidences.

Examination of starch, Pollen grains, seeds, vegetable ash, wood, Diatoms.

**Histological and Anatomical examination of some plants yielding drugs**- Opium, Cannabis sativa, Coca, Tobacco, Mushrooms.

Laboratory Examination of some fruit stains and vegetables.

**Fiber**- Types, classification, Laboratory examination of Fibers.

Examination of Rope, String and Debris.

**Hair**- Morphology, Chemistry of hair, Growth, Various Types and their features.

Determination of Sex from hair. Determination of species.

Laboratory examination of hair for Individualization

**Semen**- Occurrence and significance.

Species Determination.

Age of semen stain.

Detailed Laboratory examination of semen stain.

Polymorphic Enzymes in semen and their significance.

D.N.A. Typing of semen sample.

Examination of Saliva, Urine, Perspiration and other physiological fluids.

**Blood**- Composition of blood, significance of blood scattering at the scene of crime.

Laboratory examination of blood and blood stains.

Blood Groups, Paternity determination from blood group.

Polymorphic Enzymes in blood and their significance.

D.N.A. Typing and Individualization.

**Forensic Entomology** - Defenition and scope.

Importance of some bacteria, Micro Organism and Insects in Forensic Science.

**Forensic anthropology**- Importance in Personal Identification.

Determination of sex, height and age from bones, Super Imposition Method.

Facial Reconstruction in dead body.

**Odontology** - Identification of deceased from teeth, Age determination from teeth.

**Wild Life Forensics**- Scope and Significance.

Importance in Poaching cases.

Identification of Wild life species by Pug Marks and D.N.A. technique.

Wild life D.N.A. Data Bank.

#### Forensic Science & Forensic Serology (16)

##### Section-A

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X-Ray Analysis

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#### Forensic Science

##### Section-B (Forensic Serology)

**Forensic Serology** - Definition and Scope.

Collection and Preservation of blood, Semen and other Physiological samples from the crime scene.

**Blood and blood stains** - Composition of blood.

Significance of blood scattering at the scene of crime.

Forensic examination of blood- Preliminary tests, Crystal tests, Determination of species by Precipitin test.

**Blood Groups** - ABO, Rh, MNSS and other systems- Duffy, Kell, Kidd, Lewis,

Determination of ABO blood groups by Absorption Inhibition, Absorption

Elution and Mixed. Agglutination Methods.

Blood Groups and Disputed Paternity determination.

Grouping of Rh and MN system.

Sectors and Non-Sectors.

Biochemical Markers in blood- Polymorphic enzyme typing PGM, EsD (Estrase D), EAP, AK.

HP (Heptoglobin Characterization)

HLA System.

**D.N.A. Profiling** - Source and structure of D.N.A., Basis of D.N.A. typing.

D.N.A. typing and Individualization.

D.N.A. typing Techniques- RFLP, PCR and LCN techniques.

Mito chondrial DNA

Y-str Analysis.

**Semen**- Laboratory examination of semen stain- Physical, Chemical, Microscopical, Acid Phosphate tests.

Species Determination.

Biological markers in semen and their significance.

DNA Typing and Individualization of semen stain.

Laboratory examination of Saliva, Urine, Perspiration and Other Physiological fluids.